PROJECT MANUAL

HARTNESS DEVELOPMENT - HOTEL HARTNESS

GREENVILLE COUNTY, SC

50% CONSTRUCTION DOCUMENTS

MARCH 3, 2020

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OUTLINE SPECIFICATIONS

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SECTION 011000

GENERAL REQUIREMENTS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS, which are hereby made a part of this Section of the Specifications.

1.2 PROJECT REQUIREMENTS

A. Project Identification: Hartness Development - Hotel Hartness.

B. Summary of Requirements for Temporary Utilities and Facilities:

1. Utility Costs: The Contractor shall meter and pay for cost of utility services consumed, including electricity, water, gas and temporary heat.
2. Temporary Offices: The Contractor shall provide and pay for a temporary office for the Architect and the Owner's Representative.
3. Toilet Facilities: The Contractor shall provide and maintain temporary toilets outside the building.

C. Permits and Fees: Apply for, obtain, and pay for permits, fees, and utility company backcharges required to perform the work. Submit copies to Architect.

D. Codes: Comply with applicable codes and regulations of authorities having jurisdiction. Submit copies of inspection reports, notices and similar communications to Architect.

E. Dimensions: Verify dimensions indicated on drawings with field dimensions before fabrication or ordering of materials. Do not scale drawings.

F. Existing Conditions: Notify Architect of existing conditions differing from those indicated on the drawings.

G. Contractor's Conduct on Premises: The Contractor and their employees shall behave in a respectful, courteous and safe manner. Abusive, harassing, and lewd behavior is prohibited. Music playing is prohibited. Alcohol, tobacco, and drug use is prohibited.

1.3 SPECIFICATION INFORMATION

A. These specifications are a specialized form of technical writing edited from master specifications and contain deviations from traditional writing formats. Capitalization, underlining and bold print is only used to assist reader in finding information and no other meaning is implied.

B. Except where specifically indicated otherwise, the subject of all imperative statements is the Contractor.

C. Sections are generally numbered in conformance with Construction Specifications Institute Masterformat System. Numbering sequence is not consecutive. Refer to the Table of Contents for names and numbers of sections included in this Project.

D. Pages are numbered separately for each section. Each section is noted with "End of Section" to indicate the last page of a section.

1.4 DEFINITIONS

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

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

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

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

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

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

G. "Install": Operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

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

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

1.5 INDUSTRY STANDARDS

A. Referenced standards are part of the Contract Documents and have the same force and effect as if bound with these specifications.

B. Except where specifically indicated otherwise, comply with the current standard in effect as of the date of the Owner/Contractor Agreement. Obtain copies of industry standards directly from publisher.

C. The titles of industry standard organizations are commonly abbreviated; full titles may be found in Encyclopedia of Associations or consult Architect.

1.6 CODES AND REGULATIONS

A. Comply with all applicable codes, ordinances, regulations and requirements of authorities having jurisdiction.

B. Submit copies of all permits, licenses, certifications, inspection reports, releases, notices, judgments, and communications from authorities having jurisdiction to the Architect.

C. Exterior Wall Assemblies: NFPA 285 is applicable to this project. Exterior wall products are specified in multiple specification sections, and multiple products are listed as acceptable equals in those sections. Since not all products have been tested to meet NFPA 285 in all combinations, the Contractor shall coordinate with Subcontractors to ensure that the assembly of products meets NFPA 285 requirements. Provide documentation for exterior wall assemblies indicating compliance with NFPA 285 based on products proposed for use on this project.

1.7 PROGRESS SCHEDULE

A. Provide comprehensive bar chart schedule showing all major and critical minor portions of the work, sequence of work and duration of each activity. Update and reissue regularly, but not less than monthly.

1.8 SCHEDULE OF VALUES

A. Prepare Schedule of Values to coordinate with application for payment breakdown. Submit at least 10 days before first payment application. Update and reissue regularly, but not less than monthly.

1.9 PAYMENT REQUESTS

A. Provide three copies of each request on completely filled out copies of AIA G702 and continuation sheet G703. Substantiate requests with complete documentation; include change orders to date. Provide partial lien waivers for work in progress and full lien waivers for completed work.

B. As-Constructed Record Drawing Certification: Certify as a part of each application for payment that the project as-constructed record documents are current at the time of application is submitted. The Contractor shall require such drawings to be current as a condition of approving any payment to the trade Contractor and Subcontractor.

C. Before first payment application, provide the following:

1. List of subcontractors, suppliers and fabricators.
2. Schedule of values.
3. Progress schedule.
4. Submittal schedule keyed to project schedule.
5. List of Contractor's key project personnel.
6. Copies of permits and other communications from authorities.
7. Contractor's certificate of insurance.
8. Performance and payment bonds if required.
9. Unit price schedule.

D. Before final payment application, provide and complete the following:

1. Complete closeout requirements.
2. Complete punch list items.
3. Settle all claims.
4. Transmit record documents to Architect. Include statement that Architect’s Supplemental Instructions, Change Orders, Construction Change Directives and minor changes in the work have been incorporated in the as-constructed record drawings.
5. Prove that all taxes, fees and similar obligations have been paid.
6. Remove temporary facilities and surplus materials.
7. Change lock cylinders or cores.
8. Clean the work.
9. Submit consent of surety, if any, for final payment.

1.10 PROCEDURES AND CONTROLS

A. Project Meetings: Arrange for and attend meetings with the Architect and such other persons as the Architect requests to have present. The Contractor shall be represented by a principal, project manager, general superintendent or other authorized main office representative, as well as by the Contractor's field superintendent. An authorized representative of any subcontractor or sub-subcontractor shall attend such meetings if the representative's presence is requested by the Architect. Such representatives shall be empowered to make binding commitments on all matters to be discussed at such meetings, including costs, payments, change orders, time schedules and manpower. Any notices required under the Contract may be served on such representatives. Written reports of meeting minutes shall be prepared by the Contractor and distributed by the Contractor to attendees, the Architect, and Owner within three business days.

1. Pre-Construction Conference: Attendance by Architect, Contractor, major subcontractors. Agenda shall include: Quality of workmanship, coordination, interpretations, job schedule, submittals, approvals, requisition procedures, testing, protection of construction, indoor air quality, and construction waste management.
2. Exterior Envelope Meeting: Attendance by Architect, Contractor, major subcontractors. Agenda shall include as applicable: Review of exterior wall details, wall construction, sample panel preparation, cleaning, control and expansion joints, cold weather procedures.

a. NFPA 285: Review and confirm that products proposed for the exterior wall assemblies comply with NFPA 285 as a tested assembly. Submit manufacturer's certifications that exterior assemblies have been tested and comply with NFPA 285 promptly following the exterior envelope meeting.

3. Roofing/Flashings Meeting: Attendance by Architect, Contractor, roofing subcontractor, and representative of roofing manufacturer. Agenda shall include as applicable: Preparation of roof decks, flashing and blocking details, roofing procedures and inspections, bonds and guarantees, weather conditions during roofing, protection of roof membrane during construction.
4. Interior Finishes Meeting: Attendance by Architect, Contractor, major subcontractors. Agenda shall include as applicable: Quality of workmanship, environmental conditions for application of finishes, drywall details, millwork details, condition of surfaces to receive finishes, tile work, painting work, samples and test areas and approvals, coordination with mechanical and electrical interfaces and penetrations, indoor air quality.
5. Progress Meetings: Hold regularly before preparation of payment requests and additional meetings as requested by the Architect. Attendance by Architect, Contractor, and others as determined by Contractor. Agenda shall include work in progress and payment requests.
6. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction, as specified. Preinstallation Conferences may be part of Progress Meeting agenda. Attendance by Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow. Agenda shall include a review of progress of other construction activities and preparations for the particular activity under consideration.

B. Emergency Contacts: Furnish the Owner and Architect, in writing, the names and telephone numbers of individuals to be contacted in the event of an out-of-hours emergency at the building site. Post a similar list readily visible from the outside of the field office or a location acceptable to the Architect.

C. Layout: Layout work and be responsible for all lines, elevations, and measurements of the building, grading, utilities and other work executed under the contract. Retain a registered professional engineer or registered land surveyor, acceptable to the Architect, to initially establish exterior lines and required elevations of all buildings and structures to be erected on the site. The registered professional engineer or registered land surveyor shall certify the actual location of the constructed facilities in relation to property lines, building lines, easements, set-backs, and other restrictive boundaries.

D. Field Measurements: Verify measurements at the building prior to ordering materials or commencing work. No extra charge or compensation will be allowed because of differences between actual dimensions and measurements indicated on the Drawings. Differences which may be found shall be submitted to the Architect for decision before proceeding with the work.

E. Field Measurements for Fixed Equipment: Dimensions for fixed equipment to be supplied under this Contract or separate contracts shall be determined by field measurements taken jointly by the Contractor and the equipment supplier involved. A record of the field measurements shall be kept until time of substantial completion of the project, or until the equipment has been fully installed and accepted by the Owner, whichever is later. Responsibility for fixed equipment fabricated accurately to field measurements for proper fit and operation shall be that of the Contractor. Contractor shall pay all costs involved in correcting any misfitting fixed equipment as fabricated.

F. Project Limit Line: The boundaries of the site do not limit the responsibility of the Contractor to perform the work in its entirety. Make utility connections as indicated.

G. Matching: Where matching is indicated, the Architect shall be the sole and final judge of what is an acceptable match. Mockups and sample submissions are required.

H. Observation: Notify the Architect and authorities having jurisdiction at least thirty-six hours in advance of concealing any work.

I. Utilities: Prior to interrupting utilities, services or facilities, notify the utility owner and the Owner and obtain their written approval a minimum 48 hours in advance.

J. Furnishings, Fixtures, and Equipment: Cooperate and permit the Owner to install their furnishings and equipment during the progress of the work. Owner's installation of furnishings or equipment does not signify Owner's acceptance of any portion of the work.

K. Clean-Up: Frequently clean-up all waste, remove from site regularly, and legally dispose of off-site.

1. Comply with requirements of Section 017400 - CONSTRUCTION WASTE MANAGEMENT.

L. Installer's Acceptance of Conditions: All installers shall inspect substrates and conditions under which work is to be executed and shall report in writing to the Contractor all conditions detrimental to the proper execution and completion of the work. Do not proceed with work until unsatisfactory conditions are corrected. Beginning work means installer accepts previous work and conditions.

M. Coordination: The Contractor shall be fully responsible for coordinating all trades, coordinating construction sequences and schedules, and coordinating the actual installed location and interface of all work.

1. Prior to beginning mechanical, electrical and fire protection work, the Contractor shall prepare coordination drawings showing the exact alignment, physical location and configuration of the mechanical, electrical and fire protection installations and demonstrating to the Contractor's satisfaction that the installations will clear all obstructions, permit proper clearances for the Work of other trades, and present an orderly appearance where exposed. The Contractor shall be solely liable and responsible for any costs and delays resulting from the Contractor's failure to prepare such coordination drawings or from the negligent preparation of such coordination drawings.
2. Exact locations and groupings of mechanical, electrical and fire protection fixtures, switches, heads and outlets shall be obtained from the Architect before the Work is roughed in. Work installed without such information from the Architect shall be relocated at the Contractor's expense if the Architect so requests.

N. Request For Interpretation (RFIs):

1. Procedure: Immediately on discovery of the need for interpretation of the Contract Documents, and if not possible to request interpretation at Project meeting, prepare and submit an RFI in the form specified.

a. RFIs shall originate with Contractor. RFIs submitted by entities other than Contractor will be returned with no response.

2. Content of the RFI: Include a detailed, legible description of item needing interpretation.
3. Architect's Action: Architect will review each RFI, determine action required, and return it. Allow three working days for Architect's response for each RFI. RFIs received after 1:00 p.m. will be considered as received the following working day.
4. The following RFIs will be returned without action:
   a. Requests for approval of submittals.
   b. Requests for approval of substitutions.
   c. Requests for coordination information already indicated in the Contract Documents.
   d. Requests for adjustments in the Contract Time or the Contract Sum.
   e. Requests for interpretation of Architect's actions on submittals.
   f. Incomplete RFIs or RFIs with numerous errors.

O. Existing Articles of Unusual Value: If during demolition, excavation, or disposal work articles of unusual value or of historical or archaeological significance are encountered, the ownership of such articles is retained by the Owner, and information regarding their discovery shall be immediately furnished to the Architect. If the nature of the article is such that work cannot proceed without danger of damage, work in the area shall be immediately discontinued until the Architect has determined the proper procedure to be followed. Delays in time thereby shall be a condition for which the time of the Contract may be extended. Costs incurred after discovery in the salvaging of such articles shall be borne by the Owner.

1.11 SUBMITTALS

A. Required Submittals: Submit shop drawings, product data, initial selection samples, verification samples, calculations, coordination drawings, schedules, and all other submittals as specified in individual specification sections.

B. Submittal Schedule: Within 30 days after award of contract and before first application for payment, prepare list of submittals in chronological sequence showing all submittals and proposed date first due at Architect's office and proposed date due to be returned to Contractor. Note relevant specification section number.

C. Contractor's Preparation of Submittals: Modify and customize all submittals to show interface with adjacent work and attachment to building. Identify each submittal with name of project, date, Contractor's name, subcontractor's name, manufacturer's name, submittal name, relevant specification section numbers, and Submittal Schedule reference number. Stamp and sign each submittal to show the Contractor's review and approval of each submittal before delivery to Architect's office; unstamped and unsigned submittals will be returned without action by the Architect. Leave 4" x 6" open space for Architect's "action" stamp.

1. Electronic Submittals: Provide a copy of all submittals in electronic format to the Architect. Architect will return a file of reviewed submittal in electronic format to the Contractor for distribution to subcontractors, suppliers, fabricators, governing authorities and others as necessary for proper performance of the Work. Unless otherwise amenable to the Architect, additional hard copies of submittals will not be reviewed by the Architect (or Consultant) and will not be returned to the Contractor.
2. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.

3. Name file with submittal number or other unique identifier, including revision identifier.
4. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Architect and Construction Manager.
5. Transmittal Form for Electronic Submittals: Use electronic form acceptable to Architect.

D. Product Data: Provide manufacturer's preprinted literature including, without limitation, manufacturer's standard printed description of product, materials and construction, recommendations for application and use, certification of compliance with standards, instructions for installation, and special coordination requirements. Collect data into one submittal for each unit of work or system; mark each copy to show which choices and options are applicable to project.

1. Installer Copy: Verify that the Installer has a current copy of the relevant product data, including installation instructions, before permitting installation to begin.

E. Shop Drawings: Provide accurately prepared, large scale and detailed shop drawings prepared specifically for this project. Show adjacent conditions and related work. Show accurate field dimensions and clearly note field conditions. Identify materials and products in the work shown. Note special coordination required.

1. After Architect's action, follow specified distribution procedure.

F. Samples: Provide units identical with final materials and products to be installed in the work. Where indicated, prepare samples to match Architect's sample. Label each sample with description, source, generic name or manufacturer's name and model number. Architect will review samples for confirmation of visual design intent, color, pattern, texture and type only; Architect will not test samples for compliance with other Contract requirements which shall remain the exclusive responsibility of the Contractor.

1. Initial Selection Samples Submittal Quantities: For initial selection purposes, submit 1 set of samples showing the complete range of colors and finishes available.
2. Verification Samples Submittal Quantities: For verification of an initial selection, submit 3 sets of samples; one set will be returned to Contractor to be maintained at project site for quality control comparisons.

G. Timing of Submittals: Submit submittals in a timely fashion to allow at least 10 business days for each office's review and handling. This means that submittals which have to be reviewed by the Architect and one of their consultants require at least 20 business days for review and handling. Add ten business days for each additional consultant who must review a submission.

H. Architect's Action on Submittals: Architect will review submittals, stamp with "action stamp", mark action, and return to Contractor. Architect will review submittals only for conformance with the design concept of the project. The Contractor is responsible for confirming compliance with other Contract requirements, including without limitation, performance requirements, field dimensions, fabrication methods, means, methods, techniques, sequences and procedures of construction, coordination with other work. The Architect's review and approval of submittals shall be held to the limitations stated in the Owner/Architect Agreement and the Conditions of the Contract. In no case shall approval or acceptance by the Architect be interpreted as a release of Contractor of their responsibilities to fulfill all of the requirements of the Contract Documents.

1. Required Resubmittal: Unless submittal is noted "reviewed" or "reviewed except as noted, resubmission not required," make corrections or changes to original and resubmit to Architect.
2. Distribution: When submittal is noted "reviewed" or "reviewed as noted, resubmittal not required," make prints or copies and distribute to Owner, Subcontractors involved, and to all other parties requiring information from the submittal for performance or coordination of related work.

1.12 WARRANTIES

A. Warranties Required: Refer to individual trade sections for specific product warranty requirements.

B. Procurement: Where a warranty is required, do not purchase or subcontract for materials or work until it has been determined that parties required to countersign warranties are willing to do so.

C. Warranty Forms: Submit written warranty to Owner through Architect for approval prior to execution. Furnish two copies of executed warranty to Owner for their records; furnish two additional conformed copies where required for maintenance manual.

D. Work Covered: Contractor shall remove and replace other work of project which has been damaged as a result of failure of warranteed work or equipment, or which must be removed and replaced to provide access to work under warranty. Unless otherwise specified, warranty shall cover full cost of replacement or repair, and shall not be pro-rated on basis of useful service life.

E. Warranty Extensions: Work repaired or replaced under warranty shall be warranted until the original warranty expiration date or for ninety days whichever is later in time.

F. Warranty Effective Starting Date: Guarantee period for all work, material and equipment shall begin on the date of substantial completion of the Project, not when subcontractor has completed their work nor when equipment is turned on. In addition to the one year guarantees for the entire work covered by these Contract Documents, refer to the various sections of the specifications for extended guarantee or maintenance requirements for various material and equipment.

G. Warranties are Irrevocable: Warranties issued to the Owner are irrevocable.

1. Non-Payment: If warrantor refuses to issue warranty, or attempts to revoke warranty due to lack of payment by any party other than the Owner, the Contractor shall resolve the payment conflict, and cause the warranty to be issued or reinstated.
2. Incomplete or incorrect Installation: If warrantor refuses to issue warranty, or attempts to revoke warranty due to improper installation or other deficiency, the Contractor shall correct the deficiency and cause the warranty to be issued or reinstated.

H. Transferable Warranties: All warranties shall permit Owner to transfer or assign warranties to future owners or other assignors at no additional cost to the Owner for the full warranty period.

1.13 CUTTING AND PATCHING

A. Limitations: Do not cut and patch any work in a manner that would result in a failure of the work to perform as intended, decreased energy performance, increased maintenance, decreased operational life, or decreased safety.

1. Structural Work: Do not cut structural work or bearing walls without written approval from Architect. Where cutting and patching of structural work is necessary and approved by Architect, perform work in a manner which will not diminish structural capacity nor increase deflection of member. Provide temporary shoring and bracing as necessary. Ensure the safety of people and property at all times.

B. Cutting and Patching Materials: Use materials identical to materials to be cut and patched. If identical materials are not available or cannot be used, use materials that match existing materials to the greatest extent possible. Provide finished work that will result in equal to or better than existing performance characteristics.

C. Inspection: Before cutting and patching, examine surfaces and conditions under which work is to be performed and correct unsafe and unsatisfactory conditions prior to proceeding.

D. Protection: Protect adjacent work from damage. Protect the work from adverse conditions.

E. Cutting: Cut work using methods least likely to damage adjoining work. Use tools designed for sawing or grinding, not hammering or chopping. Use saws or drills to ensure neat, accurately formed holes to sizes required with minimum disturbance to adjacent work. Temporarily cover openings; maintain weathertightness and safety.

1. Utilities: Locate utilities before cutting. Provide temporary utilities as needed. Cap, valve, or plug and seal ends of abandoned utilities to prevent entrance of moisture or other foreign matter.

F. Patching: Patch with seams and joints which are durable and not visible. Comply with specified tolerances for similar new work; create true even planes with uniform continuous appearance. Restore finishes of patched areas and, if necessary, extend finish restoration onto adjoining unpatched area to eliminate evidence of patching and refinishing. Repaint entire assemblies, not just patched area. Remove and replace work which has been cut and patched in a visually unsatisfactory manner as determined by the Architect.

G. Qualifications: Retain experienced and specialized firms, original installers if possible, to perform cutting and patching. Workmen shall be skilled in type of cutting and patching required.

1.14 TEMPORARY FACILITIES AND UTILITIES

A. Scope of Temporary Work: This article is not intended to limit the scope of temporary work required under the Contract. Provide all temporary facilities and utilities needed.

B. Permits and Fees: Obtain and pay for all permits, fees and charges related to temporary work.

C. Codes and Authorities Having Jurisdiction for Temporary Facilities and Utilities: Comply with all requirements of authorities having jurisdiction, codes, utility companies, OSHA, and industry standards including, but not limited to the following:

1. NFPA 241, Standard for Safeguarding Construction, Alteration, and Demolition Operations.
2. ANSI-A10 Series, Safety Requirements for Construction and Demolition.
3. NECA National Joint Guideline NJG-6, Temporary Job Utilities and Services.
4. Electrical Service: NEMA, NECA, and UL.

D. Field Offices: Provide Contractor's field offices as needed. Keep current copies of all Contract Documents and project paperwork neatly on file at jobsite. Permit Architect's unrestricted use of Contractor's field office facilities including copiers, telephones, plan tables, and other equipment. Furnish, maintain, and pay for light, power, phone, fax, and other field office services.

E. Shops and Sheds: At Contractor's option, provide shops and sheds for Contractor's use as needed. Locate shops and sheds where acceptable to Owner and authorities having jurisdiction. Prior to completion of construction, temporary storage facilities and surplus stored materials shall be removed from the site.

F. Temporary Heat: Provide temporary heat as needed to protect the work and create a suitable work environment. Provide temporary heat to protect the exterior construction against injury or damage resulting from cold temperature and dampness, to heat materials, and to maintain the minimum temperatures specified herein and in individual specification sections. Protect building from soot, smoke and fire damage. Do not use heaters which would interfere with curing of mortar and grout or damage any materials.

1. Heaters for temporary heat shall be approved temporary steam generators or forced warm air heaters located outside the building or vented to the outside, or other safety type UL approved heating devices acceptable to the Architect.
2. Oil burning salamander type heaters will not be permitted. Non-vented, open flame heaters will not be permitted inside the building once the building is closed-in.
3. Propane type-heaters will not be permitted within the area of the building or near stockpiles of combustible materials.
4. Permanent building equipment shall not be used without written permission from the Owner. If the equipment is used for temporary heating or cooling, it shall be adequately maintained per manufacturer's instructions and protected with filters, strainers, controls, reliefs, and similar items. Prior to turnover to Owner, the equipment shall be in a clean, like new condition. The guarantee period shall not start until the equipment is turned over to the Owner for their use. Do not invalidate existing warranty by any action or failure to act. Clean and change air filters frequently to prevent construction dust and debris from contaminating system.

G. Pumping and Drainage: Protect excavations, trenches, buildings and materials from rain water, ground water, backup or leakage of sewers, drains and other piping, and from water of any other origin. Promptly remove any accumulation of water. Provide and operate all pumps, piping and other equipment necessary for pumping, drainage and protection from water.

H. Equipment and Tools: Provide all equipment including, but not limited to, hoists, lifts, scaffolding, machines, tools and the like, as needed for execution of the work. Provide safe access to all parts of the work.

I. Temporary Enclosures: Provide temporary enclosures to maintain proper temperatures and to prevent weather damage. Always maintain legal means of egress.

J. Snow and Ice: Remove all snow and ice which interferes with work or safety.

K. Streets, Walks and Grounds: Maintain public and private roads and walks clear of debris caused by construction operations. Repair all damage caused to streets, drives, curbs, sidewalks, fences, poles and similar items where disturbed or damaged by building construction and leave them in as good condition after completion of the work as before operations started.

L. Protection: Protect nearby property and the public from construction activities. Provide and maintain barricades, warning signs and lights, railings, walkways and similar items. Immediately repair damaged property to its condition before being damaged.

M. Public Services: Provide temporary public services such as, street lighting, night lighting, sidewalks, covered passages, signs, signals and the like, as requested by authorities having jurisdiction.

N. Construction Fencing: Provide construction fencing and barriers as applicable to the project and as required by code to protect personnel, the public, and to control access.

O. Security: Secure site against unauthorized entry at all times. Provide secure, locked temporary enclosures. Protect the work at all times. Provide watchman service, if necessary, to protect the work.

P. Signs: Erect project identification signs in compliance with details to be provided by Architect. Signs shall be minimum 4' x 8' exterior grade plywood and shall contain the names of the project, Owner, Architect, major Consultants, Contractor, and major financing institution. Except for safety and warning signs, no other signs are permitted. Location as acceptable to the Architect.

Q. Fire Prevention: Take every precaution to prevent fire. Provide and maintain in good operating condition suitable and adequate fire protection equipment and services, and comply with recommendations regarding fire protection made by the representative of the fire insurance company carrying insurance on the Work or by the local fire chief or fire marshal. The area within the site limits shall be kept orderly and clean, and all combustible rubbish shall be promptly removed from the site.

R. Egress: Maintain safe and legal means of egress at all times. At all times, provide at least two separate means of egress.

S. Mold Control and Remediation During Construction: The Contractor shall protect construction materials and building systems from moisture damage and from conditions which promote mold growth during and after construction. The Contractor shall be responsible for mold remediation and replacement of materials which cannot be successfully remediated in accordance with the following requirements:

1. Materials which become wet prior to installation shall be cleaned, treated and dried in accordance with EPA Guidelines.
2. Materials which exhibit mold growth prior to installation shall not be installed and shall be removed from the site.
3. Materials which exhibit mold growth after installation shall be remediated in accordance with EPA Guidelines for Remediating Building Materials with Mold Growth Caused by Clean Water. The Contractor shall engage and pay for a qualified industrial hygienist acceptable to the Owner to determine the cause of the mold growth, and to certify in

writing that materials have been successfully remediated. In the event that the industrial hygienist recommends methods of remediation in addition to those in the Guidelines, the Contractor shall also be responsible for the additional remediation. Materials which can not be successfully remediated shall be removed and replaced with new materials at no additional expense to the Owner.

4. Prior to the start of construction, the Contractor shall submit the name of the person in the Contractor's organization responsible for ensuring compliance with these requirements for mold control and remediation.

T. Existing Mold-Contaminated Materials: In the event that mold-contaminated materials are encountered during remodeling operations, the Contractor shall stop work in that area and notify the Owner and Architect in writing. The Owner will engage and pay for an industrial hygienist to evaluation the situation to advise the Contractor on the proper course of action.

1.15 PRODUCTS AND SUBSTITUTIONS

A. Specified Products: In all cases in which a manufacturer's name, trade name or other proprietary designation is used in connection with materials or articles to be furnished under this Contract, whether or not the phrase "or equal" is used after such name, the Contractor shall provide the product of the named manufacturers without substitution, unless a written request for a substitution has been submitted by the Contractor and approved in writing by the Architect.

B. Deviations from Detailed Requirements: If the Contractor proposes to use material which, while suitable for the intended use, deviates in any way from the detailed requirements of the Contract Documents, the Contractor shall inform the Architect in writing of the nature of such deviations at the time the materials is submitted for approval, and shall request written approval of the deviation from the requirements of the Contract Documents.

C. Approval of Substitutions: In requesting approval of deviations or substitutions, the Contractor shall provide evidence, including, but not limited to manufacturer's data, leading to a reasonable certainty that the proposed substitution or deviation will provide a quality of result at least equal to that attainable if the detailed requirements of the Contract Documents were strictly followed. If, in the opinion of the Architect, the evidence presented by the Contractor does not provide a sufficient basis for such reasonable certainty, the Architect may reject such substitution or deviation without further investigation.

D. Intent of Contract Documents: The Contract Documents are intended to produce a building of consistent character and quality of design. All components of the building including visible items of mechanical and electrical equipment have been selected to have a coordinated design in relation to the overall appearance of the building. The Architect shall judge the design and appearance of proposed substitutes on the basis of the suitability in relation to the overall design of the Project, as well as for their intrinsic merits. The Architect will not approve as equal to materials specified proposed substitutes which in the Architect's opinion, would be out of character, obtrusive, or otherwise inconsistent with the character or quality of design of the Project. In order to permit coordinated design of color and finishes the Contractor shall furnish the substituted material in any color, finish texture, or pattern which would have been available from the manufacturer originally specified, at no additional cost to the Owner.

E. Additional Costs or Impact: Any additional cost, or any loss or damage arising from the substitution of any material or any method for those originally specified shall be borne by the contractor, notwithstanding approval or acceptance of such substitution by the Owner or the

Architect, unless such substitution was made at the written request or direction of the Owner and the Architect. Any decrease in the cost of the substitution shall be returned to the Owner.

F. Manufacturers: To the greatest degree possible, provide primary materials and products from one manufacturer for each type or kind. Provide secondary materials as recommended by manufacturers of primary materials.

G. Substitution Requests: Refer to Section 016200 - SUBSTITUTION REQUEST FORM. Submit 3 copies. Identify product to be replaced by substitute by reference to specification sections and drawing numbers. Provide Contractor's certification and evidence to prove compliance with Contract Document requirements as acceptable to Architect.

H. Substitution Conditions: Substitution requests will be returned without action unless one of the following conditions is satisfied. The Contractor shall state which of the following conditions applies to the requested substitution:

1. Request is due to an "or equal" clause.
2. Specified material or product cannot be coordinated with other work.
3. Specified material or product is not acceptable to authorities having jurisdiction.
4. Substantial advantage is offered Owner in terms of cost, time, or other valuable consideration.
5. Specified material or product is not available.

I. Invalid Substitutions: Contractor's submittal and Architect's acceptance of shop drawings, samples, product data or other submittal is not a valid request for, nor an approval of a substitution unless the Contractor presents the information when first submitted as a Request for Substitution.

J. Compatibility of Materials Used in the Work:

1. Ensure complete compatibility between materials.
2. Compatibility shall include adhesion, erosion, solubility, differential thermal response, and galvanic action.
3. Provide evidence of compatibility.
4. Provide custom testing where evidence is not available.
5. Where materials are not compatible, provide necessary isolation or transition materials and provide details of same.
6. Correct defects resulting from incompatibility including de-construction and re-construction of assemblies – whether materials are part of a submittal and substitution process or not.
7. Proposed substitutions may be rejected where compatibility information is not provided; or where compatibility is not adequately addressed, according to the Architect’s judgment; or where incompatible materials would negatively impact the project’s success.

1.16 DELIVERY, STORAGE AND HANDLING

A. Manufacturer's Instructions: Strictly comply with manufacturer's instructions and recommendations and prevent damage, deterioration and loss, including theft. Minimize long-term storage at the site. Maintain environmental conditions, temperature, ventilation, and humidity within range permitted by manufacturers of materials and products used.

1.17 OWNER-FURNISHED CONTRACTOR-INSTALLED (OFCI) PRODUCTS

A. Owner will furnish products indicated. The Contractor's Work includes providing support systems to receive Owner's equipment and making plumbing, mechanical, and electrical connections.

1. Owner will arrange for and deliver Shop Drawings, Product Data, and Samples to Contractor.
2. Owner will arrange and pay for delivery of Owner-furnished items according to Contractor's Construction Schedule.
3. After delivery, Owner will inspect delivered items for damage. Contractor shall be present for and assist in Owner's inspection.
4. If Owner-furnished items are damaged, defective, or missing, Owner will arrange for replacement.
5. Owner will arrange for manufacturer's field services and for delivery of manufacturer's warranties to Contractor.
6. Owner will furnish Contractor the earliest possible delivery date for Owner-furnished products. Using Owner-furnished earliest possible delivery dates, Contractor shall designate delivery dates of Owner-furnished items in Contractor's Construction Schedule.
7. Contractor shall review Shop Drawings, Product Data, and Samples and return them to Architect noting discrepancies or anticipated problems in use of product.
8. Contractor is responsible for receiving, unloading, and handling Owner-furnished items at Project site.
9. Contractor is responsible for protecting Owner-furnished items from damage during storage and handling, including damage from exposure to the elements.
10. If Owner-furnished items are damaged as a result of Contractor's operations, Contractor shall repair or replace them.
11. Contractor shall install and otherwise incorporate Owner-furnished items into the Work.

B. Owner-Furnished Products: As directed by the Architect.

1.18 LABELS

A. Labels, Trademarks, & Tradenames: Locate required labels on inconspicuous surfaces. Do not provide labels, nameplates, or trademarks which are not required. Provide permanent data plate on each item of equipment stating manufacturer, model, serial number, capacity, ratings and all other essential data.

1.19 RECORD DOCUMENTS

A. Definition of As-Constructed Record Drawings: (commonly called "as-builts") are the record of the Project as constructed based on information the Contractor provides to the Owner under the contract for construction. Because the As-constructed Record Drawings will be based on the Contractor's mark-ups, the Architect is not responsible for the accuracy or completeness of the As-constructed Record Drawings.

B. Definition of As-Designed Record Drawings: The record of everything the Architect designed for the Project, and including the original Construction Documents plus all addenda, Architect's Supplemental Instructions, Change Orders, Construction Change Directives and minor changes in the work.

C. General: Keep as-constructed record documents neatly and accurately. Record information as the work progresses and deliver to Architect at time of final acceptance. Include in record documents all field changes made, all relevant dimensions, and all relevant details of the work. Keep record documents up to date with all Architect's Supplemental Instructions, Change Orders, Construction Change Directives and minor changes in the work clearly indicated.

D. Drawings: Keep four separate sets of blackline prints at the site, one set each for mechanical, electrical, plumbing, and architectural/structural disciplines. Neatly and accurately note all deviations from the Contract Documents and the exact actual location of the work as installed. Marked-up and colored prints will be used as a guide to determine the progress of the work installed. Requisitions for payment will not be approved until the record documents are accurate and up-to-date.

1. Work Outside Building: Record data outside of building to an accuracy of plus or minus 1 inch and determine and record the invert elevation of all drain lines.
2. At completion of the work, submit one complete set of marked-up as-built prints for review. After acceptance, these marked-up as-built prints shall be used in the preparation of the as-built drawings.
3. Architect shall furnish Contractor with AutoCAD or BIM Design Intent Model or both files for originals of the Contract Drawings. The Contractor shall make modifications to these files as shown on the marked-up prints. Remove superseded data to show the completed installation.
4. The Contractor shall deliver the completed AutoCAD or BIM Design Intent Model or both as-constructed record drawings, in the same version as Contract Drawings, properly titled and dated to the Architect. Indicate preparer of as-built drawings. These as-built drawings shall become the property of the Owner.

E. Specifications: Maintain one clean copy of complete specifications [including addenda, modifications, and bulletins with changes, substitutions, and selected options clearly noted. Circle or otherwise clearly indicate which manufacturer and products are actually used.

F. Operating and Maintenance Manuals: Manuals shall be submitted which contain the following:

1. Description of the system provided.
2. Handling, storage, and installation instructions.
3. Detailed description of the function of each principal component of the systems or equipment.
4. Operating procedures, including prestartup, startup, normal operation, emergency shutdown, normal shutdown and troubleshooting.
5. Maintenance procedures including lubrication requirements, intervals between lubrication, preventative and repair procedures, and complete spare parts list with cross reference to original equipment manufacturer's part numbers.
6. Control and alarm features including schematic of control systems, control loop electric ladder diagrams, controller operating set points, settings for alarms and shutdown systems, pump curves and fan curves.
7. Safety and environmental considerations.

G. Copies of Operating and Maintenance Manuals: Three copies of the manuals shall be provided within sufficient time to allow for training of Owner's personnel. Submit one copy of the manuals to the Architect for review no later than 90 calendar days prior to substantial completion, or building turn over, whichever comes first. Submit the remaining five copies within 15 days after

first review set is returned to contractor. Progress payment may be withheld if this requirement is not met.

H. Additional Requirements for Operating and Maintenance Manuals: The requirements for manuals applies to each packaged and field-fabricated operating system. The manuals shall be provided in three-ring side binders with durable plastic covers. The manuals shall contain a detailed table of contents and have tab dividers for major sections and special equipment.

I. Framed Data: Provide charts and lists of all valves, circuits, switches, controls and equipment. Install on walls under glass at locations directed by Architect.

1.20 PROJECT CLOSE OUT

A. Complete the following prior to Substantial Completion:

1. Provide Contractor's Punch List of incomplete items stating reason for incompletion and value of incompletion.
2. Advise Owner of insurance change over requirements.
3. Submit all warranties, maintenance contracts, final certificates and similar documents.
4. Obtain Certificate of Occupancy and similar releases which permit the Owner's full and unrestricted use of the areas claimed "Substantially Complete".
5. Submit record documents.
6. Deliver maintenance stocks of materials where specified.
7. Make final change over of lock cylinders or cores and advise Owner of change of security responsibility.
8. Complete startup of all systems and instruct Owner's personnel in proper operation and routine maintenance of systems and equipment.
9. Complete clean up and restoration of damaged finishes.
10. Remove all temporary facilities and utilities that are no longer needed.
11. Request Architect's inspection for Substantial Completion.

B. Architect will either issue a Certificate of Substantial Completion or notify Contractor of work which must be performed prior to issue of certificate.

C. Complete the following prior to Final Acceptance and payment:

1. Obtain Certificate of Substantial Completion.
2. Submit final application for payment, showing final accounting of changes in the work.
3. Provide final releases and lien waivers not previously submitted.
4. Submit certified copy of final punch list stating that Contractor has completed or corrected each item.
5. Submit final meter readings, record of stored fuel and similar information.
6. Submit Consent of Surety for final payment.
7. Submit evidence of Contractor's continuing insurance coverage (if required by Contract Documents).

1.21 FINAL CLEANING AND REPAIR

A. Clean Up: Immediately prior to the Architect's inspection for Substantial Completion, the Contractor shall completely clean the premises and clean and prepare the completed work in order for it to be used for its intended purpose in accordance with the Contract Documents. Such work shall include, but not be limited to the following:

1. Concrete and ceramic surfaces shall be cleaned and washed.
2. Resilient coverings shall be cleaned, waxed and buffed as applicable.
3. Woodwork shall be dusted and cleaned.
4. Sash, fixtures and equipment shall be thoroughly cleaned.
5. Stains, spots, dust, marks and smears shall be removed from all surfaces.
6. Hardware and metal surfaces shall be cleaned and polished.
7. Glass and plastic surfaces shall be thoroughly cleaned by professional window cleaners.
8. Damaged, broken or scratched glass or plastic shall be replaced by the Contractor at the Contractor's expense.
9. Vacuum carpeted and soft surfaces with high efficiency particulate arrestor (HEPA) vacuum.
10. Use low-emitting, environmentally friendly cleaning agents and procedures.

B. Pest Control: Engage a licensed exterminator, who practices integrated pest management (IPM), to inspect the project and eliminate rodents, termites and all other insects and pests. Coordinate pest control plan with Owner. Owner’s written approval is required prior to application. Submit proposed program to Owner and Architect. Program shall clearly indicate the following:

1. Area or areas to be treated.
2. Manufacturer's printed instructions and MSDS for each chemical to be used.
3. Pollution preventive measures to be employed.

C. Repairs: Repair and touch-up all damaged and deteriorated products and surfaces.

PART 2 - PRODUCTS [Not Used]

PART 3 - EXECUTION [Not Used]

END OF SECTION

SECTION 012300

ALTERNATES

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 SUMMARY

A. For each of the alternates Scheduled at the end of this Section, state the amount in the proposal to be added to or deducted from the Contract Sum for the work.

1.3 ALTERNATES

A. Definition: "Alternates" are alternate products, materials, equipment, systems, methods, units of work or major elements of the construction, which may, at the Owner's option and under the terms established by the Contract or Agreement, be selected for the work in lieu of the corresponding requirements of the Contract Documents. Selection may occur prior to the Contract Date, or may, by the Agreement, be deferred for possible selection at a subsequent date.

B. Alternate Requirements: A Schedule of Alternates is included at the end of this Section. Each alternate is defined using abbreviated language, recognizing that the Contract Documents define the requirements. Coordinate related work to ensure that work affected by each alternate is complete and properly interfaced with work of each selected alternate.

C. Provide written proposals for each alternate on the Bid Form for Owner's consideration. Each proposal amount shall include the entire cost of the alternate portion of the work including overhead, profit, and other costs including cost of interfacing and coordinating the alternate with related and adjacent work.

D. Selection of Alternates: Selection of alternates to be included in the work will be by the Owner.

E. Notification: Immediately following award of Contract, prepare and distribute to each entity a notification of status of each alternate. Indicate which alternates have been accepted, rejected, or deferred for consideration at a later date. Include full description of negotiated modifications to alternates, if any

PART 2 - PRODUCTS [Not Used]

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

A. Alternate No. 1: As defined by the Architect.

END OF SECTION

SECTION 014000

QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. Testing Laboratory will be contracted directly to the Owner. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.

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

1.3 DEFINITIONS

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

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

C. Mockups: Full-size physical assemblies that are constructed on-site. Mockups are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.

1. Integrated Exterior Mockups: Mockups of the exterior envelope erected separately from the building but on Project site, consisting of multiple products, assemblies, and subassemblies.
2. Room Mockups: Mockups of typical interior spaces complete with wall, floor, and ceiling finishes, doors, windows, millwork, casework, specialties, furnishings and equipment, and lighting.

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

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

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

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

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

I. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.

1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).

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

1.4 CONFLICTING REQUIREMENTS

A. Referenced Standards: 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 conflicting requirements that are different, but apparently equal, to Architect for a decision before proceeding.

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

1.5 ACTION SUBMITTALS

A. Shop Drawings: For integrated exterior mockups, provide plans, sections, and elevations, indicating materials and size of mockup construction.

1. Indicate manufacturer and model number of individual components.
2. Provide axonometric drawings for conditions difficult to illustrate in two dimensions.

1.6 INFORMATIONAL SUBMITTALS

A. Contractor's Quality-Control Plan: For quality-assurance and quality-control activities and responsibilities.

B. Qualification Data: For Contractor's quality-control personnel.

C. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility sent to authorities having jurisdiction before starting work on the following systems:

1. Seismic-force-resisting system, designated seismic system, or component listed in the designated seismic system quality-assurance plan prepared by Architect.
2. Main wind-force-resisting system or a wind-resisting component listed in the wind-force-resisting system quality-assurance plan prepared by Architect.

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

E. Schedule of Tests and Inspections: Prepare in tabular form and include the following:

1. Specification Section number and title.
2. Entity responsible for performing tests and inspections.
3. Description of test and inspection.
4. Identification of applicable standards.
5. Identification of test and inspection methods.
6. Number of tests and inspections required.
7. Time schedule or time span for tests and inspections.
8. Requirements for obtaining samples.
9. Unique characteristics of each quality-control service.

1.7 CONTRACTOR'S QUALITY-CONTROL PLAN

A. Quality-Control Plan, General: Submit quality-control plan within 10 days of Notice of Award, and not less than five days prior to preconstruction conference. Submit in format acceptable to Architect. Identify personnel, procedures, controls, instructions, tests, records, and forms to be used to carry out Contractor's quality-assurance and quality-control responsibilities. Coordinate with Contractor's construction schedule.

B. Quality-Control Personnel Qualifications: Engage qualified full-time personnel trained and experienced in managing and executing quality-assurance and quality-control procedures similar in nature and extent to those required for Project.

1. Project quality-control manager may also serve as Project superintendent.

C. Submittal Procedure: Describe procedures for ensuring compliance with requirements through review and management of submittal process. Indicate qualifications of personnel responsible for submittal review.

D. Testing and Inspection: In quality-control plan, include a comprehensive schedule of Work requiring testing or inspection, including the following:

1. Contractor-performed tests and inspections including subcontractor-performed tests and inspections. Include required tests and inspections and Contractor-elected tests and inspections.
2. Special inspections required by authorities having jurisdiction and indicated on the "Statement of Special Inspections."
3. Owner-performed tests and inspections indicated in the Contract Documents, including tests and inspections indicated to be performed by the Commissioning Authority.

E. Continuous Inspection of Workmanship: Describe process for continuous inspection during construction to identify and correct deficiencies in workmanship in addition to testing and inspection specified. Indicate types of corrective actions to be required to bring work into compliance with standards of workmanship established by Contract requirements and approved mockups.

F. Monitoring and Documentation: Maintain testing and inspection reports including log of approved and rejected results. Include work Architect has indicated as nonconforming or defective. Indicate corrective actions taken to bring nonconforming work into compliance with requirements. Comply with requirements of authorities having jurisdiction.

1.8 REPORTS AND DOCUMENTS

A. Test and Inspection Reports: Testing Agency shall prepare and submit certified written reports specified in other Sections. Include the following:

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

B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:

1. Name, address, and telephone number of technical representative making report.
2. Statement on condition of substrates and their acceptability for installation of product.
3. Statement that products at Project site comply with requirements.

4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
6. Statement whether conditions, products, and installation will affect warranty.
7. Other required items indicated in individual Specification Sections.

C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:

1. Name, address, and telephone number of factory-authorized service representative making report.
2. Statement that equipment complies with requirements.
3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
4. Statement whether conditions, products, and installation will affect warranty.
5. Other required items indicated in individual Specification Sections.

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

1.9 QUALITY ASSURANCE

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

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

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

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

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

F. Specialists: Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.

1. Requirements of authorities having jurisdiction shall supersede requirements for specialists.

G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 329; and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.

1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.

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

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

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

1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect.
2. Notify Architect seven days in advance of dates and times when mockups will be constructed.
3. Employ supervisory personnel who will oversee mockup construction. Employ workers that will be employed during the construction at Project.
4. Demonstrate the proposed range of aesthetic effects and workmanship.
5. Obtain Architect's and Owner’s approval of mockups before starting work, fabrication, or construction.

    a. Allow seven days for initial review and each re-review of each mockup.

6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
7. Demolish and remove mockups when directed unless otherwise indicated.

K. Integrated Exterior Mockups: Construct integrated exterior mockup according to approved Shop Drawings. Coordinate installation of exterior envelope materials and products for which mockups are required in individual Specification Sections, along with supporting materials.

1.10 QUALITY CONTROL

A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.

1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
2. Payment for these services will be made from testing and inspecting allowances, as authorized by Owner.

3. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Order.

B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.

1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
2. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.

    a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.

3. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
5. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

C. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Section 013300 "Submittal Procedures."

D. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.

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

F. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:

1. Access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
4. Facilities for storage and field curing of test samples.
5. Delivery of samples to testing agencies.
6. Preliminary design mix proposed for use for material mixes that require control by testing agency.

7. Security and protection for samples and for testing and inspecting equipment at Project site.

G. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.

1. Schedule times for tests, inspections, obtaining samples, and similar activities.

1.11 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: Owner will engage a qualified testing agency or special inspector to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:

1. Date test or inspection was conducted.
2. Description of the Work tested or inspected.
3. Date test or inspection results were transmitted to Architect.
4. Identification of testing agency or special inspector conducting test or inspection.

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

3.2 REPAIR AND PROTECTION

A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.

1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 017300 "Execution."

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

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

END OF SECTION

SECTION 014330

MOCKUPS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 SUMMARY

A. General: Provide and coordinate mock-up assemblies at Project site for Architect's review and acceptance, in accordance with requirements of the Contract Documents. Refer to individual Specification Sections for mock-up requirements. Generally, without limitation, mock-ups on site include the following:

1. Mock-ups of individual pieces of the work, as specified within individual Specification Section.
2. Field Mock-Up of exterior wall components. Refer to the Drawings for extent of mock-up.
3. Field Mock-Up of interior construction. Refer to the Drawings for extent of mock-up.

B. It shall be the responsibility of the Contractor to coordinate the work of the related Specification Sections so that each mock-up meets the specified requirements.

C. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Individual Specification Sections for Submittal Samples.

1.3 DEFINITIONS

A. Freestanding Mock-Ups: Full-size, physical assemblies that are constructed on-site in a protected location.

1. Freestanding mock-ups are not part of the final construction. Freestanding mock-ups will be used to verify selections made under sample submittals, to demonstrate aesthetic effects, qualities of materials and execution, and to review construction, coordination, testing, and operation.
2. Approved freestanding mock-ups establish the standard by which the Work will be judged.
3. Approved freestanding mock-ups remain on site during the balance of construction and are demolished and removed from site at completion of the Work they represent.

B. In-Place Mock-Ups: Full-size, physical assemblies that are constructed in-place and remain part of final construction.

1. In-place mock-ups will be used to verify selections made under sample submittals, to demonstrate aesthetic effects, qualities of materials and execution, and to review construction, coordination, testing, or operation.
2. Approved in-place mock-ups establish the standard by which the Work will be judged.
3. Approved mock-ups remain part of the completed Work.

1.4 SUBMITTALS

A. Schedule: Construction Manager shall submit a schedule of mock-up construction, including dates for mock-up review by the Architect.

1. Mock-up schedule shall be reviewed at each progress meeting, revised and resubmitted as required.
2. Schedule shall allow sufficient time for mock-ups which are not accepted to be reconstructed and reviewed until accepted by the Architect.

B. Shop Drawings of Mock-Ups: Provide large scale shop drawings for fabrication, installation and erection of all parts of each mock-up. Provide plans, elevations, and details of anchorage, connections and accessory items.

C. Photographs of Mock-Ups: Submit photographs of mock-ups after completion of installation and acceptance of each mock-up.

D. Submittal Samples: Refer to individual Specification Sections for submittal requirements of mock-up components and coordinate accordingly.

1.5 QUALITY ASSURANCE

A. Design Modifications: Make design modifications to work only as required to meet performance requirements and to coordinate the work. Indicate proposed design modifications on shop drawings. Maintain original design concept without altering profiles and alignments indicated.

PART 2 - PRODUCTS

2.1 MATERIALS AND PRODUCTS

A. Provide materials, components, and products for mock-ups as specified in individual Specification Sections.

PART 3 - EXECUTION

3.1 GENERAL

A. Refer to PART 3, EXECUTION portions of the various Specification Sections for specific requirements regarding condition of surfaces, erection, and erection tolerances.

3.2 FIELD MOCK-UP OF EXTERIOR WALL

A. Provide a field mock-up of the exterior wall at location and in configuration indicated on Drawings. The exterior wall mock-up shall include the veneer systems and backup, one window

and all related flashings and sealants, etc. Obtain Architect's acceptance of visual qualities prior to commencing work that individual mock-up is intended to represent. Protect and maintain approved mock-ups throughout the work of the Contract. Locate mock-ups at the Project site as directed by the Architect.

1. Refer to Drawings for extent of the field mock-up.
2. Provide modifications to mock-up as required until Architect's approval has been received.

3.3 FIELD MOCK-UP OF INTERIOR CONSTRUCTION

A. Provide a field mock-up of the interior construction items at locations and in configuration indicated on Drawings or as otherwise directed. Obtain Architect's acceptance of visual qualities prior to commencing work that individual mock-up is intended to represent. Protect and maintain approved mock-ups throughout the work of the Contract. Locate mock-ups at the Project site as directed by Architect.

1. Refer to Drawings for extent of the field mock-up.
2. Provide modifications to mock-up as required until Architect's approval has been received.

B. Interior Construction Mock-ups: Provide mock-ups of various interior construction as indicated or as specified in the applicable Specification Sections, as directed by the Architect.

3.4 INDIVIDUAL MOCK-UPS

A. Provide individual mock-ups of types and sizes required by individual Specification Sections to evaluate and set the standard of quality for that work. Obtain Architect's acceptance of visual qualities prior to commencing work that individual mock-up is intended to represent. Protect and maintain approved mock-ups throughout the work of the Contract. Locate mock-ups at the Project site as directed by the Architect.

1. Provide as many mock-ups as required until Architect's approval has been received.
2. When indicated in individual Specification Sections, approved mock-ups may be incorporated into the finish work.

3.5 REPAIR AND PROTECTION

A. General: On completion of testing, inspecting, sample taking, and similar services, repair and restore substrates and finishes.

1. Provide materials and comply with installation requirements specified in other Specification Sections. Restore patched areas and extend restoration into adjoining areas with durable seams that are as non-visible as possible.

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

3.6 REMOVAL AND DISPOSAL

A. Demolish and remove mock-ups from site at the completion of the Project. Legally dispose of demolished mock-up materials. Comply with requirements of Section 017400 – CONSTRUCTION WASTE MANAGEMENT.

END OF SECTION

SECTION 015639

TEMPORARY TREE AND PLANT PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes materials, labor, apparatus, tools, equipment, temporary construction, transportation, and services necessary for and incidental to performing the proper completion of Work for Temporary Tree and Plant Protection, as shown in the Contract Drawings, and as specified herein this Section.

B. Work under this Section consists of, but is not necessarily limited to, furnishing and installing the following:

1. Protecting and maintaining existing trees and vegetation to remain not specifically designated for removal.
2. Protection shall be extended to trees and/or vegetation located within or directly adjacent to the Project Site, whether the tree trunk and/or vegetation are located within the designated Limits of Work or not as indicated on the document sheets.

C. Related Documents: The following Documents contain requirements that relate to Work in this Section:

1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
2. Section 312219 “Landscape and Fine Grading”
3. Section 328400 "Site Irrigation Systems"
4. Section 329200 "Lawns and Grasses"
5. Section 329300 "Trees, Shrubs, Vines and Groundcovers"

1.2 DEFINITIONS AND APPLICABLE STANDARDS

A. References:

1. USDA – United States Department of Agriculture.
2. ASTM – American Society for Testing & Materials.
3. ANSI – American National Standards Institute.
4. ISA – International Society of Arboriculture.

B. Definitions:

1. Tree – A woody perennial plant which usually has (but not limited to) a single dominant trunk and has a mature height of fifteen-feet (15') or more and has a trunk diameter (caliper) of three-inches (3") or more when measured at twelve-inches (12") above the finished grade.
2. Drip-line – The outermost extent of the tree's foliaged canopy, which encompasses the tree leaves or fronds, trunk, branches, roots, and soil. In no case shall a drip line encompass an area under a tree canopy, which is less than ten-feet (10') in diameter. Since each tree is unique in size, scale, and form, the delineated drip-line of each tree shall be refined at the discretion of the Landscape Architect.

3. Injury – Bruising, scarring, tearing, gouging, or breaking of roots, branches, or trunk(s), soil compaction around or within the drip-line, or contamination around the drip-line which results in the decline to the health of the tree.
4. Root Zone– The soil volume surrounding a plant containing the roots.

C. Reference Standards:

1. American National Standard for Tree Care Operation, Tree, Shrub, and Other Woody Plant Maintenance (ANSI A300), American National Standards Institute, Latest Edition.
2. American National Standard for Tree Care Operations (ANSI Z133), American National Standards Institute, Latest Edition.
3. *Tree Pruning Guidelines*, International Society of Arboriculture, 1995 Edition.
4. *Pruning Standards for Shade Trees*, National Arborists Association, Latest Edition.

D. Product Data and Sample of fence mesh materials listed in contract documents.

1.3 SUBMITTALS

A. General: Refer to Division 01 for project submittal requirements and timelines. If provided in hardcopy submittal booklets submit each item in this Article in required copies with three (3) copies for review by Landscape Architect. Two (2) copies shall be returned (one for Client and one for Contractor) and one copy maintained by Landscape Architect. Provide two (2) sets of Material Samples for review by the Landscape Architect unless requested otherwise. One set will be returned for use as site/field referee sample and the other shall be maintained by the Landscape Architect.

B. Submittal Booklets: Each Submittal Booklet under this Section shall be tabbed into specific sections, containing clearly identified (through yellow highlighter or other specific identification methods) and legible information on the following information indicated in this Article.

C. Electronic Submittals: Electronic Submittal shall be provided in a single bound file, PDF format preferred, unless otherwise noted in Division 01.

D. Submittals under this Article will be rejected and returned without the benefit of review by the Landscape Architect if they are difficult to read due to insufficient scale, poor image quality, or poor drafting quality; or if all of the required information is missing or not presented in the format as requested.

E. No Work under this Section shall proceed until all information indicated herein this Article have been reviewed, accepted, and approved by the Landscape Architect, in writing.

F. Contractor shall provide site photographs or videotape, sufficiently detailed and described, of existing conditions of trees and vegetation, adjoining construction, and site improvements that might be misconstrued as damage caused by site clearing, tree pruning, or tree protection. Submit photographs or videotape to the Landscape Architect prior to commencement of Work.

G. Preliminary layout of fence protection system shall be laid out with staking on approval by Landscape Architect.

H. Product Data: Submit complete and legible materials list of items to be provided for Work described herein this Section.

I. Submit complete detailed schedule and description of Work to be done within drip-line, (if any), including list of equipment to be used.

1. A Certified Arborist may propose pruning of trees or other vegetation not a part of Contractor scope for prevention of tree health decline for approved work occurring within dripline. The Certified Arborist shall have a minimum of five (5) year's post-certification experience performing pruning and observation work for projects of comparable size with trees of similar size and nature.

1.4 QUALITY ASSURANCE AND CONTROL

A. Pruning and remedial work shall be done under the direct supervision of an Arborist certified by the International Society of Arborists (ISA); or Arborist who is a member in good standing in the American Society of Consulting Arborists, in compliance with ISA and ANSI Standards. Arborist shall be on Site continuously while existing trees or roots are being pruned or remedial work is being performed.

1.1 PRE-INSTALLATION MEETING

A. Shall not occur without Submittals approved by the Contractor and accepted by the Project Landscape Architect, Client and Owner.

B. Shall convene a minimum of two weeks before starting work of this section.

C. Required Attendees:

1. Contractor.
2. Any other subcontractors associated with demolition and tree/vegetation protection Work.
3. Landscape Architect.
4. Owner or Owner’s Project Manager or Representative.
5. Client or Client’s Project Manager or Representative
6. City entity Building Department Representative or Inspector.
7. Project Arborist, if any.

D. The Contractor shall make arrangements for the meeting and notify the parties required to attend.

E. Agenda shall include:

1. Review preparation and installation procedures and coordinating and scheduling required with related work.
2. Review protective measures system and detail requirements (drawings, specifications, and other contract documents).
3. Review associated submittals.
4. Review and finalize construction schedule related to site work and verify availability of materials, personnel, equipment and facilities needed to make progress and avoid delays.
5. Review required inspection material usage procedures.
6. Review weather and forecasted weather conditions, and procedures for coping with unfavorable conditions.
7. Tour site, inspect and discuss conditions necessary to complete the work of this section.

1.5 PROJECT SITE CONDITIONS

A. Contractor shall become aquatinted with existing site conditions, verifying quantities and locations of all protected trees and vegetation, and other information as may be necessary. Notify the Landscape Architect of unsatisfactory conditions, in writing, prior to commencement of Work.

B. Tree Flagging: Prior to commencement of Work, Contractor shall flag existing trees and vegetation to be removed per the plan documents. Adequately flag tree trunks with bright-colored tape (neon colors preferred). Verify flagged trees and vegetation with the Landscape Architect prior to removal or protection device setup. No paint marking of vegetation is allowed.

C. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during tree-pruning or tree-protection operations.

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

D. Locate all utilities prior to any Work, and perform Work in a manner which will avoid possible damage. Notify utility locator service for area where Project is located before site clearing where applicable. Notify the Landscape Architect if conflicts exist.

E. Improvements on Adjoining Property: Authority for performing indicated removal and alteration Work on property adjoining Owner's property shall be obtained by the adjoining property Owner(s) prior to commencement of Work.

F. Protect existing Work and Work of other trades: Damage to existing construction caused by Work of this Section shall be promptly repaired and/or replaced at the expense of the Contractor.

G. Environmental Requirements: Perform actual pruning operations (if needed) during those seasons suitable for the specific tree type, in accordance with locally acceptable horticultural practices.

1.6 GUARANTEE

A. Contractor shall guarantee that plants covered under the Provisions of this Section shall be protected from damage due to construction operations from start of construction until the date of Final Acceptance.

B. Requirements of the guarantee shall apply if failure of the Contractor to take specified precautions and Work within restrictions of this Section contributes to the destruction, decline, or injury to a tree or plant materials to remain, in the judgment of the Landscape Architect.

C. If a tree designated to be protected accordingly is destroyed or injured so that in the judgment of the Landscape Architect or third party reviewer, it should be replaced, it shall be removed at the expense of the Contractor. Contractor shall pay compensation to the Owner or Client where the tree or plant material was located at the rate as specified herein this Section (see Compensation).

1.7 COMPENSATION

A. Contractor shall replace existing plant material designated to remain that dies or sustained injury from the result of the Contractor's negligence to provide adequate required protection, pruning, or maintenance during the course of construction operations. Replacement shall equate or match material removed

B. Trees: Contractor shall thoroughly remove damaged tree, including trunk, branches, and roots, at no cost to the Owner or Owner, and at the direction of the Landscape Architect.

1. Contractor shall furnish and install per requirements in Section 329300 “Trees, Shrubs, Vines and Groundcovers”, with an equal size tree (in height, spread, and caliper), and of the same form, species, and in the same quantity as those tree(s) that were damaged, at the direction of the Landscape Architect. Compensation shall include the actual cost of the item prepared for procurement; transportation or delivery of boxed item to the site; unloading, planting and staking; maintenance, including watering, fertilizing, pruning, pest control, and other care to bring replacement to same general condition of the original item. Maintenance terms shall be substantial completion or one calendar year from date of acceptance.

C. Other Plant Material (other than Trees): Contractor shall replace other vegetation (other than trees) that died or sustained injury from the result of the Contractor's negligence to provide adequate required vegetation protection, pruning, or maintenance during the course of construction operations. Compensation shall be awarded to the Owner as follows:

1. Contractor shall thoroughly remove damaged vegetation at no cost to the Owner or Owner, and at the direction of the Landscape Architect.
2. Contractor shall furnish and install per requirements in Section 329300 – Trees, Shrubs, Vines and Groundcovers, with equal size plant material as those which were damaged (as applicable) of the same form, species, and in the same quantity as vegetation that was damaged, at the direction of the Landscape Architect.

PART 2 - PRODUCTS

2.1 TREE PROTECTION MATERIALS

A. Temporary Barricade for Protection of Existing Vegetation (for temporary uses only):

1. Fabric: Utility (snow) type fencing, minimum four-feet (4'-0") high, consisting of a vinyl meshed fabric, extended in a bright orange color and approved by the Landscape Architect.
2. Posts: Metal sufficient in gauge (as appropriate) and size to support the fabric material in a taut and plumb condition. Posts shall be subject to approval by the Landscape Architect. Refer to contract documents.
3. Wire- 12-1/2 gauge Shaffield wire, spaced per drawings

B. Chain Link Fencing:

1. 6' fencing, 2" square galvanized chain link with galvanized posts and continuous tension wire, top and bottom. Minimum wire size 14 gauge galvanized. Set 2” diameter posts in soil with adequate size and embedment for support through construction. Provide terminal and anchor posts for support at size and frequency required. Provide stantions for 2” posts where required on hardscape surfaces.

C. Mulch: Where available, Contractor shall stockpile and reuse shredded wood chips produced from on-site tree removals and remedial work, if chips are disease free and acceptable to the Landscape Architect. Where on-site chips are not available, Contractor shall provide Shredded Wood Mulch as specified in Section 329400 – Landscape Planting Accessories.

D. Screening Fabric: Woven polyethylene product with min 80% density to 100% for visual impeding however with wind allowance. All edges shall be hemmed and tie-ins shall be grommeted. Dark Green in color. Minimum one (1) year warranty on product.

PART 3 - EXECUTION

3.1 GENERAL

A. NO WORK UNDER THIS SECTION SHALL COMMENCE UNTIL ALL SUBMITTALS UNDER THIS SECTION HAVE BEEN REVIEWED AND APPROVED, IN WRITING. DO NOT PROCEED WITH INSTALLATION UNTIL UNSATISFACTORY CONDITIONS HAVE BEEN CORRECTED.

3.2 PREPARATION

A. Provide erosion-control measures as needed to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

1. Standard State of Texas Environmental Regulations apply including all Stormwater Pollution Prevention measures for site over five (5) acres.
2. Standard City of Dallas Environmental Regulations apply. Refer to City for requirements.

B. Locate and clearly flag trees and vegetation to be removed or to be relocated.

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

3.3 TREE AND VEGETATION PROTECTION

A. Protect existing trees and other vegetation indicated to remain in place against the following:

1. Storage or parking of automobiles or other vehicles.
2. Stockpiling of building materials, refuse, or excavated materials.
3. Use of trees as support posts, power posts, or sign posts, anchorage for ropes, guy wires, or power lines, or other similar functions.
4. Dumping of poisonous materials on or around plant roots, trunks, branches, or foliage. Such materials include, but are not limited to, paint, petroleum products, dirty water, or other deleterious materials.
5. Cutting, breaking, or shinning of roots caused by utility trenching, foundation digging, placement of curbs and trenches, and other miscellaneous excavation without prior written approval by the Landscape Architect.
6. Damage by skinning or bruising of bark on trunks or branches, caused by maneuvering vehicles or stacking material or equipment too close to the plant.
7. Compaction of the soil within the drip-line of the plants due to movement of trucks or grading machines, pedestrian or vehicular traffic, storage of equipment or materials.
8. Excessive water or heat from equipment or utility line construction.
9. Damage to root system from flooding, erosion, and excessive wetting and drying resulting from watering and other operations.

B. Prior to commencement of construction activities, the Contractor shall erect and maintain a temporary fenced (chain link) barricade around the drip-line of individual trees, around perimeter drip-line of groups of trees, or around other vegetation to remain at distance specified in contract drawings or approved by Landscape Architect.

1. Prevent damage to roots during installation of barricade posts. Space posts approximately 6'-0" on-center (O.C.) and securely attach fabric.
2. Barricades top wire shall be installed plumb, taut, and sturdy to prevent unauthorized access around drip-line of trees and protected vegetation. Repair sagging or damaged barricades immediately.

3. During the course of construction, relocation of the barricade may be required to facilitate construction. Contractor shall relocate barricade as directed by the Landscape Architect at no additional expense to the Owner or Client.
4. Remove barricade when construction operations are complete or when directed by the Landscape Architect.

C. Irrigation: Contractor shall supply fresh potable water in adequate amounts and rates of application as required to maintain the health of protected plant material throughout the duration of the construction operations. Contractor shall maintain a watering schedule and document dates and duration of irrigation applications.

1. Provide supplemental watering and dust control as needed and requested by arborist or Landscape Architect review at no additional cost to the owner.

D. Do not excavate within drip line of trees, unless approved, in writing, by the Landscape Architect.

E. Where excavation for new construction is required within drip line of trees, hand clear and excavate to minimize damage to root systems. Use narrow-tine spading forks, comb soil to expose roots, and cleanly cut roots as close to excavation as possible.

1. Cover exposed roots with burlap and water regularly.
2. Temporarily support and protect roots from damage until they are permanently relocated and covered with soil.
3. Coat cut faces of roots more than 1-1/2 inches in diameter with emulsified asphalt or other approved coating formulated for use on damaged plant tissues.
4. Cover exposed roots with wet burlap to prevent roots from drying out. Backfill with soil as soon as possible.

F. Protect root systems of existing trees and vegetation from damage due to chemically injurious materials in solution caused by run-off or spillage during mixing or placement of construction materials, and drainage of stored materials.

G. Protect root systems from flooding, erosion, excessive wetting or drying resulting from de-watering or other operations.

H. Repair or replace trees and vegetation indicated to remain that are damaged by construction operations, in a manner approved by the Landscape Architect.

1. Employ a qualified arborist, licensed in jurisdiction where Project is located, to submit details of proposed repairs and to repair damage to trees and shrubs.
2. Replace trees that cannot be repaired and restored to full-growth status, as determined by the qualified Arborist.

3.4 PRUNING AND REMEDIAL WORK

A. Pruning and remedial work shall be done under continuous supervision of the approved Arborist, according to approved submittals, and per ANSI A300 Pruning Standards.

B. Provide pruning, cabling and bracing, irrigation, pest and disease control and other remedial treatments as recommended by the approved Arborist, required to assure the long-term health of the trees and existing vegetation, and the safety of persons and property.

C. Salvage trees 18" diameter and smaller for shredding of wood material to mulch. Mulch to be used on site for tree protection and temporary access.

3.5 MAINTENANCE

A. Keep areas within tree protection barricades free from weeds, trash, and debris. Do not use herbicides.

B. Maintain mulch layer and protective devices throughout entire period of construction.

END OF SECTION

SECTION 16200

SUBSTITUTION REQUEST FORM

No substitutions will be considered without this completed substitution request form and supporting documentation. Substitutions made without completion of this form will be considered defective work as stated in AIA A201.

Date: _____ Number: _____

Re: Request for Substitution

The Contractor proposes the following substitution in accordance with the requirements of the Contract Documents:

Scope of Substitution _____

_____

Specification Reference _____

_____

Drawing Reference _____

_____

Reason for Proposed Substitution _____

_____

Benefit to Owner _____

_____

Impact on Project Cost _____

_____

Impact on Project Schedule _____

_____

Impact on Guarantees and Warranties _____

_____

Coordination and Compatibility Required with Adjacent Materials and System _____

_____

List Deviations From Specified Requirements

Attachments: Attach supporting documentation sufficient for Architect to evaluate substitution. Substitution Request Forms submitted without adequate documentation will be returned without review.

Attachments

Response Date: List date by which response by Architect is requested to maintain project schedule and allow sufficient time for inclusion of proposed substitution.

Response Date

Submitted By

Firm and Address

Signature below signifies acceptance of responsibility for accuracy and completeness of information included in this Substitution Request Form.

Authorized Signature

ARCHITECT'S RESPONSE

Notations listed below shall have same meaning as on Architect's approval stamp. Clarifications to or changes in project schedule or time shall be processed using standard project forms.

Architect's Response

_____ Approved

_____ Approved as Corrected

_____ Revise and Resubmit

_____ Rejected

_____ Returned Without Review

Remarks _____

_____

_____

_____

_____

_____

Date _____

Signed _____

END OF FORM

SECTION 017400

CONSTRUCTION WASTE MANAGEMENT

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS, which are hereby made a part of this Section of the Specifications.

1.2 SUMMARY

A. This Section includes requirements for the Contractor's implementation of waste management controls and systems for the duration of the Work.

B. Develop a waste management plan, quantifying material diversion by either weight or volume to recycle and/or salvage non-hazardous construction and demolition debris.

1.3 INTENT

A. The Owner and Architect have established that this Project shall generate the least amount of waste practical and that processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors shall be employed.

B. With regard to these goals the Contractor shall develop, for the Architect's review, a Construction Waste Management Plan (CWMP) for this Project.

C. Each Subcontractor shall be responsible for segregating his own waste into different dumpsters as directed by the Contractor.

D. Contractor shall be responsible for ensuring that debris will be disposed of at appropriately designated licensed solid waste disposal facilities, as defined by MGL Chapter 111, Section 150A.

1.4 SUBMITTALS

A. Waste Management Plan (WMP): Submit within 21 calendar days after receipt of Notice to Proceed, in a format acceptable to the Owner.

1. Analysis of the proposed jobsite waste to be generated, including types and rough quantities.
2. Landfill Options: The name of the landfills where trash and building debris will be disposed of, the applicable landfill tipping fees, and the projected cost of disposing of all Project waste in the landfills.
3. Landfill Certification: Contractor’s statement of verification that landfills proposed for use are licensed for types of waste to be deposited and have sufficient capacity to receive waste from this project.

4. Alternatives to Landfilling: A list of each material proposed to be salvaged or recycled during the course of the Project. Include the following and any additional items proposed:
   a. Cardboard and paper products.
   b. Clean dimensional wood.
   c. Beverage containers.
   d. Concrete.
   e. Slurry wall materials.
   f. Bricks and masonry.
   g. Asphalt.
   h. Metals from framing, banding, stud trim, ductwork, piping, rebar, roofing, other trim, steel, iron, galvanized sheet steel, stainless steel, aluminum, copper, zinc, lead, brass, and bronze.
   i. Mechanical and electrical equipment.
   j. Building components which can be removed relatively intact from existing construction.
   k. Packaging materials, including cardboard, boxes, plastic sheet and film, polystyrene packaging, wood crates, plastic pails.
   l. Glass.
   m. Scraps from new gypsum wall board.
   n. Carpet and pad.
   o. Acoustical ceiling panels.
   p. Plastics.
5. Meetings: A description of the regular meetings to be held to address waste management.
6. Materials Handling Procedures: A description of the means by which any waste materials identified above will be protected from contamination, and a description of the means to be employed in recycling the above materials consistent with requirements for acceptance by designated facilities.
7. Transportation: A description of the means of transportation of the recyclable materials (whether materials will be site-separated and self-hauled to designated centers, or whether mixed materials will be collected by a waste hauler and removed from the site) and destination of materials.

B. Waste Management Progress Reports: Concurrent with each Application for Payment, submit a written Waste Management Progress Report in the same format as required for Final Report.

C. Waste Management Final Report: Prior to Substantial Completion, submit a written Waste Management Final Report summarizing the types and quantities of materials recycled and disposed of under the Waste Management Plan. Include the name and location of disposal facilities.

   1. Material category.
   2. Generation point of waste.
   3. Total quantity of waste, by weight.

D. Other Submittals:

   1. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.
   2. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.

3. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, and/or receipts.
4. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, and/or receipts.
5. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

1.5 CONTRACTORS

A. Contractor may subcontract work of this Section to a sub-contractor specializing in recycling and salvaging of construction waste.

B. Acoustical Ceiling Panel Recycling: Demolition and construction waste pulpable mineral fiber ceiling panels may be recycled by Armstrong World Industries and US Gypsum. Contact Armstrong at 1-877-ARMSTRONG (1-877-276-7876) or www.armstrong.com or contact USG at 1-800-USG-4YOU or www.usg.com, to coordinate recycling efforts, apply for product approvals, and receive reclamation procedure requirements.

C. Carpet Recycling: Demolition and construction waste carpet and carpet padding may be recycled by Carpet America Recovery Effort (CARE). Visit www.carpetrecovery.org to locate carpet reclaimers in local project area and reclamation procedure requirements.

PART 2 - PRODUCTS [Not Used]

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

A. General: Implement Waste Management Plan as approved by the Architect. Provide containers, storage, signage, transportation, and other items as required to implement WMP for the entire duration of the Contract.

3.2 WASTE MANAGEMENT PLAN IMPLEMENTATION

A. Manager: The Contractor shall designate an on-site person responsible for instructing workers and overseeing and documenting results of the Waste Management Plan for the Project.

B. Distribution: The Contractor shall distribute copies of the Waste Management Plan to the Job Site Foreman, each Subcontractor, the Owner and the Architect.

C. Instruction: The Contractor shall 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. Separation Facilities: The Contractor shall lay out and label a specific area to facilitate separation of materials for recycling, salvage, reuse, and return. Recycling and waste bin areas

are to be kept neat and clean and clearly marked in order to avoid contamination of materials. Location shall be acceptable to the Architect.

E. Hazardous Wastes: Any unforeseen hazardous wastes shall be separated, stored, and disposed of according to local regulations and as directed by the Owner.

END OF SECTION

SECTION 018120

CONSTRUCTION INDOOR AIR QUALITY (IAQ) MANAGEMENT

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Requirements for minimum indoor air quality (IAQ) performance standards during the construction period and before occupancy.
2. With regard to these goals the Contractor shall develop, for Owner and Architect review, a Construction Indoor Air Quality Management Plan for this Project.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 011000 - GENERAL REQUIREMENTS; Submittal requirements.
2. Section 011000 - GENERAL REQUIREMENTS; Construction facilities and controls.
3. Section 017400 - CONSTRUCTION WASTE MANAGEMENT.
4. Division 23 - HVAC.
5. Divisions 02 through 48 Specification Sections; Specific requirements relating to indoor air quality for each Section.

1.3 PERFORMANCE REQUIREMENTS

A. Prevent exposure of building systems to environmental tobacco smoke during construction. At a minimum, take the following measures:

1. Do not allow smoking in enclosed portions of the project site.
2. Locate exterior designated smoking areas at least 25 feet away from entries, outdoor air intakes and operable windows. Provide signage for designated smoking areas at each entry.

B. During construction meet or exceed the minimum requirements of the recommended Control Measures of the Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ Guidelines for Occupied Buildings under Construction, Second Edition, November 2007, Chapter 3.

C. Protect absorptive materials from moisture damage when stored on-site and after installation.

1.4 SUBMITTALS

A. Construction Indoor Air Quality (IAQ) Management Plan: With the completed Form of Bidder's Proposal, the Contractor shall submit a preliminary Construction IAQ Management Plan.

1. Within 21 calendar days after receipt of Notice to Proceed, the Contractor shall submit to the Owner a finalized Construction IAQ Management Plan.
2. The proposed Plan shall comply with Division 23 – HVAC requirements.
3. The proposed Plan shall include, but not be limited to, the following:
   a. Protection of ventilation system components during construction.
   b. Cleaning and replacing contaminated ventilation system components after construction, including filtration media.
   c. Temporary ventilation.
   d. Protection of absorptive materials from moisture damage when stored on-site and after installation, including exterior wall rain protection.
   e. Sequence of finish installation plan.
   f. Selection of cleaning products and procedures to be used during construction and final cleaning.
   g. Other items as required by SMACNA IAQ Guidelines for Occupied Buildings under Construction, Chapter 3.
4. Coordinate Construction IAQ Management Plan with Owner's current IAQ management plans and procedures.

B. Indoor Air Quality (IAQ) Data: Submit emission test data as required, with testing laboratory and date clearly identified.

C. Material Safety Data Sheets (MSDS): Submit for materials as required, with date clearly identified. MSDS must contain specific chemical content data identifying the percent of the total product mass represented by each listed chemical.

D. Product Data: Submit for each type of filtration media used during construction and installed immediately prior to occupancy, with MERV values clearly identified.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Take special care to prevent accumulation of moisture on materials and within packaging during delivery, storage, and handling to prevent development of mold and mildew inside packaging and on products.

B. Immediately remove from site and properly dispose of materials showing signs of mold and mildew, including materials with moisture stains.

PART 2 - PRODUCTS

2.1 FILTRATION MEDIA

A. Filtration Media: Comply with ASHRAE 52.2-1999 and provide MERV as required.

PART 3 - EXECUTION

3.1 CONSTRUCTION IAQ MANAGEMENT PLAN IMPLEMENTATION

A. IAQ Manager: The Contractor shall designate an on-site person responsible for instructing workers and overseeing and documenting results of the Construction IAQ Management Plan for the Project.

B. Distribution: The Contractor shall distribute copies of the Construction IAQ Management Plan to the Job Site Foreman, each subcontractor, the Owner, and the Architect.

C. Instruction: The Contractor shall provide on-site instruction of appropriate procedures and methods to be used by all parties at the appropriate stages of the Project.

D. Preconditioning: Allow products, which have odors and significant VOC emissions, to off-gas in a dry, well-ventilated space for sufficient period to dissipate odors and emissions prior to delivery to Project.

1. Remove containers and packaging from materials prior to conditioning to maximize off-gassing of VOCs.
2. Condition products in ventilated warehouse or other building.

E. Coordinate Construction IAQ Management Plan with final cleaning as indicated in Section 011000, GENERAL REQUIREMENTS.

END OF SECTION

SECTION 023000

SUBSURFACE INVESTIGATION

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS, which are hereby made a part of this Section of the Specifications.

1.2 SUBSURFACE INVESTIGATION

A. Information Not Guaranteed: Information on the Drawings and in the Project Manual relating to subsurface conditions, natural phenomena, and existing utilities and structures is from the best sources presently available. Such information is furnished only for the information and convenience of the Contractor, and the accuracy or completeness of this information is not guaranteed.

B. Foundation Engineering Report: Refer to the Geotechnical Report in the Appendices.

1.3 CONFIRMATION OF GRADES AND UTILITIES

A. Prior to commencement of site excavating operations, the Contractor shall compare existing site grading and proposed new site grading. Where existing utilities are indicated but their inverts or depths are not, exploratory excavating shall be performed to assure that sufficient earth coverage will be attained during the course of new site grading.

1. Utilities existing on the site shall be carefully protected from damage and relocated or removed as required by the work. When an active utility line is exposed during construction, its location and elevation shall be plotted on the record drawings and the Architect, Owner and the utility owner notified in writing.

B. If exploratory excavating confirms that the depth of existing utilities will be negatively impacted by proposed new grades (i.e., will be too shallow or become exposed), immediately notify the Architect and the Owner. Do not proceed with work in such areas until instructions are issued by the Architect. Continue work in other areas.

1.4 CONFIRMATION OF INTEGRITY OF ADJACENT STRUCTURES

A. Prior to commencement of site excavating operations, the Contractor shall compare foundation depths of existing structures and proposed depths of new utilities. Where existing structures are indicated but their foundation depths are not, exploratory excavating shall be performed to assure that proposed new excavations adjacent to them, or in near proximity of them, will not undermine the structural integrity of the existing structures.

B. If exploratory excavating confirms that the footing depths of existing structures may be negatively impacted or undermined by proposed new excavations, immediately notify the Architect and the Owner. Do not proceed with work in such areas until instructions are issued by the Architect. Continue work in other areas.

PART 2 - PRODUCTS [Not Used]

PART 3 - EXECUTION [Not Used]

END OF SECTION

SECTION 024100

DEMOLITION

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS, which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. Work Included:

1. Demolition and removal of selected portions of buildings and structures and as required for new work. Refer to the Drawings for additional requirements.
2. Demolition and removal of selected site elements and as required for new work. Refer to the Drawings for additional requirements.
3. Salvage of existing items to be reused or turned over to the facility.
4. Removal and legal disposal of demolished materials off site. Except those items specifically designated to be relocated, reused, or turned over to the facility, all existing removed materials, items, trash and debris shall become property of the Contractor and shall be completely removed from the site and legally disposed of at her/his expense. Salvage value belongs to the Contractor. On-site sale of materials is not permitted.
5. Maintenance, watering and care of trees designated to remain by a certified arborist during the construction period.
6. Demolition and removal work shall properly prepare for alteration work and new construction to be provided under the Contract.
7. Scheduling and sequencing operations without interruption to utilities serving occupied areas. If interruption is required, obtain written permission from the utility company and the Owner.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 011000 - GENERAL REQUIREMENTS for temporary facilities and controls, for maintenance of access, for cleaning during construction, and for dust and noise control.
2. Section 017400 - CONSTRUCTION WASTE MANAGEMENT for waste management and recycling.
3. Section 018120 - CONSTRUCTION INDOOR AIR QUALITY (IAQ) MANAGEMENT for indoor air quality control procedures.
4. Section 017419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL:
   a. Waste management and recycling.
5. Section 210001 - FIRE PROTECTION:
   a. Disconnecting, capping and otherwise making inactive existing fire protection services in areas where demolition and removal work is required.
   b. Disconnect and reinstallation of fire protection equipment temporarily interrupted during construction.

6. Section 220001 - PLUMBING:
   a. Disconnecting, capping and otherwise making inactive existing plumbing services in areas where demolition and removal work is required.
   b. Disconnection and reinstallation of plumbing equipment temporarily interrupted during construction.
7. Section 230001 - HEATING, VENTILATING AND AIR CONDITIONING:
   a. Disconnecting, capping and otherwise making inactive existing HVAC services in areas where demolition and removal work is required.
   b. Disconnect and reinstallation of HVAC equipment temporarily interrupted during construction.
8. Section 260001 - ELECTRICAL WORK:
   a. Disconnecting, capping and otherwise making inactive existing electrical services in areas where demolition and removal work is required.
   b. Disconnect and reinstallation of electrical equipment temporarily interrupted during construction.
9. Section 311000 – SITE CLEARING:
   a. Excavating and removal of existing pavement, sub-surface building and utility structures and lines, appurtenances, and other elements indicated on the Drawings.

1.3 DEFINITIONS

A. Remove: Detach items from existing construction and legally dispose of them off-site, unless indicated to be removed and salvaged or removed and reinstalled.

B. Remove and Salvage: Detach items from existing construction and deliver them to the Owner ready for reuse, at a location designated by the Owner. Protect from weather until accepted by Owner.

C. Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated. Protect from weather until reinstallation.

D. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.4 MATERIALS OWNERSHIP

A. Historic items, relics, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques, antiques, and other items of interest or value to Owner that may be encountered during selective demolition remain property of the Owner as applicable. Carefully remove each item or object in a manner to prevent damage and deliver promptly to a location acceptable to the Owner.

1.5 SUBMITTALS

A. Schedule of Selective Demolition Activities: Indicate the following:

1. Detailed sequence of selective demolition and removal work, with early and late starting and finishing dates for each activity. Ensure Owner's on-site operations are uninterrupted if applicable.
2. Interruption of utility services. Indicate how long utility services will be interrupted.
3. Coordination for shutoff, capping, and continuation of utility services.

4. Use of elevator and stairs.
5. Locations of proposed dust- and noise-control temporary partitions and means of egress, including for other occupants affected by selective demolition operations.
6. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.
7. Means of protection for items to remain and items in path of waste removal from building.

B. Inventory: After selective demolition is complete, submit a list of items that have been removed and salvaged, and turned over the Owner.

C. Predemolition Video and Pictures: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by selective demolition operations. Comply with Division 01 requirements. Submit before Work begins.

1.6 QUALITY ASSURANCE

A. Examination of Existing Conditions: The Contractor shall examine the Contract Drawings for demolition and removal requirements and provisions for new work. Verify all existing conditions and dimensions before commencing work. The Contractor shall visit the site and examine the existing conditions as he finds them and shall inform herself/himself of the character, extent and type of demolition and removal work to be performed. Submit any questions regarding the extent and character of the demolition and removal work in the manner and within the time period established for receipt of such questions during the bidding period.

B. Demolition Firm Qualifications: An experienced firm that has specialized in demolition work similar in material and extent to that indicated for this Project.

C. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

D. Standards: Comply with ANSI A10.6 and NFPA 241.

E. Predemolition Conference: Conduct conference at Project site to comply with requirements in Section 011000 - GENERAL REQUIREMENTS, Project Meetings. Review methods and procedures related to selective demolition including, but not limited to, the following:

1. Inspect and discuss condition of construction to be selectively demolished.
2. Review structural load limitations of existing structure.
3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
5. Review areas where existing construction is to remain and requires protection.

1.7 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS

2.1 SALVAGING

A. Salvaged for Reinstallation: Materials indicated on the Drawings to be salvaged and reinstalled shall be carefully removed and stored at a location acceptable to the Architect and Owner.

B. Salvaged for Storage: Materials indicated on the Drawings or designated in the field by the Owner to be salvaged and stored shall be carefully removed and delivered to the Owner at locations determined by Owner.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped.

B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

C. Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.

D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.

E. Engage a professional engineer registered in the state that the project is located to survey condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective demolition operations.

F. Survey of Existing Conditions: Record existing conditions by use of preconstruction videotapes.

1. Before selective demolition or removal of existing building elements that will be reproduced or duplicated in final Work, make permanent record of measurements, materials, and construction details required to make exact reproduction.

G. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Service/System Requirements: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.

1. Arrange to shut off indicated utilities with utility companies and Owner.
2. If services/systems are required to be removed, relocated, or abandoned, before proceeding with selective demolition provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.

3. Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing. Where entire wall is to be removed, existing services/systems may be removed with removal of the wall.
4. Prior to commencing cutting work in existing surfaces, take all precautionary measures to assure that mechanical and electrical services to the particular area have been made inactive. Coordinate with Fire Suppression, Plumbing, HVAC, and Electrical subcontractors. Only licensed tradesmen of that particular trade shall disconnect and cap existing mechanical and electrical items that are to be removed, abandoned and/or relocated.
5. If, during the process of cutting work, existing utility lines are encountered which are not indicated on the Drawings, regardless of their condition, immediately report such items to the Architect. Do not proceed with work in such areas until instructions are issued by the Architect. Continue work in other areas.

3.3 PREPARATION

A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Comply with requirements for access and protection specified in Section 011000 - GENERAL REQUIREMENTS, Temporary Facilities and Controls.
2. Maintain adequate passage to and from all exits at all times. Before any work is done which significantly alters access or egress patterns, consult with the Architect and obtain approval of code required egress. Under no condition block or interfere with the free flow of people at legally required exits, or in any way alter the required condition of such exits.

B. Temporary Shoring: Provide and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

1. Strengthen or add new supports when required during progress of selective demolition.
2. Remove temporary shoring, bracing and structural supports when no longer required.
3. Post warning signs and place barricades as applicable during placement and removal of temporary shoring.

C. Conduct demolition operations to prevent injury to people and damage to adjacent buildings and facilities to remain. Ensure safe passage of people around demolition area(s).

1. Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction. Provide temporary barricades as required to limit access to demolition areas.
2. Protect existing site improvements, appurtenances, and landscaping to remain.

3.4 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain fire watch and portable fire-suppression devices during flame-cutting operations.
5. Maintain adequate ventilation when using cutting torches.
6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
7. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
8. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
9. Maintain clear unimpeded passage through the work area for safety and emergency egress.
10. Saw cut overruns in concrete and masonry for new door, window and other finish openings is not permitted. Core drill corners and finish square to match required opening.
11. Dispose of demolished items and materials promptly.

    a. Comply with requirements in Section 017400 - CONSTRUCTION WASTE MANAGEMENT.

B. Removed and Salvaged Items:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to storage area designated by the Owner.
5. Protect items from damage during transport and storage.

C. Removed Items for Reinstallation by the Respective Trade.

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to storage area designated by the Owner.
5. Protect items from damage during transport and storage.

D. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

E. Items for Re-use and Preservation of Existing Surfaces to Remain:

1. The Contractor shall inspect closely each item specifically designated to be relocated, re-used, or turned over to the Owner prior to its removal, and immediately report damages and defects to the Architect and the Owner. The Contractor shall be responsible for any subsequent damage to the same other than latent defects not readily apparent from close inspection, and shall bear responsibility for its repair or same replacement as directed by the Architect, to the satisfaction of the Owner.
2. Unless special surface preparation is specified under other Specification Sections, leave existing surfaces that are to remain in a condition suitable to receive new materials and/or finishes.

3.5 PROTECTION OF PUBLIC AND PROPERTY

A. Provide all measures required by federal, state and municipal laws, regulations, and ordinances for the protection of surrounding property, the public, workmen, and Owner's employees during all demolition and removal operations. Measures are to be taken, but not limited to installation of sidewalks, sheds, barricades, fences, warning lights and signs, trash chutes and temporary lighting.

B. Protect all walks, roads, streets, curbs, pavements, trees and plantings, on and off premises, and bear all costs for correcting such damage as directed by the Architect, and to the satisfaction of the Owner.

C. Demolition shall be performed in such a manner that will insure the safety of adjacent property. Protect adjacent property from damage and protect persons occupying adjacent property from injuries which might occur from falling debris or other cause and so as not to cause interference with the use of other portions of the building, of adjacent buildings or the free access and safe passage to and from the same.

D. Every precaution shall be taken to protect against movement or settlement of the building, of adjacent buildings, sidewalks, roads, streets, curbs and pavements. Provide and place at the Contractor's own expense, all necessary bracing and shoring in connection with demolition and removal work.

E. Remove portions of structures with care by using tools and methods that will not transfer heavy shocks to existing and adjacent building structures, both internal and external of the particular work area.

F. Provide and maintain in proper condition, suitable fire resistive dust barriers around areas where interior demolition and removal work is in progress. Dust barriers shall prevent the dust migration to adjacent areas. Remove dust barriers upon completion of major demolition and removal in the particular work area.

3.6 DISCOVERY OF HAZARDOUS MATERIALS

A. If hazardous materials, such as chemicals, asbestos-containing materials, or other hazardous materials are discovered during the course of the work, cease work in affected area only and immediately notify the Architect and the Owner of such discovery. Do not proceed with work in such areas until instructions are issued by the Architect. Continue work in other areas.

B. If unmarked containers are discovered during the course of the work, cease work in the affected area only and immediately notify the Architect and the Owner of such discovery. Do not proceed with work in such areas until instructions are issued by the Architect. Take immediate precautions to prohibit endangering the containers integrity. Continue work in other areas.

3.7 CUTTING

A. Perform all cutting of existing surfaces in a manner which will ensure a minimal difference between the cut area and new materials when patched. Use extreme care when cutting existing surfaces containing concealed utility lines which are indicated to remain and bear full responsibility for repairing or replacement of all such utilities that are accidentally damaged.

B. Provide a flush saw cut edge where pavement, curb and concrete removals abut new construction work or existing surfaces to remain undisturbed.

C. All slurry and water shall be contained and managed to avoid damage to existing conditions when using a wet saw or wet core driller.

D. Obtain and pay for a hot work permit and arrange to have on-site a Fire Watch when using a cutting torch or similar item.

3.8 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Comply with requirements of Section 017400 - CONSTRUCTION WASTE MANAGEMENT and the following:

1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.

B. Burning: Do not burn demolished materials.

3.9 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Premises shall be left in a clean condition and ready to accept alteration work and new construction.

END OF SECTION

SECTION 03 30 00

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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes 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.
5. Concrete toppings.
6. Building frame members.
7. Building walls.

B. Related Sections:

1. Section 03 33 00 "Architectural Concrete" for general building applications of specially finished formed concrete.
2. Section 03 53 00 "Concrete Topping" for emery- and iron-aggregate concrete floor toppings.
3. Section 31 20 00 "Earth Moving" for drainage fill under slabs-on-grade.
4. Section 32 13 13 "Concrete Paving" for concrete pavement and walks.
5. Section 32 13 16 "Decorative Concrete Paving" for decorative 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 ACTION 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. Formwork Shop Drawings: Prepared by or under the supervision of a qualified professional engineer detailing fabrication, assembly, and support of formwork.

1. Shoring and Reshoring: Indicate proposed schedule and sequence of stripping formwork, shoring removal, and reshoring installation and removal.

E. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.

1. Location of construction joints is subject to approval of the Architect & Structural Engineer.

F. Samples: For waterstops, vapor retarder & other specified products.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer, manufacturer and testing agency.

B. Welding certificates.

C. 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. Fiber reinforcement.
6. Waterstops.
7. Curing compounds.
8. Floor and slab treatments.
9. Bonding agents.
10. Adhesives.
11. Vapor retarders.
12. Semirigid joint filler.
13. Joint-filler strips.
14. Repair materials.

D. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:

1. Aggregates. Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.

E. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.

F. Field quality-control reports.

1.6 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, acceptable to owner and authorities having jurisdiction, 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.
2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.

D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.

E. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4/D 1.4M, "Structural Welding Code - Reinforcing Steel."

F. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:

1. ACI 301, "Specifications for Structural Concrete," Sections 1 through 5.
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.

1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials.

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, shoring and reshoring procedures, vapor-retarder installation, steel reinforcement installation, floor and slab flatness and levelness measurement, concrete repair procedures, and concrete protection.

H. Mockups: Provide mockups if specified by the Architect. Cast concrete formed-surface panels to demonstrate typical joints, surface finish, texture, tolerances, floor treatments, and standard of workmanship.

1. Build panel approximately 100 sq. ft. for formed surfaces in the location indicated or, if not indicated, as directed by Architect.

2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

I. Preinstallation Conference: Conduct conference at Project site.

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.
e. Special concrete finish 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, shoring and reshoring procedures, vapor-retarder installation, steel reinforcement installation, floor and slab flatness and levelness measurement, concrete repair procedures, and concrete protection.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage. Avoid damaging coatings on steel reinforcement.

B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

PART 2 - PRODUCTS

2.1 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, complying with DOC PS 1, and as follows:
   a. Medium-density overlay, Class 1 or better; mill-release agent treated and edge sealed.
   b. Structural 1, B-B or better; mill oiled and edge sealed.
   c. B-B (Concrete Form), Class 1 or better; mill oiled and edge sealed.

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. Pan-Type Forms: Glass-fiber-reinforced plastic or formed steel, stiffened to resist plastic concrete loads without detrimental deformation.

E. Void Forms: Biodegradable paper surface, treated for moisture resistance, structurally sufficient to support weight of plastic concrete and other superimposed loads.

F. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.

G. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.

H. 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.

I. 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.
3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.2 STEEL REINFORCEMENT

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 60 percent.

B. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.

C. Low-Alloy-Steel Reinforcing Bars: ASTM A 706/A 706M, deformed.

D. Galvanized Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed bars, ASTM A 767/A 767M, Class I zinc coated after fabrication and bending.

E. Epoxy-Coated Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed bars,, epoxy coated, with less than 2 percent damaged coating in each 12-inch bar length.

F. Steel Bar Mats: ASTM A 184/A 184M, fabricated from ASTM A 615/A 615M, Grade 60, deformed bars, assembled with clips.

G. Plain-Steel Wire: ASTM A 82/A 82M, galvanized.

H. Deformed-Steel Wire: ASTM A 496/A 496M.

I. Epoxy-Coated Wire: ASTM A 884/A 884M, Class A, Type 1 coated, as-drawn, plain-steel wire, with less than 2 percent damaged coating in each 12-inch wire length.

J. Plain-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, plain, fabricated from as-drawn steel wire into flat sheets.

K. Deformed-Steel Welded Wire Reinforcement: ASTM A 497/A 497M, flat sheet.

L. Galvanized-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, plain, fabricated from galvanized-steel wire into flat sheets.

M. Epoxy-Coated Welded Wire Reinforcement: ASTM A 884/A 884M, Class A coated, Type 1, plain steel.

2.3 REINFORCEMENT ACCESSORIES

A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60, plain-steel bars, cut true to length with ends square and free of burrs.

B. Epoxy-Coated Joint Dowel Bars: ASTM A 615/A 615M, Grade 60, plain-steel bars, ASTM A 775/A 775M epoxy coated.

C. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating; compatible with epoxy coating on reinforcement and complying with ASTM A 775/A 775M.

D. Zinc Repair Material: ASTM A 780, zinc-based solder, paint containing zinc dust, or sprayed zinc.

E. 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. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.
3. For zinc-coated reinforcement, use galvanized wire or dielectric-polymer-coated wire bar supports.

2.4 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 or Type III, gray. Supplement with the following:

   a. Fly Ash: ASTM C 618, Class F or C.
   b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.

2. Blended Hydraulic Cement: ASTM C 595, Type IP, portland-pozzolan cement.

B. Silica Fume: ASTM C 1240, amorphous silica.

C. Normal-Weight Aggregates: ASTM C 33, Class 3M coarse aggregate or better, graded. Provide aggregates from a single source.

1. Maximum Coarse-Aggregate Size: ASTM C33, hard, durable crushed stone, graded in accordance with size #467 for piers and footings and size #67 for all other concrete.

2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement. ASTM C33, clean, hard, durable uncoated, natural sand, free of silt, loam and clay.

D. Lightweight Aggregate: ASTM C 330, clean, durable, uncoated, graded in accordance with size ¾ inch to #4, Table 1.

E. Water: ASTM C 94/C 94M and potable, clean, free of oil, acid and vegetable matter, alkalies and impurities.

2.5 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 exceeding those permitted in hardened concrete. 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.
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.

7. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   a. BASF Construction Chemicals - Building Systems; Rheocrete CNI.
   b. Euclid Chemical Company (The), an RPM company; ARRMATECT.
   c. Grace Construction Products, W. R. Grace & Co.; DCI.
   d. Sika Corporation; Sika CNI.

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

   a. ChemMasters.
   b. Davis Colors.
   c. Dayton Superior Corporation.
   d. Hoover Color Corporation.
   e. Lambert Corporation.
   f. QC Construction Products.
   g. Rockwood Pigments NA, Inc.
   h. Scofield, L. M. Company.
   i. Solomon Colors, Inc.

2. Color: As selected by Architect from manufacturer's full range.

2.6 WATERSTOPS

A. Flexible Rubber Waterstops: CE CRD-C 513, with factory-installed metal eyelets, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.

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

   a. Greenstreak.
   b. Williams Products, Inc.

2. Profile: Flat, dumbbell with center bulb.
3. Dimensions: 6 inches by 3/8 inch thick (150 mm by 10 mm thick); nontapered.

B. Chemically Resistant Flexible Waterstops: Thermoplastic elastomer rubber waterstops, for embedding in concrete to prevent passage of fluids through joints; resistant to oils, solvents, and chemicals. Factory fabricate corners, intersections, and directional changes.

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

   a. JP Specialties, Inc.; Earth Shield TPE-Rubber.
   b. Vinylex Corp.; PetroStop.
   c. WESTEC Barrier Technologies, Inc.; 600 Series TPE-R.

2. Profile: Flat, dumbbell with center bulb.
3. Dimensions: 6 inches by 3/16 inch thick ; nontapered.

C. 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: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. BoMetals, Inc.
   b. Greenstreak.
   c. Paul Murphy Plastics Company.
   d. Vinylex Corp.

2. Profile: Flat, dumbbell with center bulb.
3. Dimensions: 6 inches by 3/8 inch thick (150 mm by 10 mm thick); nontapered.

D. Self-Expanding Butyl Strip Waterstops: Manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete, 3/4 by 1 inch (19 by 25 mm).

1. Products: Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:

   a. Carlisle Coatings & Waterproofing, Inc.; MiraSTOP.
   b. CETCO; Volclay Waterstop-RX.
   c. Concrete Sealants Inc.; Conseal CS-231.
   d. Greenstreak; Swellstop.
   e. Henry Company, Sealants Division; Hydro-Flex.

f. Synko-Flex, Synko-Flex Products Company.

E. 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 (10 by 19 mm).

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

a. Adeka Ultra Seal/OCM, Inc.; Adeka Ultra Seal.
b. Greenstreak; Hydrotite.
c. Vinylex Corp.; Swellseal.

2.7 VAPOR RETARDERS

A. Sheet Vapor Retarder: ASTM E 1745, Class C, except with maximum perm rating of .037. Include manufacturer's recommended adhesive or pressure-sensitive tape.

1. Products: Subject to compliance with requirements, provide the following:

a. Stego Industries, LLC; Stego Wrap 10 mil Class C.

2.8 FLOOR AND SLAB TREATMENTS

A. Slip-Resistive Emery Aggregate Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive, crushed emery aggregate containing not less than 50 percent aluminum oxide and not less than 20 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials with 100 percent passing No. 8 (2.36-mm) sieve.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
a. Dayton Superior Corporation; Emery Tuff Non-Slip.
b. Lambert Corporation; EMAG-20.
c. L&M Construction Chemicals, Inc.; Grip It.
d. Metalcrete Industries; Metco Anti-Skid Aggregate.

B. Slip-Resistive Aluminum Granule Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of not less than 95 percent fused aluminum-oxide granules.

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

a. Anti-Hydro International, Inc.; A-H Alox.
b. BASF Construction Chemicals - Building Systems; Frictex NS.
c. L&M Construction Chemicals, Inc.; Grip It AO.

C. Emery Dry-Shake Floor Hardener: Unpigmented, factory-packaged, dry combination of portland cement, graded emery aggregate, and plasticizing admixture; with emery aggregate consisting of no less than 60 percent of total aggregate content.

1. Color: As selected by Architect from manufacturer's full range.

D. Metallic Dry-Shake Floor Hardener: Unpigmented, factory-packaged, dry combination of portland cement, graded metallic aggregate, rust inhibitors, and plasticizing admixture; with metallic aggregate consisting of no less than 65 percent of total aggregate content.

1. Color: As selected by Architect from manufacturer's full range.

E. Unpigmented Mineral Dry-Shake Floor Hardener: Factory-packaged dry combination of portland cement, graded quartz aggregate, and plasticizing admixture.

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

a. BASF Construction Chemicals - Building Systems; Maximent.
b. ChemMasters; ConColor.
c. Conspec by Dayton Superior; Conshake 500.
d. Dayton Superior Corporation; Quartz Tuff.
e. Edoco by Dayton Superior; Burke Non Metallic Floor Hardener 250.
f. Euclid Chemical Company (The), an RPM company; Surflex.
g. Kaufman Products, Inc.; Tycron.
h. Lambert Corporation; Colorhard.
i. L&M Construction Chemicals, Inc.; Quartzplate FF.
j. Metalcrete Industries; Floor Quartz.
k. Scofield, L. M. Company; Lithochrome Color Hardener.
l. Symons by Dayton Superior; Hard Top.

2.9 LIQUID FLOOR TREATMENTS

A. VOC Content: Liquid floor treatments shall have a VOC content of 200 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Penetrating Liquid Floor Treatment: Clear, chemically reactive, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless; that penetrates, hardens, and densifies concrete surfaces.

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

a. ChemMasters; Chemisil Plus.
b. ChemTec Int'l; ChemTec One.
c. Conspec by Dayton Superior; Intraseal.
d. Curecrete Distribution Inc.; Ashford Formula.
e. Dayton Superior Corporation; Day-Chem Sure Hard (J-17).
f. Edoco by Dayton Superior; Titan Hard.
g. Euclid Chemical Company (The), an RPM company; Euco Diamond Hard.
h. Kaufman Products, Inc.; SureHard.
i. L&M Construction Chemicals, Inc.; Seal Hard.
j. Meadows, W. R., Inc.; LIQUI-HARD.
k. Metalcrete Industries; Floorsaver.
l. Nox-Crete Products Group; Duro-Nox.
m. Symons by Dayton Superior; Buff Hard.
n. US SPEC, Division of US Mix Products Company; US SPEC Industraseal.

C. Penetrating Liquid Floor Treatments for Polished Concrete Finish: Clear, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless; that penetrates, hardens, and is suitable for polished concrete surfaces.

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

a. Advanced Floor Products; Retro-Plate 99.
b. L&M Construction Chemicals, Inc.; FGS Hardener Plus.
c. QuestMark, a division of CentiMark Corporation; DiamondQuest Densifying Impregnator Application.

2.10 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
a. BASF Construction Chemicals - Building Systems; Confilm.
b. ChemMasters; SprayFilm.
c. Conspec by Dayton Superior; Aquafilm.
d. Dayton Superior Corporation; Sure Film (J-74).
e. Edoco by Dayton Superior; BurkeFilm.
f. Euclid Chemical Company (The), an RPM company; Eucobar.
g. Kaufman Products, Inc.; Vapor-Aid.
h. Lambert Corporation; LAMBCO Skin.
i. L&M Construction Chemicals, Inc.; E-CON.
j. Meadows, W. R., Inc.; EVAPRE.
k. Metalcrete Industries; Waterhold.
l. Nox-Crete Products Group; MONOFILM.
m. Sika Corporation; SikaFilm.
n. SpecChem, LLC; Spec Film.
o. Symons by Dayton Superior; Finishing Aid.
p. TK Products, Division of Sierra Corporation; TK-2120 TRI-FILM.
q. Unitex; PRO-FILM.
r. Vexcon Chemicals, Inc.; Certi-Vex Envio Set.

B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) 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, dissipating.

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

a. Anti-Hydro International, Inc.; AH Curing Compound #2 DR WB.
b. BASF Construction Chemicals - Building Systems; Kure 200.
c. ChemMasters; Safe-Cure Clear.

d. Conspec by Dayton Superior; W.B. Resin Cure.
e. Dayton Superior Corporation; Day-Chem Rez Cure (J-11-W).
f. Edoco by Dayton Superior; Res X Cure WB.
g. Euclid Chemical Company (The), an RPM company; Kurez W VOX; TAMMSCURE WB 30C.
h. Kaufman Products, Inc.; Thinfilm 420.
i. Lambert Corporation; AQUA KURE - CLEAR.
j. L&M Construction Chemicals, Inc.; L&M Cure R.
k. Meadows, W. R., Inc.; 1100-CLEAR.
l. Nox-Crete Products Group; Resin Cure E.
m. Right Pointe; Clear Water Resin.
n. SpecChem, LLC; Spec Rez Clear.
o. Symons by Dayton Superior; Resi-Chem Clear.
p. TK Products, Division of Sierra Corporation; TK-2519 DC WB.
q. Vexcon Chemicals, Inc.; Certi-Vex Enviocure 100.

F. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, nondissipating, certified by curing compound manufacturer to not interfere with bonding of floor covering.

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

a. Anti-Hydro International, Inc.; AH Clear Cure WB.
b. BASF Construction Chemicals - Building Systems; Kure-N-Seal WB.
c. ChemMasters; Safe-Cure & Seal 20.
d. Conspec by Dayton Superior; Cure and Seal WB.
e. Cresset Chemical Company; Crete-Trete 309-VOC Cure & Seal.
f. Dayton Superior Corporation; Safe Cure and Seal (J-18).
g. Edoco by Dayton Superior; Spartan Cote WB II.
h. Euclid Chemical Company (The), an RPM company; Aqua Cure VOX; Clearseal WB 150.
i. Kaufman Products, Inc.; Cure & Seal 309 Emulsion.
j. Lambert Corporation; Glazecote Sealer-20.
k. L&M Construction Chemicals, Inc.; Dress & Seal WB.
l. Meadows, W. R., Inc.; Vocomp-20.
m. Metalcrete Industries; Metcure.
n. Nox-Crete Products Group; Cure & Seal 150E.
o. Symons by Dayton Superior; Cure & Seal 18 Percent E.
p. TK Products, Division of Sierra Corporation; TK-2519 WB.
q. Vexcon Chemicals, Inc.; Starseal 309.

G. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

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

a. BASF Construction Chemicals - Building Systems; Kure 1315.
b. ChemMasters; Polyseal WB.
c. Conspec by Dayton Superior; Sealcure 1315 WB.
d. Edoco by Dayton Superior; Cureseal 1315 WB.
e. Euclid Chemical Company (The), an RPM company; Super Diamond Clear VOX; LusterSeal WB 300.
f. Kaufman Products, Inc.; Sure Cure 25 Emulsion.
g. Lambert Corporation; UV Safe Seal.

h. L&M Construction Chemicals, Inc.; Lumiseal WB Plus.
i. Meadows, W. R., Inc.; Vocomp-30.
j. Metalcrete Industries; Metcure 30.
k. Right Pointe; Right Sheen WB30.
l. Symons by Dayton Superior; Cure & Seal 31 Percent E.
m. Vexcon Chemicals, Inc.; Vexcon Starseal 1315.

2. VOC Content: Curing and sealing compounds shall have a VOC content of 200 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.11 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/C 1059M, 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 IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

E. Reglets: Fabricate reglets of not less than 0.022-inch- (0.55-mm-) 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 0.034 inch (0.85 mm) thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

2.12 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 5000psi 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 1/4 inch and that can be filled in over a scarified surface 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 at 28 days when tested according to ASTM C 109/C 109M.

2.13 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: Use fly ash as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 20 percent. Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:

1. Fly Ash: 20 percent maximum for horizontally cast concrete.
2. Fly Ash: 30 percent maximum for vertically cast concrete.

C. Calcium Chloride is strictly prohibited.

D. Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.45.

E. 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.

2.14 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Concrete Strengths: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: In accordance with the Contract Documents at 28 days.
2. Maximum Water-Cementitious Materials Ratio: In accordance with the Contract Documents.
3. Slump Limit:
   Drilled Piers – 4” minimum, 6” maximum
   All other concrete – 3” minimum, 5” minimum
4. Air Content: In accordance with the Contract Documents.
5. Synthetic Micro-Fiber: In accordance with the Contract Documents.
6. Calculated Equilibrium Unit Weight: In accordance with the Contract Documents.

B. Concrete Toppings: Proportion normal-weight concrete mixture as follows:

2.15 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.16 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 above 90 deg F , reduce mixing and delivery time to 60 minutes.

2. Furnish batch ticket for each load delivered to site. Contractor shall log and maintain tickets on site for review throughout construction and provide them ordered and logged to owner during project close out.

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. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:

1. Class A, 1/8 inch (3.2 mm) for smooth-formed finished surfaces.
2. Class B, 1/4 inch (6 mm) for rough-formed finished surfaces.

D. Construct forms tight enough to prevent loss of concrete mortar.

E. 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.

F. 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.

G. 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.

H. Chamfer exterior corners and edges of permanently exposed concrete.

I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

L. 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. Concrete has to be hard enough to not be damaged by form-removal operations and curing and protection operations need to be 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 75 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 SHORES AND RESHORES

A. Comply with ACI 318 (ACI 318M) and ACI 301 for design, installation, and removal of shoring and reshoring.

1. Do not remove shoring or reshoring until measurement of slab tolerances is complete.

B. In multistory construction, extend shoring or reshoring over a sufficient number of stories to distribute loads in such a manner that no floor or member will be excessively loaded or will induce tensile stress in concrete members without sufficient steel reinforcement.

C. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

3.5 VAPOR RETARDERS

A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder 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 bituminous vapor retarder according to manufacturer's written instructions.

3.6 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/D 1.4M, 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.

F. Epoxy-Coated Reinforcement: Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D 3963/D 3963M. Use epoxy-coated steel wire ties to fasten epoxy-coated steel reinforcement.

G. Zinc-Coated Reinforcement: Repair cut and damaged zinc coatings with zinc repair material according to ASTM A 780. Use galvanized steel wire ties to fasten zinc-coated steel reinforcement.

3.7 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 (38 mm) 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. Space vertical joints in walls at 30' O.C. 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.

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 at locations noted on the Contract Documents and as follows:
1. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3.2-mm-) 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 Section 079200 "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.

3.8 WATERSTOPS

A. 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.

3.9 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 the Structural Engineer & the Testing Laboratory.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

C. 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.

D. 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.

E. 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.

F. Hot-Weather Placement: Comply with ACI 301 and as follows:

1. Maintain concrete temperature below 95 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.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.10 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, to receive a rubbed finish, or to be covered with a coating or covering material applied directly to concrete.

C. Rubbed Finish: Apply the following to smooth-formed finished as-cast concrete where indicated:

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.

3.11 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 (6 mm) in one direction.

1. Apply scratch finish to surfaces indicated and 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 and to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.

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 (ASTM E 1155M), 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.

3. Finish and measure surface so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.- (3.05-m-) long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/8 inch (3.2 mm).

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, 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 aluminum granule finish where indicated and to concrete stair treads, platforms, and ramps. Apply according to manufacturer's written instructions and as follows:

1. Uniformly spread 25 lb/100 sq. ft. (12 kg/10 sq. m) of dampened slip-resistive aluminum granules over surface in one or two applications. Tamp aggregate flush with surface, but do not force below surface.
2. After broadcasting and tamping, apply float finish.
3. After curing, lightly work surface with a steel wire brush or an abrasive stone and water to expose slip-resistive aluminum granules.

H. Dry-Shake Floor Hardener Finish: After initial floating, apply dry-shake floor hardener to surfaces according to manufacturer's written instructions and as follows:

1. Uniformly apply dry-shake floor hardener at a rate of 100 lb/100 sq. ft. (49 kg/10 sq. m) unless greater amount is recommended by manufacturer.
2. Uniformly distribute approximately two-thirds of dry-shake floor hardener over surface by hand or with mechanical spreader, and embed by power floating. Follow power floating with a second dry-shake floor hardener application, uniformly distributing remainder of material, and embed by power floating.
3. After final floating, apply a trowel finish. Cure concrete with curing compound recommended by dry-shake floor hardener manufacturer and apply immediately after final finishing.

3.12 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. 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.

3.13 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 (1 kg/sq. m 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 (300-mm) 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 (300 mm), 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. Removal: 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.

3.14 LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment according to manufacturer's written instructions.

1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
2. Do not apply to concrete that is less than manufacturer’s recommendation for days' old.
3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing. Rinse with water; remove excess material until surface is dry. Apply a second coat in a similar manner if surface is rough or porous.

B. Polished Concrete Floor Treatment: Apply polished concrete finish system to cured and prepared slabs to match accepted mockup.

1. Machine grind floor surfaces to receive polished finishes level and smooth and to depth required to reveal aggregate to match approved mockup.
2. Apply penetrating liquid floor treatment for polished concrete in polishing sequence and according to manufacturer's written instructions, allowing recommended drying time between successive coats.
3. Continue polishing with progressively finer grit diamond polishing pads to gloss level to match approved mockup.
4. Control and dispose of waste products produced by grinding and polishing operations.
5. Neutralize and clean polished floor surfaces.

C. Sealing Coat: Uniformly apply a continuous sealing coat of curing and sealing compound to hardened concrete by power spray or roller according to manufacturer's written instructions.

3.15 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 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 1 1/2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.16 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 to solid concrete. Limit cut depth to 3/4 inch . 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 (0.25 mm) 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. Repair defective areas, except random cracks and single holes 1 inch (25 mm) 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 (19-mm) 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.
6. Repair random cracks and single holes 1 inch (25 mm) or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Engineer and Architect's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.17 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage a special inspector as required by local codes and a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Inspections:

1. Steel reinforcement placement.
2. Steel reinforcement welding.
3. Headed bolts and studs.
4. Verification of use of required design mixture.
5. Concrete placement, including conveying and depositing.
6. Curing procedures and maintenance of curing temperature.
7. All inspections required by the local building code.
8. Verification of concrete strength before removal of shores and forms from beams and slabs.

C. 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 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.

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, for normal-weight concrete; ASTM C 173/C 173M, volumetric method, for structural lightweight concrete; 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 80 deg F and above, and one test for each composite sample.
5. 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.
6. Compression Test Specimens: ASTM C 31/C 31M.

    a. Cast and laboratory cure two sets of three standard cylinder specimens for each composite sample. Cylinders shall be kept in an insulated box until transported to the testing laboratory.

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. The remaining set will be tested as directed by the structural engineer.

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. 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 .
9. Test results shall be reported in writing to Architect & Structural Engineer, 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.
10. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Structural Engineer but will not be used as sole basis for approval or rejection of concrete.
11. 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.
12. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
13. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

D. Measure floor and slab flatness and levelness according to ASTM E 1155 (ASTM E 1155M) within 24 hours of finishing.

3.18 PROTECTION OF LIQUID FLOOR TREATMENTS

A. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.

END OF SECTION

SECTION 033300

ARCHITECTURAL CONCRETE

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Cast-in-place architectural concrete including form facings, reinforcement accessories, concrete materials, concrete mixture design, placement procedures, and finishes.
2. The requirements of this Section complement Section 033000, CAST-IN-PLACE CONCRETE; and apply to architectural concrete as specified and as indicated on Drawings.

B. Related Work: The following items are not included in this Section and will be performed under the designated Sections:

1. Section 033000 - CAST-IN-PLACE CONCRETE for formwork; material, fabrication, and installation requirements for steel reinforcement; and field quality control.
2. Section 079200 - JOINT SEALANTS for elastomeric joint sealants in contraction and other joints in cast-in-place architectural concrete.

1.3 DEFINITIONS

A. Cast-in-Place Architectural Concrete: Formed concrete that is exposed to view on surfaces of completed structure or building and that requires special concrete materials, formwork, placement, or finishes to obtain specified architectural appearance.

B. 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.

C. Design Reference Sample: Sample designated by Architect in the Contract Documents that reflects acceptable surface quality and appearance of cast-in-place architectural concrete.

D. Reveal: Projection of coarse aggregate from matrix or mortar after completion of exposure operations.

1.4 SUBMITTALS

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

B. Description of Methods and Sequence of Placement. For each type of specially-finished concrete provide description of methods and sequence of placement.

C. Certificates: Prior to installation submit copies of a signed affidavit from the manufacturer of the coloring product stating that coloring product to be used in concrete is compatible with the concrete mix and type to which it will be combined, and that no adverse affects will occur to the workability, setting, or strength of concrete.

D. Manufacturer's Review: Submit written signed statement, that Contract Documents have been reviewed by qualified representatives of the materials manufacturer, and that materials and system to be used for floor finish are proper and adequate for the applications shown.

E. Manufacturer's Data: Submit manufacturer's specifications and installation instructions for all products in concrete floor finish, including certifications and other data as may be required to show compliance with the Contract Documents.

F. Substrate Acceptability: Submit a certified statement issued by the manufacturer of concrete floor finish materials and countersigned by installer, attesting that surfaces designated to receive concrete floor finish are satisfactory warranty requirements. Application of materials will be construed as acceptance of surfaces.

G. Statement of Supervision: Submit signed statement signed that field supervision by manufacturer's representative was sufficient to ensure proper application of materials and that the installation is acceptable to manufacturer.

H. Samples for Verification: Architectural concrete samples, cast vertically, approximately 18 by 18 by 2 inches, of finishes, colors, and textures to match design reference sample. Include Sample sets showing the full range of variations expected in these characteristics.

1.5 QUALITY ASSURANCE

A. Finish Objective Samples. If samples are placed on display in the office of the Architect, to describe finish objectives, such samples are hereby made part of these Specifications to the degree that the samples exhibit the required color, texture and surface finish requirements. Such samples, if provided, are provided for bidding purposes only; the actual mix components, forming, placing, and finishing procedures and requirements shall be as determined by acceptable preconstruction mock-ups.

B. Preconstruction Conference. Attend a preconstruction conference prior to the start of architectural concrete construction as directed by the Architect. Discussion will include the following:

1. The Contractor's program to obtain the specified quality of architectural concrete.
2. The procedures and methods for construction of preconstruction mock-ups specified herein.

C. Preconstruction Mock-up Panels or Areas:

1. General:

a. Schedule mock-up casting for acceptance 30 days prior to casting of architectural concrete surfaces represented by the mock-ups.

b. Locate mock-up panels in non-public areas acceptable to the Architect. Brace panels as required for safety.
c. Continue to cast mock-ups until acceptable mock-ups are produced. Accepted mock-ups shall be the standard for color, texture, and workmanship for the work.
d. Mock-up sequence of forming, placing, form removal, curing and finishing shall be reviewed and accepted by the Architect.
e. Mock-up formwork shall be inspected and accepted by the Architect before placing of concrete.
f. Use the same concrete mixes and placement procedures, accepted in mock-ups, in the final work, unless otherwise directed by the Architect.
g. Protect accepted mock-ups from damage until completion and acceptance of the work represented by the mock-up.
h. Remove mock-up panels from site at completion of Project, as directed by the Architect.

2. Construct mock-up panels or areas as indicated to demonstrate the ability to cast architectural concrete to achieve shapes, color, and textured finishes required. Mock-ups shall include or meet the following requirements:

a. Provide full scale mock-up panels and areas.
b. Provide mock-ups simulating actual design and execution conditions for concrete mix materials, reinforcement, formwork, placing sequence, form removal, curing, finishing, and methods and materials of stain removal and correction of defective work.
c. On mock-ups where directed by the Architect, provide minimum of five variation of mix color to be used in the repair of defective work, in order to determine acceptable color and texture match.
d. Demonstrate, on the mock-ups, materials and methods of plugging tie-holes unless tie holes are indicated to be left in place.
e. Demonstrate in the construction of the mock-up formwork the sealer material, form release agent, and curing materials and methods to be used.

D. Source of Materials. Utilize the same source, stock or brand of concrete materials for each class or mix of architectural concrete. Do not interchange materials or mixes until an additional mock-up shows that uniformity in finish, texture, and color, as compared to original mock-up will be maintained. If necessary, obtain and stockpile materials in sufficient quantity to ensure continuity and uniformity.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's unopened containers identified with brand, type, grade, date of manufacture, class, lot number, and other qualifying information.

B. Store materials in original sealed containers, in dry enclosed storage area, within temperature range recommended by manufacturer.

1.7 JOB CONDITIONS

A. Maintain manufacturer's current installation instructions at Project site.

B. Maintain interior building area above 50oF before, during, and after installation of architectural concrete until structure and subfloor temperatures are stabilized.

C. Provide and maintain adequate ventilation until concrete cures completely.

1.8 PROTECTION

A. Protect adjacent surfaces and repair, restore, or replace soiled or damaged in performance of special architectural concrete finish work.

1.9 GUARANTEE

A. Warrant work of this Section for five years from date of Substantial Completion; correct defects upon written notice at no additional cost to Owner. Warranty shall be signed by installer and materials manufacturer.

PART 2 - PRODUCTS

2.1 CONCRETE

A. Except as otherwise indicated, concrete materials including aggregates, Portland cement, and water shall conform to Section 033000, CAST-IN-PLACE CONCRETE.

2.2 ARCHITECTURAL CONCRETE FOR VERTICAL WALLS

A. Concrete: Color of concrete shall be normalweight concrete without color additive; color for architectural concrete shall be uniform throughout area designated.

B. Formwork Ties: Formwork tie spacing and location of ties shall be in a consistent pattern or layout acceptable to the Architect. Tie design shall be acceptable to the Architect.

C. Formwork Materials: Steel faced or fiberglass faced formwork as required to produce a smooth form finish acceptable to the Architect.

1. Architectural Concrete Finish No. 1 - Smooth Form Finish with Smooth Rubbed Finish:

a. Formwork: Smooth form concrete using steel forms or fiberglass forms. Joints in formwork shall be sealed. Form ties shall be uniformly placed accurately located in accordance with layout approved by the Architect.
b. Finish Description/Procedure: Rubbing shall be produced on newly hardened concrete no later than the day following form removal. When required by the Architect to correct work done in an incorrect manner or in a manner not as specified, rubbing shall commence within 48 hours of notification by the Architect. Surfaces to be rubbed shall be wetted and rubbed with carborundum brick or other approved abrasive of equal quality until uniform color and texture are produced, without applying any cement, grout or other coating. Rubbing will not be permitted when the air temperature is expected to fall below 40 degrees F. Rubbing may be performed by use of approved power equipment and tools, providing that the operational procedures shall produce the same desired effects as hand rubbing.
c. Cement Color: Color meeting approved mock-up. In order to achieve the desired color/finish of concrete, concrete mix may required the use of a white cement or control of color of aggregates may be required.

2. Architectural Concrete Finish No. 2 - Smooth Form Finish with Grout Cleaned Finish:

a. Formwork: Smooth form concrete using steel forms or fiberglass forms.
b. Finish Description/Procedure: Smooth form finish with grout cleaned finish. No cleaning operations shall be undertaken until all adjoining surfaces to be cleaned are completed and accessible. Cleaning as the work progresses shall not be permitted. Mix 1 part portland cement and 1-1/2 parts fine sand with sufficient water to produce a grout having the consistency of thick paint. White portland cement shall be substituted for a part of the gray portland cement in order to produce a color matching the color of the surrounding concrete, as determined by a trial patch. Wet the surface of the concrete sufficiently to prevent absorption of water from the grout and apply the grout uniformly with brushes or a spray gun. Immediately after applying the grout, scrub the surface vigorously with a cork float or stone to coat the surface and fill all air bubbles and holes. While the grout is still plastic, remove all excess grout by working the surface with a rubber float, sack, or other means. After the surface whitens from drying, rub vigorously with clean burlap. Keep the finish damp for at least 36 hours after burlap rubbing.

2.3 ARCHITECTURAL CONCRETE FOR SLABS

A. Concrete: Color of concrete shall be normalweight concrete without color additive; color for architectural concrete shall be uniform throughout area designated.

1. Architectural Concrete Finish No. 3 – Smooth, Steel Troweled Finish Concrete Slab with Concrete Sealer.

a. Finish Description/Procedure: Smooth, steel troweled concrete finish (Architectural Finish) with concrete sealer. It is intended that this floor finish be a very high quality cast-in-place concrete finish with smooth steel troweled finish and a special concrete sealer to achieve the acceptable appearance.

PART 3 - EXECUTION

3.1 PLACING CONCRETE

A. Except as modified herein, concrete shall be placed in accordance with Section 033000, CAST-IN-PLACE CONCRETE.

1. Consolidate vertical colored concrete in lifts 1 ft. or less in depth and vibrate twice that normally required by decreasing the spacing, depth, and time to ensure uniform color.
2. There shall be no honeycombing or segregated aggregates in concrete exposed to view in areas identified as Architectural Concrete.

B. Finish: Provide the following finish for vertical Architectural Concrete:

1. Smooth form finish with smooth rubbed finish. Rubbing shall be produced on newly hardened concrete no later than the day following form removal. When required by the Architect to correct work done in an incorrect manner or in a manner not as specified, rubbing shall commence within 48 hours of notification by the Architect. Surfaces to be rubbed shall be wetted and rubbed with carborundum brick or other approved abrasive of equal quality until uniform color and texture are produced, without applying any cement, grout or other coating. Rubbing will not be permitted when the air temperature is expected to fall below 40 degrees F. Rubbing may be performed by use of approved

power equipment and tools, providing that the operational procedures shall produce the same desired effects as hand rubbing.

3.2 PROTECTION FROM AND REMOVAL OF STAINS

A. On mock-up where directed by the Architect, demonstrate methods of rust stain removal in accordance with recommendations of ACI 303 Chapter 10, Section 10.4.

B. Comply with requirements of Section 033000, CAST-IN-PLACE CONCRETE, and procedures used in construction of accepted mock-ups.

END OF SECTION

SECTION 033515

CONCRETE FINISHING

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Concrete sealer.
2. Polished concrete finish system.
3. Stained and polished concrete finish system.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 033000 - CAST-IN-PLACE CONCRETE for concrete substrates.
2. Section 099000 - PAINTING AND COATINGS for paints applied to concrete substrates.

1.3 PERFORMANCE REQUIREMENTS

A. Wet Dynamic Coefficient of Friction: For flooring exposed as a walking surface, provide products with the following values as determined by testing identical products per ANSI/ NFSI B101.3 - 2012 Test Method for Measuring Wet DCOF of Common Hard-Surface Floor Materials, or ANSI 326.3 - American National Standard Test Method for Measuring Dynamic Coefficient of Friction of Hard Surface Materials - 2017. Testing by other methods or earlier editions of the specified test method is not acceptable.

1. Wet Dynamic Coefficient of Friction: Not less than 0.43.

1.4 SUBMITTALS

A. Product Data: For each system indicated.

1. Material List: Indicate each material and cross-reference specific coating, finish system, and application.
2. Manufacturer's Information: Manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material.
3. Include manufacturer's documentation for static coefficient of friction indicating compliance with values specified in this Section.

B. Samples for Verification: Submit two eight inch by 12 inch Samples for each type of finish coating for Architect's review of color and texture only.

C. Qualification Data: For Applicator.

D. Maintenance Data: For finish flooring to include in maintenance manuals. Include Product Data for floor-care products used or recommended by Installer and names, addresses, and telephone numbers of local sources for products.

1.5 QUALITY ASSURANCE

A. Applicator Qualifications: A firm or individual experienced in concrete finishing similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.

B. Freestanding Mock-Ups: Refer to Section 014330 - MOCK-UPS for requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label.

B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F. Maintain storage containers in a clean condition, free of foreign materials and residue.

1. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily.

1.7 PROJECT CONDITIONS

A. Comply with manufacturer's recommendations for application conditions and temperatures.

B. Close areas to traffic during system application and, after application, for time period recommended in writing by manufacturer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Concrete Sealer:
   a. Curecrete Chemical Company, Inc.
   b. Euclid Chemical Company, Inc.
   c. GCP Applied Technologies (formerly W.R. Grace).
   d. L & M Construction Chemicals

2. Polished Concrete Finish System:
   a. Advanced Floor Products, Inc

b. L. M. Scofield Companies.
c. Tamms Industries, Inc.

3. Acid Stain for Concrete Finish System:
   a. Bomanite.
   b. Lafarge QC Construction Products.
   c. L. M. Scofield Companies.

2.2 CONCRETE SEALER

A. Concrete Sealer: Water-based, chemically reactive transparent sealer for concrete, formulated to penetrate concrete surface to control curing, increase hardness and provide a permanent seal. Sealer shall react chemically with salts in the concrete to prevent release of concrete dust and neutralize alkali in the concrete.

B. Performance Criteria:

1. Abrasion, per ASTM C779: Minimum 30% increase in abrasion resistance.
2. Hardness:
   a. Increase in compressive strength of surface, per ASTM C39: minimum 40% increase in compressive strength at 7 days and 35% increase at 28 days over strength of untreated samples.
   b. Impact resistance, per ASTM C805-Schmidt hammer: Minimum 13% increase in impact resistance.
3. Weathering, per ASTM G23-81: No measurable adverse effect from ultraviolet light, nor from water spray.

C. Basis-of-Design Product: Curecrete Chemical co., Inc., Ashford Formula.

2.3 POLISHED CONCRETE FINISH SYSTEM

A. Concrete Stabilizer: Factory-prepared and dry-packaged mixture of chemically reactive concrete stabilizer formulated to increase concrete density and hardness so that it can be polished to a high gloss.

B. Performance Criteria:

1. Abrasion Resistance: ASTM C779 – Up to 400% increase in abrasion resistance.
2. Impact Strength: ASTM C805 – 21% increase impact strength.
3. Ultra Violet Light and Water Spray: ASTM G23-81 – No adverse effect to ultra violet and water spray.
4. Co-efficient of Friction: ASTM 1028 – all levels of finish (up to 800 grit) exceed OSHA and ADA recommendations.
5. Reflectivity: 30% increase in reflectivity.

C. Accessory Materials:

1. Neutralizing Agent: Tri-sodium phosphate.
2. Water: Potable
3. Coating: Manufacturer’s recommended protective finish coating.
4. Finish Sealer: Manufacturer’s recommended product.

D. Basis-of-Design Product: Advanced Floor Products, Inc.; Retro Plate 99, with Retro-Pel coating, and Retro-Guard finish sealer.

2.4 CONCRETE STAIN

A. Acid Stain: Water-based, slightly acidic solution of metallic salts, formulated to lightly etch and penetrate concrete surface to form permanent insoluble colored precipitates that remain in the pores of the concrete.

B. Acceptable Product: The following product is considered to be compatible with the concrete finish system specified herein. No stain shall be approved by the Architect unless it has been approved in writing by the manufacturer of the approved finish system:

1. Lafarge QC Construction Products; QC Chemical Stains.

2.5 MIXING

A. Floor Finish System: Mix concrete floor finish system materials and water in appropriate drum-type batch machine mixer or truck mixer according to manufacturer's written instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for conditions affecting performance of concrete floor finish system.

B. Verify that base concrete slabs comply with surface requirements specified in Section 033000 - CAST-IN-PLACE CONCRETE.

C. Verify that base slabs are visibly dry and free of moisture. Test for capillary moisture by the plastic sheet method according to ASTM D 4263.

D. Proceed with application only after unsatisfactory conditions have been corrected.

3.2 CONCRETE SEALER APPLICATION

A. Apply sealer to saturate concrete surface, in strict accordance with manufacturer’s recommendations. Sealer may be spray-applied, or poured and broomed.

B. Surface Preparations: Sweep all areas to be treated with a fine bristle broom or scrub. Hose off with water and allow to dry.

C. Application to New Concrete:

1. Apply sealer following concrete finishing operation, as soon as the surface is firm enough to walk on, and before hairline checking and temperature cracking begin. Keep the entire surface wet with sealer for 30 minutes.
2. When sealer becomes slippery, lightly mist the surface with water.
3. When the sealer again becomes slippery, thoroughly flush the entire surface with water and squeegee the surface completely dry to remove all surface alkali or sealer residue.

D. Application to Cured Concrete:

1. Apply sealer to entire surface to saturation. Keep the entire surface wet with sealer for 30 minutes.
2. If, after 30 to 40minutes, most of the sealer has been absorbed into the surface, broom or squeegee any excess material from all low spots and puddles so that all remaining sealer is entirely absorbed into the concrete or totally removed from the surface..
3. If, after 30 to 40minutes, most of the sealer is still on the surface, wait until it becomes slippery, then thoroughly flush the entire surface with water and squeegee the surface completely dry to remove all surface alkali or sealer residue.

E. Cleaning: Wash or wet mop sealed concrete floor with a neutral or high pH detergent.

3.3 POLISHED FLOOR FINISH SYSTEM APPLICATION

A. Commence application in the presence of the manufacturer's technical representative, after concrete has been in place a minimum of 45 days. Apply concrete floor finish system in strict accordance with manufacturer's recommendations and instructions.

B. Grind concrete substrate to achieve Level 2 polish.

C. Apply acid stain where stain is indicated on Drawings.

1. Spray-apply stain to surface of concrete.
2. Massage stain into surface using a stiff nylon-bristled brush in a circular motion.
3. Use brush to remove puddles of excess stain.
4. Repeat stain application after first coat has dried, a minimum of 5 hours.
5. Apply additional coats as needed to match color of approved mock-up.
6. After final coat has dried completely, a minimum of 10 hours, remove salt residue by spraying with water and agitating with a stiff nylon-bristled brush, or a rotary floor machine with a soft pad.
7. Rinse until rinse water runs clean. Control and collect run-off water to prevent it from discoloring surfaces not to be stained, using a squeegee or wet-vac. Dispose of water in a legal manner.
8. Cure stained surface.
9. Neutralize stained concrete surface with neutralizing agent and flush with water.

D. Sealing and Hardening Concrete Surface: Apply concrete stabilizer.

E. Polishing: Polish cured surface to Level 2 hard-shell medium sheen.

F. Coating: Apply manufacturer's recommended coating to protect polished surface. Apply finish sealer over coating.

3.4 PROTECTING AND CURING

A. General: Protect freshly placed concrete floor finish system from premature drying and excessive cold or hot temperatures.

B. Cover all concrete finishes with construction paper or plywood to protect them from construction traffic.

3.5 REPAIRS

A. Defective Finish system: Repair and patch defective concrete floor finish system areas, including areas that have not bonded to concrete substrate.

END OF SECTION

SECTION 034500

ARCHITECTURAL PRECAST CONCRETE

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Architectural precast concrete lintels, sills, copings, and base.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 033000 - CAST-IN-PLACE CONCRETE for installing connection anchors in concrete.
2. Section 051200 - STRUCTURAL STEEL FRAMING for furnishing and installing connections attached to structural-steel framing.
3. Section 055000 - METAL FABRICATIONS for miscellaneous steel shapes.

1.3 DEFINITION

A. Design Reference Sample: Sample of approved architectural precast concrete color, finish, and texture, preapproved by Architect.

1.4 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide architectural precast concrete units and connections capable of withstanding the following design loads within limits and under conditions indicated.

1. Wind Loads: As required by Code.

1.5 SUBMITTALS

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

B. Design Mixtures: For each precast concrete mixture. Include compressive strength and water-absorption tests.

C. Shop Drawings: Detail fabrication and installation of architectural precast concrete units. Indicate locations, plans, elevations, dimensions, shapes, and cross sections of each unit.

Indicate joints, reveals, and extent and location of each surface finish. Indicate details at building corners.

1. Indicate separate face and backup mixture locations and thicknesses.
2. Indicate welded connections by AWS standard symbols. Detail loose and cast-in hardware and connections.
3. Indicate locations, tolerances, and details of anchorage devices to be embedded in or attached to structure or other construction.
4. Indicate locations, extent, and treatment of dry joints if two-stage casting is proposed.
5. Include plans and elevations showing unit location and sequence of erection for special conditions.
6. Indicate location of each architectural precast concrete unit by same identification mark placed on panel.
7. Indicate relationship of architectural precast concrete units to adjacent materials.
8. Design Modifications: If design modifications are proposed to meet performance requirements and field conditions, submit design calculations and Shop Drawings. Do not adversely affect the appearance, durability, or strength of units when modifying details or materials and maintain the general design concept.
9. Comprehensive engineering analysis signed and sealed by the qualified professional engineer responsible for its preparation. Show governing panel types, connections, and types of reinforcement, including special reinforcement. Indicate location, type, magnitude, and direction of loads imposed on the building structural frame from architectural precast concrete.

D. Samples: For each type of finish indicated on exposed surfaces of architectural precast concrete units, in sets of 3, illustrating full range of finish, color, and texture variations expected; approximately 12 by 12 by 2 inches.

1. When other faces of precast concrete unit are exposed, include Samples illustrating workmanship, color, and texture of backup concrete as well as facing concrete.

E. Welding certificates.

F. Qualification Data: For Installer and fabricator

G. Material Test Reports: For aggregates.

H. Material Certificates: Include statements of material properties indicating compliance with requirements including compliance with standards and type designations within standards. Provide for each type and size of the following:

1. Cementitious materials.
2. Reinforcing materials and prestressing tendons.
3. Admixtures.
4. Bearing pads.
5. Structural-steel shapes and hollow structural sections.

I. Source quality-control test reports.

J. Field quality-control test and special inspection reports.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A precast concrete erector qualified and designated by PCI's Certificate of Compliance to erect Category A (Architectural Systems) for non-load-bearing members.

B. Fabricator Qualifications: A firm that assumes responsibility for engineering architectural precast concrete units to comply with performance requirements. This responsibility includes preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.

1. Participates in PCI's plant certification program and is designated a PCI-certified plant for Group A, Category A1 - Architectural Cladding and Load Bearing Units.

C. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

D. Design Standards: Comply with ACI 318 and design recommendations of PCI MNL 120, "PCI Design Handbook - Precast and Prestressed Concrete," applicable to types of architectural precast concrete units indicated.

E. Quality-Control Standard: For manufacturing procedures and testing requirements, quality-control recommendations, and dimensional tolerances for types of units required, comply with PCI MNL 117, "Manual for Quality Control for Plants and Production of Architectural Precast Concrete Products."

F. Welding: Qualify procedures and personnel according to AWS D1.1/D.1.1M, "Structural Welding Code - Steel"; and AWS D1.4, "Structural Welding Code - Reinforcing Steel."

G. Sample Panels: After sample approval and before fabricating architectural precast concrete units, produce a minimum of 2 sample panels approximately 3 sq. ft. in area for review by Architect. Incorporate full-scale details of architectural features, finishes, textures, and transitions in sample panels.

1. Locate panels where indicated or, if not indicated, as directed by Architect.
2. Damage part of an exposed-face surface for each finish, color, and texture, and demonstrate adequacy of repair techniques proposed for repair of surface blemishes.
3. After acceptance of repair technique, maintain one sample panel at manufacturer's plant and one at Project site in an undisturbed condition as a standard for judging the completed Work.
4. Demolish and remove sample panels when directed.

H. Range Samples: After sample panel approval and before fabricating architectural precast concrete units, produce a minimum of 5 sets of samples, approximately 3 sq. ft. in area, representing anticipated range of each color and texture on Project's units. Following range sample, maintain one set of samples at Project site and remaining sample sets at manufacturer's plant as color and texture approval reference.

I. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01. Agenda shall include protection of air barrier membrane during construction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver architectural precast concrete units in such quantities and at such times to limit unloading units temporarily on the ground.

B. Support units during shipment on nonstaining shock-absorbing material.

C. Store units with adequate dunnage and bracing and protect units to prevent contact with soil, to prevent staining, and to prevent cracking, distortion, warping or other physical damage.

D. Place stored units so identification marks are clearly visible, and units can be inspected.

E. Handle and transport units in a position consistent with their shape and design in order to avoid excessive stresses which would cause cracking or damage.

F. Lift and support units only at designated points shown on Shop Drawings.

1.8 PROJECT CONDITIONS

A. Protection of Air Barrier Membrane: During construction, protect air barrier membrane from penetrations which allow air to pass through air barrier assemblies. Engage original installer to repair damage promptly using identical materials and methods of installation, and to the satisfaction of the Architect.

1.9 SEQUENCING

A. Furnish loose connection hardware and anchorage items to be embedded in or attached to other construction without delaying the Work. Provide locations, setting diagrams, templates, instructions, and directions, as required, for installation.

PART 2 - PRODUCTS

2.1 MOLD MATERIALS

A. Molds: Rigid, dimensionally stable, non-absorptive material, warp and buckle free, that will provide continuous and true precast concrete surfaces within fabrication tolerances indicated; nonreactive with concrete and suitable for producing required finishes.

1. Mold-Release Agent: Commercially produced liquid-release agent that will not bond with, stain or adversely affect precast concrete surfaces and will not impair subsequent surface or joint treatments of precast concrete.

B. Form Liners: Units of face design, texture, arrangement, and configuration indicated. Furnish with manufacturer's recommended liquid-release agent that will not bond with, stain, or adversely affect precast concrete surfaces and will not impair subsequent surface or joint treatments of precast concrete.

C. Surface Retarder: Chemical set retarder, capable of temporarily delaying final hardening of newly placed concrete mixture to depth of reveal specified.

2.2 REINFORCING MATERIALS

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.

B. Epoxy-Coated Reinforcing Bars: ASTM A 775/A 775M epoxy coated.

C. Epoxy-Coated-Steel Wire: ASTM A 884/A 884M, Class A coated, deformed, flat sheet, Type 1 bendable coating.

D. Supports: Suspend reinforcement from back of mold or use bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place according to PCI MNL 117.

2.3 CONCRETE MATERIALS

A. Portland Cement: ASTM C 150, Type I or Type III, gray, unless otherwise indicated.

1. For surfaces exposed to view in finished structure, mix gray with white cement, of same type, brand, and mill source.

B. Normal-Weight Aggregates: Except as modified by PCI MNL 117, ASTM C 33, with coarse aggregates complying with Class 5S. Stockpile fine and coarse aggregates for each type of exposed finish from a single source (pit or quarry) for Project.

1. Face-Mixture-Coarse Aggregates: Selected, hard, and durable; free of material that reacts with cement or causes staining; to match selected finish sample.

a. Gradation: To match design reference sample.

2. Face-Mixture-Fine Aggregates: Selected, natural or manufactured sand of same material as coarse aggregate, unless otherwise approved by Architect.

C. Coloring Admixture: ASTM C 979, synthetic or natural mineral-oxide pigments or colored water-reducing admixtures, temperature stable, and nonfading.

D. Water: Potable; free from deleterious material that may affect color stability, setting, or strength of concrete and complying with chemical limits of PCI MNL 117.

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

2.4 STAINLESS-STEEL CONNECTION MATERIALS

A. Stainless-Steel Plate: ASTM A 666, Type 304, of grade suitable for application.

B. Stainless-Steel Bolts and Studs: ASTM F 593, Alloy 304 or 316, hex-head bolts and studs; stainless-steel nuts; and flat, stainless-steel washers.

1. Lubricate threaded parts of stainless-steel bolts with an antiseize thread lubricant during assembly.

C. Stainless-Steel-Headed Studs: ASTM A 276, with minimum mechanical properties of PCI MNL 117, Table 3.2.3.

2.5 BEARING PADS

A. Provide one of the following bearing pads for architectural precast concrete units as recommended by precast fabricator for application:

1. Elastomeric Pads: AASHTO M 251, plain, vulcanized, 100 percent polychloroprene (neoprene) elastomer, molded to size or cut from a molded sheet, Type A durometer hardness of 50 to 70, ASTM D 2240, minimum tensile strength 2250 psi, ASTM D 412.
2. Random-Oriented, Fiber-Reinforced Elastomeric Pads: Preformed, randomly oriented synthetic fibers set in elastomer. Type A durometer hardness of 70 to 90, ASTM D 2240; capable of supporting a compressive stress of 3000 psi with no cracking, splitting, or delaminating in the internal portions of pad. Test one specimen for every 200 pads used in Project.
3. Cotton-Duck-Fabric-Reinforced Elastomeric Pads: Preformed, horizontally layered cotton-duck fabric bonded to an elastomer; Type A durometer hardness of 80 to 100, ASTM D 2240; complying with AASHTO's "AASHTO Load and Resistance Factor Design (LRFD) Bridge Design Specifications, Division II, Section 18.10.2, or with MIL-C-882E.
4. Frictionless Pads: Tetrafluoroethylene (Teflon), glass-fiber reinforced, bonded to stainless or mild-steel plate, of type required for in-service stress.
5. High-Density Plastic: Multimonomer, nonleaching, plastic strip.

2.6 ACCESSORIES

A. Reglets: Stainless steel, Type 302 or 304, felt or fiber filled, or with face opening of slots covered.

B. Precast Accessories: Provide clips, hangers, plastic or steel shims, and other accessories required to install architectural precast concrete units.

2.7 GROUT MATERIALS

A. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, plasticizing and water-reducing agents, complying with ASTM C 1107, Grade A for drypack and Grades B and C for flowable grout and of consistency suitable for application within a 30-minute working time.

2.8 CONCRETE MIXTURES

A. Prepare design mixtures for each type of precast concrete required.

B. Design mixtures may be prepared by a qualified independent testing agency or by qualified precast plant personnel at architectural precast concrete fabricator's option.

C. Limit water-soluble chloride ions to maximum percentage by weight of cement permitted by ACI 318 or PCI MNL 117 when tested according to ASTM C 1218/C 1218M.

D. Normal-Weight Concrete Mixtures: Proportion face and backup mixtures by either laboratory trial batch or field test data methods according to ACI 211.1, with materials to be used on Project, to provide normal-weight concrete with the following properties:

1. Compressive Strength (28 Days): 5000 psi minimum.
2. Maximum Water-Cementitious Materials Ratio: 0.45.

E. Water Absorption: 6 percent by weight or 14 percent by volume, tested according to PCI MNL 117.

F. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content complying with PCI MNL 117.

G. When included in design mixtures, add other admixtures to concrete mixtures according to manufacturer's written instructions.

2.9 MOLD FABRICATION

A. Molds: Accurately construct molds, mortar tight, of sufficient strength to withstand pressures due to concrete-placement operations and temperature changes and for prestressing and detensioning operations. Coat contact surfaces of molds with release agent before reinforcement is placed. Avoid contamination of reinforcement and prestressing tendons by release agent.

1. Place form liners accurately to provide finished surface texture indicated. Provide solid backing and supports to maintain stability of liners during concrete placement. Coat form liner with form-release agent.

B. Maintain molds to provide completed architectural precast concrete units of shapes, lines, and dimensions indicated, within fabrication tolerances specified.

1. Form joints are not permitted on faces exposed to view in the finished work.
2. Edge and Corner Treatment: Uniformly chamfered.

2.10 FABRICATION

A. Cast-in Anchors, Inserts, Plates, Angles, and Other Anchorage Hardware: Fabricate anchorage hardware with sufficient anchorage and embedment to comply with design requirements. Accurately position for attachment of loose hardware, and secure in place during precasting operations. Locate anchorage hardware where it does not affect position of main reinforcement or concrete placement.

1. Weld-headed studs and deformed bar anchors used for anchorage according to AWS D1.1/D1.1M and AWS C5.4, "Recommended Practices for Stud Welding."

B. Furnish loose hardware items including steel plates, clip angles, seat angles, anchors, dowels, cramps, hangers, and other hardware shapes for securing architectural precast concrete units to supporting and adjacent construction.

C. Cast-in reglets, slots, holes, and other accessories in architectural precast concrete units as indicated on the Contract Drawings.

D. Cast-in openings larger than 10 inches in any dimension. Do not drill or cut openings or prestressing strand without Architect's approval.

E. Reinforcement: Comply with recommendations in PCI MNL 117 for fabricating, placing, and supporting reinforcement.

1. Clean reinforcement of loose rust and mill scale, earth, and other materials that reduce or destroy the bond with concrete. When damage to epoxy-coated reinforcing exceeds limits specified in ASTM A 775/A 775M, repair with patching material compatible with coating material and epoxy coat bar ends after cutting.
2. Accurately position, support, and secure reinforcement against displacement during concrete-placement and consolidation operations. Completely conceal support devices to prevent exposure on finished surfaces.
3. Place reinforcement to maintain at least 3/4-inch minimum coverage. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position while placing concrete. Direct wire tie ends away from finished, exposed concrete surfaces.
4. Place reinforcing steel and prestressing strand to maintain at least 3/4-inch minimum concrete cover. Increase cover requirements for reinforcing steel to 1-1/2 inches when units are exposed to corrosive environment or severe exposure conditions. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position while placing concrete. Direct wire tie ends away from finished, exposed concrete surfaces.
5. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh spacing and wire tie laps, where required by design. Offset laps of adjoining widths to prevent continuous laps in either direction.

F. Reinforce architectural precast concrete units to resist handling, transportation, and erection stresses.

G. Prestress tendons for architectural precast concrete units by either pretensioning or post-tensioning methods. Comply with PCI MNL 117.

1. Delay detensioning or post-tensioning of precast, prestressed architectural concrete units until concrete has reached its indicated minimum design release compressive strength as established by test cylinders cured under same conditions as concrete.
2. Detension pretensioned tendons either by gradually releasing tensioning jacks or by heat-cutting tendons, using a sequence and pattern to prevent shock or unbalanced loading.
3. If concrete has been heat cured, detension while concrete is still warm and moist to avoid dimensional changes that may cause cracking or undesirable stresses.
4. Protect strand ends and anchorages with bituminous, zinc-rich, or epoxy paint to avoid corrosion and possible rust spots.

H. Comply with requirements in PCI MNL 117 and requirements in this Section for measuring, mixing, transporting, and placing concrete. After concrete batching, no additional water may be added.

I. Place face mixture to a minimum thickness after consolidation of the greater of 1 inch or 1.5 times the maximum aggregate size, but not less than the minimum reinforcing cover specified.

J. Place concrete in a continuous operation to prevent seams or planes of weakness from forming in precast concrete units.

1. Place backup concrete mixture to ensure bond with face-mixture concrete.

K. Thoroughly consolidate placed concrete by internal and external vibration without dislocating or damaging reinforcement and built-in items, and minimize pour lines, honeycombing, or entrapped air on surfaces. Use equipment and procedures complying with PCI MNL 117.

1. Place self-consolidating concrete without vibration according to PCI TR-6, "Interim Guidelines for the Use of Self-Consolidating Concrete in Precast/Prestressed Concrete Institute Member Plants."

L. Comply with PCI MNL 117 for hot- and cold-weather concrete placement.

M. Identify pickup points of architectural precast concrete units and orientation in structure with permanent markings, complying with markings indicated on Shop Drawings. Imprint or permanently mark casting date on each architectural precast concrete unit on a surface that will not show in finished structure.

N. Cure concrete, according to requirements in PCI MNL 117, by moisture retention without heat or by accelerated heat curing using low-pressure live steam or radiant heat and moisture. Cure units until compressive strength is high enough to ensure that stripping does not have an effect on performance or appearance of final product.

O. Discard and replace architectural precast concrete units that do not comply with requirements, including structural, manufacturing tolerance, and appearance, unless repairs meet requirements in PCI MNL 117 and Architect's approval.

2.11 FABRICATION TOLERANCES

A. Fabricate architectural precast concrete units straight and true to size and shape with exposed edges and corners precise and true so each finished panel complies with PCI MNL 117 product tolerances as well as position tolerances for cast-in items.

B. Fabricate architectural precast concrete units straight and true to size and shape with exposed edges and corners precise and true so each finished panel complies with the following product tolerances:

1. Overall Height and Width of Units, Measured at the Face Exposed to View: As follows:

a. 10 feet or under, plus or minus 1/8 inch.
b. 10 to 20 feet, plus 1/8 inch, minus 3/16 inch.
c. 20 to 40 feet, plus or minus 1/4 inch.
d. Each additional 10 feet, plus or minus 1/16 inch.

2. Overall Height and Width of Units, Measured at the Face Not Exposed to View: As follows:

a. 10 feet or under, plus or minus 1/4 inch.
b. 10 to 20 feet, plus 1/4 inch, minus 3/8 inch.
c. 20 to 40 feet, plus or minus 3/8 inch.
d. Each additional 10 feet, plus or minus 1/8 inch.

3. Total Thickness or Flange Thickness: Plus 1/4 inch, minus 1/8 inch.
4. Rib Thickness: Plus or minus 1/8 inch.
5. Rib to Edge of Flange: Plus or minus 1/8 inch.

6. Distance between Ribs: Plus or minus 1/8 inch.
7. Variation from Square or Designated Skew (Difference in Length of the Two Diagonal Measurements): Plus or minus 1/8 inch per 72 inches or 1/2 inch total, whichever is greater.
8. Length and Width of Block-outs and Openings within One Unit: Plus or minus 1/4 inch.
9. Location and Dimension of Block-outs Hidden from View and Used for HVAC and Utility Penetrations: Plus or minus 3/4 inch.
10. Dimensions of Haunches: Plus or minus 1/4 inch.
11. Haunch Bearing Surface Deviation from Specified Plane: Plus or minus 1/8 inch.
12. Difference in Relative Position of Adjacent Haunch Bearing Surfaces from Specified Relative Position: Plus or minus 1/4 inch.
13. Bowing: Plus or minus L/360, maximum 1 inch.
14. Local Smoothness: 1/4 inch per 10 feet.
15. Warping: 1/16 inch per 12 inches of distance from nearest adjacent corner.
16. Tipping and Flushness of Plates: Plus or minus 1/4 inch.
17. Dimensions of Architectural Features and Rustications: Plus or minus 1/8 inch.

C. Position Tolerances: For cast-in items measured from datum line location, as indicated on Shop Drawings.

1. Weld Plates: Plus or minus 1 inch.
2. Inserts: Plus or minus 1/2 inch.
3. Handling Devices: Plus or minus 3 inches.
4. Reinforcing Steel and Welded Wire Fabric: Plus or minus 1/4 inch where position has structural implications or affects concrete cover; otherwise, plus or minus 1/2 inch.
5. Reinforcing Steel Extending out of Member: Plus or minus 1/2 inch of plan dimensions.
6. Tendons: Plus or minus 1/4 inch, vertical; plus or minus 1 inch, horizontal.
7. Location of Rustication Joints: Plus or minus 1/8 inch.
8. Location of Opening within Panel: Plus or minus 1/4 inch.
9. Location of Flashing Reglets: Plus or minus 1/4 inch.
10. Location of Flashing Reglets at Edge of Panel: Plus or minus 1/8 inch.
11. Reglets for Glazing Gaskets: Plus or minus 1/8 inch.
12. Electrical Outlets, Hose Bibs: Plus or minus 1/2 inch.
13. Location of Bearing Surface from End of Member: Plus or minus 1/4 inch.
14. Allowable Rotation of Plate, Channel Inserts, and Electrical Boxes: 2-degree rotation or 1/4 inch maximum over the full dimension of unit.
15. Position of Sleeve: Plus or minus 1/2 inch.
16. Location of Window Washer Track or Buttons: Plus or minus 1/8 inch.

2.12 FINISHES

A. Panel faces shall be free of joint marks, grain, and other obvious defects. Corners, including false joints shall be uniform, straight, and sharp. Finish exposed-face surfaces of architectural precast concrete units to match approved sample panels and as follows:

1. Abrasive-Blast Finish: Use abrasive grit, equipment, application techniques, and cleaning procedures to expose aggregate and surrounding matrix surfaces.
2. Acid-Etched Finish: Use acid and hot-water solution, equipment, application techniques, and cleaning procedures to expose aggregate and surrounding matrix surfaces. Protect hardware, connections, and insulation from acid attach.

B. Finish exposed top and bottom surfaces of architectural precast concrete units to match face-surface finish.

C. Finish exposed back surfaces of architectural precast concrete units by smooth, steel-trowel finish.

2.13 SOURCE QUALITY CONTROL

A. Quality-Control Testing: Test and inspect precast concrete according to PCI MNL 117 requirements. If using self-consolidating concrete, also test and inspect according to PCI TR-6, "Interim Guidelines for the Use of Self-Consolidating Concrete in Precast/Prestressed Concrete Institute Member Plants."

B. Owner will employ an independent testing agency to evaluate architectural precast concrete fabricator's quality-control and testing methods.

1. Allow Owner's testing agency access to material storage areas, concrete production equipment, concrete placement, and curing facilities. Cooperate with Owner's testing agency and provide samples of materials and concrete mixtures as may be requested for additional testing and evaluation.

C. Strength of precast concrete units will be considered deficient if units fail to comply with ACI 318 requirements for concrete strength.

D. Testing: If there is evidence that strength of precast concrete units may be deficient or may not comply with ACI 318 requirements, precaster will employ an independent testing agency to obtain, prepare, and test cores drilled from hardened concrete to determine compressive strength according to ASTM C 42/C 42M.

1. A minimum of three representative cores will be taken from units of suspect strength, from locations directed by Architect.
2. Cores will be tested in an air-dry condition.
3. Strength of concrete for each series of 3 cores will be considered satisfactory if average compressive strength is equal to at least 85 percent of 28-day design compressive strength and no single core is less than 75 percent of 28-day design compressive strength.
4. Test results will be made in writing on same day that tests are performed, with copies to Architect, Contractor, and precast concrete fabricator. Test reports will include the following:

a. Project identification name and number.
b. Date when tests were performed.
c. Name of precast concrete fabricator.
d. Name of concrete testing agency.
e. Identification letter, name, and type of precast concrete unit(s) represented by core tests; design compressive strength; type of break; compressive strength at breaks, corrected for length-diameter ratio; and direction of applied load to core in relation to horizontal plane of concrete as placed.

E. Patching: If core test results are satisfactory and precast concrete units comply with requirements, clean and dampen core holes and solidly fill with precast concrete mixture that has no coarse aggregate, and finish to match adjacent precast concrete surfaces.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting structural frame or foundation and conditions for compliance with requirements for installation tolerances, true and level bearing surfaces, and other conditions affecting performance.

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

C. Do not install precast concrete units until supporting cast-in-place building structural framing has attained minimum allowable design compressive strength or supporting steel or other structure is complete.

3.2 INSTALLATION

A. Install clips, hangers, bearing pads, and other accessories required for connecting architectural precast concrete units to supporting members and backup materials.

B. Erect architectural precast concrete level, plumb, and square within specified allowable tolerances. Provide temporary supports and bracing as required to maintain position, stability, and alignment as units are being permanently connected.

1. Install temporary steel or plastic spacing shims or bearing pads as precast concrete units are being erected. Tack weld steel shims to each other to prevent shims from separating.
2. Maintain horizontal and vertical joint alignment and uniform joint width as erection progresses.
3. Remove projecting lifting devices and grout fill voids within recessed lifting devices flush with surface of adjacent precast surfaces when recess is exposed.
4. Unless otherwise indicated, maintain uniform joint widths of 3/4 inch.

C. Connect architectural precast concrete units in position by bolting, welding, grouting, or as otherwise indicated on Shop Drawings. Remove temporary shims, wedges, and spacers as soon as practical after connecting and grouting are completed.

1. Do not permit connections to disrupt continuity of roof flashing.

D. Welding: Comply with applicable AWS D1.1/D1.1M and AWS D1.4 for welding, welding electrodes, appearance, quality of welds, and methods used in correcting welding work.

1. Protect architectural precast concrete units and bearing pads from damage by field welding or cutting operations, and provide noncombustible shields as required.
2. Welds not specified shall be continuous fillet welds, using no less than the minimum fillet as specified by AWS.
3. Clean weld-affected metal surfaces with chipping hammer followed by brushing, and apply a minimum 4.0-mil- thick coat of galvanized repair paint to galvanized surfaces according to ASTM A 780.
4. Remove, reweld, or repair incomplete and defective welds.

E. At bolted connections, use lock washers, tack welding, or other approved means to prevent loosening of nuts after final adjustment.

1. Where slotted connections are used, verify bolt position and tightness. For sliding connections, properly secure bolt but allow bolt to move within connection slot. For friction connections, apply specified bolt torque and check 25 percent of bolts at random by calibrated torque wrench.

F. Grouting Connections: Grout connections where required or indicated. Retain grout in place until hard enough to support itself. Pack spaces with stiff grout material, tamping until voids are completely filled. Place grout to finish smooth, level, and plumb with adjacent concrete surfaces. Keep grouted joints damp for not less than 24 hours after initial set. Promptly remove grout material from exposed surfaces before it affects finishes or hardens.

3.3 ERECTION TOLERANCES

A. Erect architectural precast concrete units level, plumb, square, true, and in alignment without exceeding the noncumulative erection tolerances of PCI MNL 117, Appendix I.

B. Erect architectural precast concrete units level, plumb, square, and true, without exceeding the following noncumulative erection tolerances:

1. Plan Location from Building Grid Datum: Plus or minus 1/2 inch.
2. Plan Location from Centerline of Steel: Plus or minus 1/2 inch.
3. Top Elevation from Nominal Top Elevation: As follows:

    a. Exposed Individual Panel: Plus or minus 1/4 inch.
    b. Non-Exposed Individual Panel: Plus or minus 1/2 inch.
    c. Exposed Panel Relative to Adjacent Panel: 1/4 inch.
    d. Non-Exposed Panel Relative to Adjacent Panel: 1/2 inch.

4. Support Elevation from Nominal Support Elevation: As follows:

    a. Maximum Low: 1/2 inch.
    b. Maximum High: 1/4 inch.

5. Maximum Plumb Variation over the Lesser of Height of Structure or 100 Feet: 1 inch.
6. Plumb in Any 10 Feet of Element Height: 1/4 inch.
7. Maximum Jog in Alignment of Matching Edges: 1/4 inch.
8. Joint Width (Governs over Joint Taper): Plus or minus 1/4 inch.
9. Maximum Joint Taper: 3/8 inch.
10. Joint Taper in 10 Feet: 1/4 inch.
11. Maximum Jog in Alignment of Matching Faces: 1/4 inch.
12. Differential Bowing or Camber, as Erected, between Adjacent Members of Same Design: 1/4 inch.
13. Opening Height between Spandrels: Plus or minus 1/4 inch.

3.4 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections and prepare reports:

1. Erection of precast concrete members.

B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections and prepare test reports.

C. Field welds will be subject to visual inspections and nondestructive testing according to ASTM E 165 or ASTM E 709. High-strength bolted connections will be subject to inspections.

D. Testing agency will report test results promptly and in writing to Contractor and Architect.

E. Repair or remove and replace work where tests and inspections indicate that it does not comply with specified requirements.

F. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

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. 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.

C. Prepare and repair damaged galvanized coatings with galvanizing repair paint according to ASTM A 780.

D. Wire brush, clean, and paint damaged prime-painted components with same type of shop primer.

E. Remove and replace damaged architectural precast concrete units when repairs do not comply with requirements.

3.6 CLEANING

A. Clean surfaces of precast concrete units exposed to view.

B. Clean mortar, plaster, fireproofing, weld slag, and other deleterious material from concrete surfaces and adjacent materials immediately.

C. Clean exposed surfaces of precast concrete units after erection and completion of joint treatment to remove weld marks, other markings, dirt, and stains.

1. Perform cleaning procedures, if necessary, according to precast concrete fabricator's recommendations. Clean soiled precast concrete surfaces with detergent and water, using stiff fiber brushes and sponges, and rinse with clean water. Protect other work from staining or damage due to cleaning operations.
2. Do not use cleaning materials or processes that could change the appearance of exposed concrete finishes or damage adjacent materials.

END OF SECTION

SECTION 040120

MASONRY RESTORATION AND CLEANING

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Repairing clay and stone masonry, including replacing damaged units as indicated on Drawings.
2. Reanchoring veneers.
3. Repointing mortar joints, removing existing mortar and replacing with new color mortar.
4. Removing plant growth (vines).
5. Cleaning exposed clay and stone masonry surfaces, including decorative stonework.
6. Provide for repair or replacement of clay and stone masonry broken or damaged during disassembly and reconstruction. Contractor shall be responsible for damage resulting from work of this Section.
7. Provide shoring and bracing required to maintain stability of masonry during work of this Section. Coordinate with requirements of Section 011000 - GENERAL REQUIREMENTS.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 024100 - DEMOLITION for demolition, removal and salvage requirements, to the extent not specified in this Section.
2. Section 042000 - UNIT MASONRY for new clay masonry veneer.
3. Section 044300 - STONE MASONRY for new stone masonry veneer.
4. Section 076200 - SHEET METAL FLASHING AND TRIM for metal flashing installed in or on restored masonry.
5. Section 079200 - JOINT SEALANTS for sealing joints in restored masonry.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include recommendations for application and use. Include test data substantiating that products comply with requirements.

B. Samples for Verification: Before erecting mockup, submit samples of the following:

1. Each type of exposed masonry unit to be used for replacing existing units.
   a. For each brick type, provide straps or panels containing at least four bricks.
   b. For each stone type, provide straps or panels containing at least four stones.

2. Each type of sand used for pointing mortar.
   a. For blended sands, provide samples of each component and blend.
   b. Identify sources, both supplier and quarry, of each type of sand.
3. Each type of pointing mortar in the form of sample mortar strips, 6 inches long by 1/2 inch wide, set in aluminum or plastic channels.
   a. Include with each sample a list of ingredients with proportions of each. Identify sources, both supplier and quarry, of each type of sand and brand names of cementitious materials and pigments if any.
4. Each type of anchor, insert, dowel, and attachment, full size.
5. Each type of masonry patching compound in the form of briquettes, at least 3 inches long by 1-1/2 inches wide. Document each sample with manufacturer and stock number or other information necessary to order additional material.

C. Qualification Data: For restoration specialists including field supervisors and chemical manufacturer.

D. Restoration Program: For each phase of restoration process, provide detailed description of materials, methods, equipment, and sequence of operations to be used for each phase of restoration work including protection of surrounding materials on building and Project site.

1. Include methods for keeping pointing mortar damp during curing period.
2. If materials and methods other than those indicated are proposed for any phase of restoration work, provide a written description, including evidence of successful use on comparable projects, and a testing program to demonstrate their effectiveness for this Project.

E. Cleaning Program: Describe cleaning process in detail, including materials, methods, and equipment to be used and protection of surrounding materials on building and Project site, and control of runoff during operations.

1. If materials and methods other than those indicated are proposed for cleaning work, provide a written description, including evidence of successful use on comparable projects, and a testing program to demonstrate their effectiveness for this Project.

1.4 QUALITY ASSURANCE

A. Restoration Specialist Qualifications: Engage an experienced, masonry restoration and cleaning firm to perform work of this Section. Firm shall have completed work similar in material, design, and extent to that indicated for this Project with a record of successful in-service performance.

1. At Contractor's option, work may be divided between two specialist firms: one for cleaning work and one for repair work.
2. Field Supervision: Restoration specialist firms shall maintain experienced full-time supervisors on Project site during times that masonry restoration and cleaning are in progress. Supervisors shall not be changed during Project except for causes beyond the control of restoration specialist firm.
3. Restoration Worker Qualifications: Persons who are experienced and specialize in restoration work of types they will be performing.

B. Chemical Manufacturer Qualifications: A firm regularly engaged in producing masonry cleaners that have been used for similar applications with successful results, and with factory-trained

representatives who are available for consultation and Project-site inspection and assistance at no additional cost.

C. Source Limitations: Obtain each type of material for masonry restoration (face brick, stone, cement, sand, etc.) from one source with resources to provide materials of consistent quality in appearance and physical properties.

D. Preconstruction Testing Service: Owner will engage a qualified independent testing agency to test the following. Provide test specimens and assemblies as indicated.

1. Replacement Brick: For each proposed type of replacement brick, according to sampling and testing methods in ASTM C 67 for compressive strength, 24-hour cold-water absorption, 5-hour boil absorption, saturation coefficient, and initial rate of absorption (suction).
2. Existing Brick: For each type of existing brick indicated for replacement, according to testing methods in ASTM C 67 for compressive strength, 24-hour cold-water absorption, 5-hour boil absorption, saturation coefficient, and initial rate of absorption (suction). Carefully remove existing bricks from locations designated by Architect.

E. Mockups: Prepare mockups of restoration and cleaning as follows to demonstrate aesthetic effects and qualities of materials and execution. Prepare mockups on existing walls under same weather conditions to be expected during remainder of the Work.

1. Repair an area approximately 36 inches high by 48 inches wide for each type of masonry material indicated to be rebuilt or replaced.
2. Patch three small areas at least 1 inch in diameter for each type of masonry material indicated to be patched.
3. Clean an area approximately 25 sq. ft. in area for each type of masonry and surface condition.
    a. Test cleaners and methods on samples of adjacent materials for possible adverse reactions unless cleaners and methods are known to have deleterious effect.
    b. Allow a waiting period of not less than seven days after completion of sample cleaning to permit a study of sample panels for negative reactions.
4. Rake out joints in two separate areas approximately 36 inches high by 72 inches wide for each type of repointing required and repoint one of the two areas.

F. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver masonry units to Project site strapped together in suitable packs or pallets or in heavy-duty cartons.

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

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

D. Store hydrated lime in manufacturer's original and unopened containers. Discard lime if containers have been damaged or have been opened for more than two days.

E. Store lime putty covered with water in sealed containers.

F. Store sand where grading and other required characteristics can be maintained and contamination avoided.

1.6 PROJECT CONDITIONS

A. Repoint mortar joints and repair masonry only when air temperature is between and 40 and 90 deg F and is predicted to remain so for at least 7 days after completion of work.

B. Cold-Weather Requirements: Comply with the following procedures for masonry repair and mortar-joint pointing:

1. When air temperature is below 40 deg F, heat mortar ingredients, masonry repair materials, and existing masonry walls to produce temperatures between 40 and 120 deg F.
2. When mean daily air temperature is below 40 deg F, provide enclosure and heat to maintain temperatures above 32 deg F within the enclosure for 7 days after repair and pointing.

C. Hot-Weather Requirements: Protect masonry repair and mortar-joint pointing when temperature and humidity conditions produce excessive evaporation of water from mortar and repair materials. Provide artificial shade and wind breaks and use cooled materials as required. Do not apply mortar to substrates with temperatures of 90 deg F and above.

D. Patch masonry only when air and surface temperatures are between and 55 and 100 deg F and are predicted to remain above 55 deg F for at least 7 days after completion of work. On days when air temperature is predicted to go above 90 deg F, schedule patching work to coincide with time that surface being patched will be in shade or during cooler morning hours.

E. Clean masonry surfaces only when air temperature is 40 deg F and above and is predicted to remain so for at least 7 days after completion of cleaning.

1.7 SEQUENCING AND SCHEDULING

A. Order replacement materials at earliest possible date, to avoid delaying completion of the Work.

B. Order sand for repointing mortar immediately after approval of Samples or mockups. Take delivery of and store at Project site a sufficient quantity of sand to complete Project.

C. Perform masonry restoration work in the following sequence:

1. Remove plant growth.
2. Repair existing masonry, including the following:
   a. Reconstructing and resetting existing stone work.
   b. Replacing existing masonry with new masonry materials.
3. Rake out joints that are to be repointed.
4. Point mortar joints.
5. Inspect for open mortar joints and repair before cleaning to prevent the intrusion of water and other cleaning materials into the wall.
6. Clean masonry surfaces.

D. As scaffolding is removed, patch anchor holes used to attach scaffolding. Patch holes in masonry units to comply with Part 3 "Masonry Unit Patching and Repairs" Article. Patch holes in mortar joints to comply with Part 3 "Repointing Masonry" Article.

PART 2 - PRODUCTS

2.1 MASONRY MATERIALS

A. Face Brick and Accessories: Provide face brick and accessories, including specially molded, ground, cut, or sawed shapes where required to complete masonry restoration work.

1. Provide units with colors, surface texture, size, and shape to match existing brickwork and with physical properties not less than those determined from preconstruction testing of selected existing units.
    a. For replacement brick at existing building provide brick to match existing as approved by Architect.
    b. For existing brickwork that exhibits a range of colors, provide brick that matches that range rather than brick that matches an individual color within that range.
2. Provide units with colors, surface texture, and physical properties to match Architect's sample. Match existing units in size and shape.
    a. For sample that exhibits a range of colors, provide brick that matches that range rather than brick that matches an individual color within that range.
3. Provide specially molded shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.
4. Provide specially ground units, shaped to match patterns, for arches and where indicated.

B. Building Brick: Provide building brick complying with ASTM C 62, of same vertical dimension as face brick, for masonry work concealed from view.

1. Grade SW where in contact with earth.
2. Grade SW, MW, or NW for concealed backup.

C. Stone: Reuse existing salvaged stones, where available, and as follows:

1. Varieties, Cut and Finish: To match existing stones, as approved by Architect.
2. For existing stone that exhibits a range of colors, finishes, sizes, or shapes, provide stone that matches that range rather than stone that matches an individual color, finish, size, or shape within that range.

2.2 MORTAR MATERIALS

A. Portland Cement: ASTM C 150, Type I or Type II.

1. Provide white cement containing not more than 0.60 percent total alkali when tested according to ASTM C 114.

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

C. Quicklime: ASTM C 5, pulverized lime.

D. Factory-Prepared Lime Putty: Screened, fully-slaked lime putty, prepared from pulverized lime complying with ASTM C 5.

E. Mortar Sand: ASTM C 144, unless otherwise indicated.

1. Color: Provide natural sand or ground marble, granite, or other sound stone; of color necessary to produce required mortar color.
2. For pointing mortar, provide sand with rounded edges.
3. Match size, texture, and gradation of existing mortar sand as closely as possible. Blend several sands, if necessary, to achieve suitable match.

F. Mortar Pigments: Natural and synthetic iron oxides, compounded for mortar mixes. Use only pigments with a record of satisfactory performance in masonry mortars.

1. Available Products: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. SGS Mortar Colors: Solomon Grind-Chem Services, Inc.
   b. True Tone Mortar Colors: Davis Colors, a Subsidiary of Rockwood Industries, Inc.

G. Water: Potable, clean and free from injurious amount of oil, alkali, organic matter or other deleterious material.

2.3 PAINT REMOVERS

A. Alkaline Paste Paint Remover: Manufacturer's standard alkaline paste formulation for removing paint coatings from masonry.

1. Available Products:
   a. American Building Restoration Products, Inc.; 800 Brush Grade.
   b. Diedrich Technologies Inc.; 606/606X Extra Thick Multi-Layer Paint Remover.
   c. Hydrochemical Techniques, Inc.; Hydroclean Heavy Duty Paint Remover (HT-716).
   d. Price Research, Ltd.; Price Heavy Duty Paint Stripper.
   e. ProSoCo; Sure Klean Heavy-Duty Paint Stripper.

B. Covered or Skin-Forming Alkaline Paint Remover: Manufacturer's standard covered or skin-forming alkaline formulation for removing paint coatings from masonry.

1. Available Products:
   a. American Building Restoration Products, Inc.; Grip 'N Strip 800 F.A.
   b. Diedrich Technologies Inc.; 404 Rip-Strip.
   c. Dumond Chemicals, Inc.; Peel Away 1 System.
   d. ProSoCo; Enviro Strip #2.

C. Solvent-Type Paint Remover: Manufacturer's standard water-rinsable, solvent-type gel formulation for removing paint coatings from masonry.

1. Available Products:
   a. American Building Restoration Products, Inc.; No. 3 Grip 'N Strip.
   b. Diedrich Technologies Inc.; 505 Special Coatings Stripper.
   c. Dominion Restoration, Inc.; Dominion Multi-Layer Paint & Graffiti Remover.
   d. Dumond Chemicals, Inc.; Peel Away 2.

e. Hydrochemical Techniques, Inc.; Hydroclean Solvent Paint Remover (HT-300).
f. Price Research, Ltd.; Price Strip-All.
g. ProSoCo; Sure Klean Fast Acting Paint Stripper.

D. Low-Odor, Solvent-Type Paint Remover: Manufacturer's standard low-odor, water-rinsable solvent-type gel formulation, containing no methanol or methylene chloride, for removing paint coatings from masonry.

1. Available Products:
a. American Building Restoration Products, Inc.; 800 No Lye Grip 'N Strip.
b. Dumond Chemicals, Inc.; Peel Away 6.
c. ProSoCo; Enviro Klean NMC.

2.4 CLEANING MATERIALS

A. Water: Potable, clean and free from injurious amount of oil, alkali, organic matter or other deleterious material.

B. Hot Water: Heat water to a temperature of 140 to 160 deg F.

C. Job-Mixed Detergent Solution: Solution prepared by mixing 2 cups of trisodium phosphate (TSP), 1/2 cup of laundry detergent, and 20 quarts of hot water for every 5 gal. of solution required.

D. Job-Mixed Mold, Mildew, and Algae Remover: Solution prepared by mixing 2 cups of trisodium phosphate (TSP), 5 quarts of 5 percent sodium hypochlorite (bleach), and 15 quarts of hot water for every 5 gal. of solution required.

E. Nonacidic Gel Cleaner: Manufacturer's standard gel formulation, with pH between 6 and 9, that contains detergents and chelating agents and is specifically formulated for cleaning masonry surfaces.

1. Available Products:
a. Price Research, Ltd.; Price Marble Cleaner-Gel.
b. ProSoCo; Sure Klean 942 Masonry Cleaner.
c. Dumond Chemicals, Inc.; Ultimate Stone and Masonry Cleaner.

F. Nonacidic Liquid Cleaner: Manufacturer's standard mildly alkaline liquid cleaner formulated for removing mold, mildew, and other organic soiling from ordinary building materials, including polished stone, brick, aluminum, plastics, and wood.

1. Available Products:
a. Dominion Restoration, Inc.; Bio-Cleanse.
b. Dumond Chemicals, Inc.; Safe n' Easy Architectural Cleaner/Restorer.
c. Price Research, Ltd.; Price Non-Acid Masonry Cleaner.
d. ProSoCo; Enviro Klean Restoration Cleaner.

G. Mild Acidic Cleaner: Manufacturer's standard mildly acidic cleaner containing no hydrochloric, hydrofluoric, or sulfuric acid; or chlorine bleaches.

1. Available Products:
a. Diedrich Technologies Inc.; Envirorestore 100.

b. Dominion Restoration, Inc.; DR-60 Stone and Masonry Cleaner.
c. Dumond Chemicals, Inc.; Safe n' Easy Heavy Duty Restoration Cleaner.
d. ProSoCo; Sure Klean Light-Duty Restoration Cleaner.

H. Acidic Cleaner: Manufacturer's standard acidic masonry restoration cleaner composed of hydrofluoric acid blended with other acids, detergents, wetting agents, and inhibitors.

1. Available Products:
   a. American Building Restoration Products, Inc.; 801 Heavy Duty Masonry Cleaner.
   b. Diedrich Technologies Inc.; 101 Masonry Restorer.
   c. Hydrochemical Techniques, Inc.; Hydroclean Brick, Granite, Sandstone and Terra Cotta Cleaner (HT-626).
   d. ProSoCo; Sure Klean Heavy-Duty Restoration Cleaner, Sure Klean 1028 Restoration Cleaner or Sure Klean Restoration Cleaner.

I. Two-Part Chemical Cleaner: Manufacturer's standard system consisting of potassium or sodium hydroxide based, alkaline prewash cleaner and acidic afterwash cleaner that does not contain hydrofluoric acid.

1. Available Products:
   a. ProSoCo; Sure Klean 766 Limestone & Masonry Prewash and Afterwash.

2.5 MISCELLANEOUS MATERIALS

A. Masonry Patching Compound: Factory-mixed cementitious product that is custom manufactured for patching masonry, is vapor- and water permeable, exhibits low shrinkage, and develops high bond strength to all types of masonry.

1. Formulate patching compound used for patching brick in colors and textures to match brick being patched. Provide number of colors needed to enable matching each brick.
2. Available Products:
   a. Cathedral Stone Products, Inc.; Jahn Restoration Mortar.
   b. Edison Coatings, Inc.; Custom System 45.
   c. Bonstone Materials Corp., Stone Repair.

B. Liquid Strippable Masking Agent: Manufacturer's standard liquid, film-forming, strippable masking material for protecting glass, metal, and polished stone surfaces from damaging effects of acidic and alkaline masonry cleaners.

1. Available Products:
   a. American Building Restoration Products, Inc.; LM 130 Acid Shield.
   b. Diedrich Technologies Inc.; Diedrich Acid Guard.
   c. Price Research, Ltd.; Price Mask.
   d. ProSoCo; Sure Klean Strippable Masking.

C. Masonry Repair Anchors, Expansion Type: Mechanical fasteners designed for masonry veneer stabilization consisting of 1/4-inch- diameter, Type 316 stainless-steel rod with brass expanding shells at each end and water-shedding washer in the middle. Expanding shells shall be designed to provide positive mechanical anchorage to veneer on one end and backup masonry on the other.

1. Available Products:

a. BLOK-LOK, a Hohmann & Barnard Company; Torq-Lok.
b. Dur-O-Wal, a Hohmann & Barnard Company; Dur-O-Wal Repair Anchor.
c. Hohmann & Barnard, Inc.; #521RA-B Restoration Anchor.

D. Masonry Repair Anchors, Spiral Type: Type 304 stainless-steel spiral rods designed to anchor to backing and veneer. Anchors are flexible in plane of veneer but rigid perpendicular to it.

1. Provide adhesive-installed anchors complete with manufacturer's standard epoxy adhesive and injection tubes, screens, sleeves, or other devices required for installation.
2. Provide driven-in anchors designed to be installed in drilled holes and relying on screw effect rather than adhesive to secure them to backup and veneer.
3. Available Products:
   a. Dur-O-Wal, a Hohmann & Barnard Company; Dur-O-Flex.
   b. Heckmann Building Products, Inc.; #391 Spiro Remedial Tie.
   c. Helifix Ltd.; Helifix HRT60 or Helifix HRT80.
   d. Hohmann & Barnard, Inc.; Helix Spiro-Ties.

E. Stone Anchors: Type and size indicated or, if not indicated, to match existing anchors in size and type. Fabricate anchors and dowels from ASTM A 167, Type 304 stainless steel.

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. Halfen USA.
   b. Heckmann Building Products.
   c. Hohmann & Barnard, Inc.
2. Adhesives, for Stone Anchors and Pins: ASTM C 881, Types I, II, IV & V, Grade 1, high modulus, high strength, moisture-insensitive, high-viscosity epoxy adhesive.
   a. Basis of Design: Sika; Sikadur 31, Hi-Mod Gel, or approved equal by anchor manufacturer.

F. Stone-to-Stone Adhesive: 2-part polyester or epoxy-resin stone adhesive with a 15- to 45-minute cure at 70 deg F or 1-part cementitious stone adhesive, recommended by adhesive manufacturer for type of stone repair indicated, and matching stone color.

1. Available Products: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Two-Part Polyester or Epoxy:
      1) Akemi North America; Akepox.
      2) Bonstone Materials, Inc.; A-199-T/B-439-T.
      3) Edison Coatings, Inc.; Flexi-Weld 520T.
         a) Aggregate for mixing with epoxy: Granite of the same color as the area to be patched, reduced to a fine aggregate with a mallet. Use particles that pass through a No. 50 sieve and are retained on a No. 200 sieve.
   b. One-Part Cementitious Stone Adhesive:
      1) Cathedral Stone Products, Inc.; Jahn Restoration Adhesive.

G. Joint Sealant and Backer Rods: Refer to Section 079200 - JOINT SEALANTS.

2.6 MORTAR MIXES

A. Preparing Lime Putty: Slake quicklime and prepare lime putty according to appendix to ASTM C 5 and manufacturer's written instructions.

B. Measurement and Mixing: Measure cementitious materials and sand in a dry condition by volume or equivalent weight. Do not measure by shovel; use known measure. Mix materials in a clean, mechanical batch mixer.

1. Mixing Pointing Mortar: Thoroughly mix cementitious materials and sand together before adding any water. Then mix again adding only enough water to produce a damp, unworkable mix that will retain its form when pressed into a ball. Maintain mortar in this dampened condition for 15 to 30 minutes. Add remaining water in small portions until mortar reaches desired consistency. Use mortar within one hour of final mixing; do not retemper or use partially hardened material.

C. Colored Mortar: Produce mortar of color required by using selected ingredients. Do not alter specified proportions without Architect's approval.

1. Mortar Pigments: Where mortar pigments are indicated, do not exceed a pigment-to-cement ratio of 1:10 by weight.
2. Color: Match existing, or as otherwise directed by Architect.

D. Do not use admixtures of any kind in mortar, unless otherwise indicated.

E. Mortar Proportions: Mix mortar materials in the following proportions:

1. Pointing Mortar for Brick: 1 part portland cement, 2 parts lime, and 6 parts sand.
   a. Add mortar pigments to produce mortar colors required.
2. Rebuilding (Setting) and Pointing Mortar, for Stone: Comply with ASTM C 270, Proportion Specification, Type N, unless otherwise indicated, with cementitious material limited to portland cement and lime.
   a. Mix: 1 part portland cement, 2 parts lime, and 6-7 parts sand.
   b. Add mortar pigments to produce mortar colors required.

2.7 CHEMICAL CLEANING SOLUTIONS

A. Dilute chemical cleaners with water to produce solutions not exceeding concentration recommended by chemical cleaner manufacturer.

B. Acidic Cleaner Solution for Brick: Dilute with water to produce hydrofluoric acid content of 3 percent or less, but not greater than that recommended by chemical cleaner manufacturer.

C. Acidic Cleaner Solution for Unpolished Stone: Dilute with water to produce hydrofluoric acid content of 3 percent or less, but not greater than that recommended by chemical cleaner manufacturer.

1. Use only on unpolished granite, unpolished dolomite marbles, and siliceous sandstone.

PART 3 - EXECUTION

3.1 PROTECTION

A. Protect persons, motor vehicles, surrounding surfaces of building being restored, building site, plants, and surrounding buildings from harm resulting from masonry restoration work.

1. Erect temporary protective covers over walkways and at points of pedestrian and vehicular entrance and exit that must remain in service during course of restoration and cleaning work.

B. Comply with chemical cleaner manufacturer's written instructions for protecting building and other surfaces against damage from exposure to its products. Prevent chemical cleaning solutions from coming into contact with pedestrians, motor vehicles, landscaping, buildings, and other surfaces that could be harmed by such contact.

1. Cover adjacent surfaces with materials that are proven to resist chemical cleaners used unless chemical cleaners being used will not damage adjacent surfaces. Use materials that contain only waterproof, UV-resistant adhesives. Apply masking agents to comply with manufacturer's written instructions. Do not apply liquid masking agent to painted or porous surfaces. When no longer needed, promptly remove masking to prevent adhesive staining.
2. Keep wall wet below area being cleaned to prevent streaking from runoff.
3. Do not clean masonry during winds of sufficient force to spread cleaning solutions to unprotected surfaces.
4. Neutralize and collect alkaline and acid wastes for disposal off Owner's property.
5. Dispose of runoff from cleaning operations by legal means and in a manner that prevents soil erosion, undermining of paving and foundations, damage to landscaping, and water penetration into building interiors.

C. Prevent mortar from staining face of surrounding masonry and other surfaces.

1. Cover sills, ledges, and projections to protect from mortar droppings.
2. Keep wall area wet below rebuilding and pointing work to discourage mortar from adhering.
3. Immediately remove mortar in contact with exposed masonry and other surfaces.
4. Clean mortar splatters from scaffolding at end of each day.

3.2 UNUSED ANCHOR OR EMBEDDED STEEL REMOVAL

A. Remove embedded masonry anchors, brackets, wood nailers, and other extraneous items no longer in use unless identified as historically significant or indicated to remain.

1. Remove items carefully to avoid spalling or cracking masonry.
2. If item cannot be removed without damaging surrounding masonry, cut off item flush with surface and core drill surrounding masonry and item as close around item as practical.
3. Patch holes where items were removed unless directed to remove and replace units.

3.3 MASONRY REMOVAL AND REPLACEMENT

A. At locations indicated, remove masonry units that are damaged, spalled, or deteriorated. Carefully demolish or remove entire units from joint to joint, without damaging surrounding masonry, in a manner that permits replacement with full-size units.

1. When removing single bricks, remove material from center of brick and work toward outside edges.

B. Support and protect remaining masonry that surrounds removal area. Maintain flashing, reinforcement, lintels, and adjoining construction in an undamaged condition.

C. Notify Architect of unforeseen detrimental conditions including voids, cracks, bulges, and loose masonry units in existing masonry backup, rotted wood, rusted metal, and other deteriorated items.

D. Remove in an undamaged condition as many whole bricks and stones as possible.

1. Remove mortar, loose particles, and soil from brick and stone by cleaning with hand chisels, brushes, and water.
2. Remove sealants by cutting close to brick and stone with utility knife and cleaning with solvents.
3. Store brick and stone for reuse, as indicated.
4. Deliver cleaned brick and stone not required for reuse to Owner, unless otherwise directed.

E. Clean masonry surrounding removal areas by removing mortar, dust, and loose particles in preparation for replacement.

F. Install replacement masonry into bonding and coursing pattern of existing masonry, match existing mortar joints for size. If cutting is required, use a motor-driven saw designed to cut masonry with clean, sharp, unchipped edges.

G. Lay replacement masonry units with completely filled bed, head, and collar joints. Butter ends with sufficient mortar to fill head joints and shove into place. Maintain joint width for replacement units to match existing joints.

1. Bricks: Wet both replacement and surrounding bricks that have ASTM C 67 initial rates of absorption (suction) of more than 30 g/30 sq. in. per min. Use wetting methods that ensure that units are nearly saturated but surface is dry when laid.
2. Tool exposed mortar joints in repaired areas to match joints of surrounding existing masonry work.
3. Rake out mortar used for laying brick and stone before mortar sets and point new mortar joints in repaired area to comply with requirements for repointing existing masonry, and at same time as repointing of surrounding area.

3.4 REANCHORING VENEERS

A. Install masonry repair anchors in horizontal mortar joints and according to manufacturer's written instructions. Install at not more than 16 inches o.c. vertically and 32 inches o.c. horizontally, unless otherwise indicated. Install at locations to avoid penetrating flashing.

B. Recess anchors at least 5/8 inch from surface of mortar joint and fill recess with pointing mortar.

3.5 MASONRY UNIT PATCHING AND REPAIRS

A. Patch the following masonry units:

1. Units indicated to be patched.
2. Units with holes.
3. Units with chipped edges or corners.
4. Units with small areas of deep deterioration.

B. Remove and replace existing patches, unless otherwise indicated or approved by Architect.

C. Patching Bricks:

1. Remove loose material from brick surface. Remove additional material so patch will not have feathered edges and will be at least 1/4 inch thick, but not less than recommended by patching compound manufacturer.
2. Mask or remove surrounding mortar joints if patch will extend to edge of brick.
3. Mix patching compound in individual batches to match each unit being patched. Combine one or more colors of patching compound, as needed, to produce exact match.
4. Rinse surface to be patched and leave damp, but without standing water.
5. Brush-coat surfaces with slurry coat of patching compound according to manufacturer's written instructions.
6. Place patching compound in layers as recommended by patching compound manufacturer, but not less than 1/4 inch or more than 2 inches thick. Roughen surface of each layer to provide a key for next layer.
7. Trowel, scrape, or carve surface of patch to match texture and surface plane of surrounding brick. Shape and finish surface before or after curing, as determined by testing, to best match existing brick.
8. Keep each layer damp for 72 hours or until patching compound has set.

D. Stone Repairs and Partial Stone Replacement (Dutchman Repair):

1. At locations indicated, remove rectangular portion of stone units. Carefully remove stone by making vertical and horizontal saw cuts at face of stone and demolishing corner portion of stone unit to depth required for fitting partial replacement (Dutchman). Make edges of stone at cuts smooth and square to each other and to finished surface. Make back of removal area flat and parallel to stone face.
2. Remove mortar from joints that abut area of stone removal to same depth as stone was removed. Remove loose mortar particles and other debris from surfaces to be bonded and surfaces of adjacent stone units that will receive mortar by cleaning with stiff-fiber brush.
3. Trim partial replacement (Dutchman) to accurately fit area where stone was removed.
4. Apply stone-to-stone adhesive to comply with adhesive manufacturer's written instructions. Coat bonding surfaces of existing stone and partial replacement, completely filling all crevices and voids.
    a. Apply partial replacement or fit stone fragments onto building stone while adhesive is still tacky and hold fragment securely in place until adhesive has cured.
    b. Use shims, clamps, wedges, or other devices as necessary to align face of partial replacement with face of stone unit being repaired.

5. After adhesive has fully cured, further anchor partial replacements where indicated with 1/4-inch- diameter, plain stainless-steel rods set into 1/4-inch- diameter holes drilled at a 45-degree downward angle through face of stone. Center and space anchor rods between 3 and 5 inches apart and at least 2 inches from any edge. Insert rods at least 2 inches into backing stone and 2 inches into partial replacements with end countersunk at least 3/4 inch from exposed face of stone.
6. Clean residual adhesive from exposed surfaces.

3.6 CLEANING MASONRY, GENERAL

A. Examination: Examine all surfaces scheduled for cleaning, for roughness, contaminants, unsound structural substrates, or other conditions that may impair the application. Notify the Engineer in writing of any such conditions; do not continue work until directed by Architect on how to proceed.

1. Monitor weather prior to work to ensure that air temperatures remain between 50°F and 85°F, or as recommended by the manufacturer of chemical compounds and proprietors of cleaning methods.
2. Ensure that building components not to be cleaned, adjacent persons, property, and plant life are protected from all cleaning activities and wind drift. Test adjacent non-masonry materials for reaction with cleaning materials. Mask all windows, ornamental fixtures, hardware, wood doors, or other non-masonry surfaces.

B. Proceed with cleaning in an orderly manner; work from top to bottom of each scaffold width and from one end of each elevation to the other.

C. Use only those cleaning methods indicated for each masonry material and location.

1. Do not use wire brushes or brushes that are not resistant to chemical cleaner being used. Do not use plastic-bristle brushes if natural-fiber brushes will resist chemical cleaner being used.
2. Use spray equipment that provides controlled application at volume and pressure indicated, measured at spray tip. Adjust pressure and volume to ensure that cleaning methods do not damage masonry.
    a. Equip units with pressure gages.
    b. Provide spray applications as follows:
        1) Low-Pressure Spray: 100 to 400 psi; 4 to 6 gpm.
        2) Medium-Pressure Spray: 400 to 800 psi; 4 to 6 gpm.
        3) High-Pressure Spray: 800 to 1200 psi; 4 to 6 gpm.
3. For chemical cleaner spray application, use low-pressure tank or chemical pump suitable for chemical cleaner indicated, equipped with cone-shaped spray tip.
4. For water spray application, use fan-shaped spray tip that disperses water at an angle of 25 to 50 degrees.
5. For high-pressure water spray application, use fan-shaped spray tip that disperses water at an angle of at least 40 degrees.
6. For heated water spray application, use equipment capable of maintaining temperature between 140 and 160 deg F at flow rates indicated.
7. For steam application, use steam generator capable of delivering live steam at nozzle.

D. Perform each cleaning method indicated in a manner that results in uniform coverage of all surfaces, including corners, moldings, and interstices, and that produces an even effect without streaking or damaging masonry surfaces.

E. Removing Plant Growth: Completely remove plant, moss, and shrub growth from masonry surfaces. Carefully remove plants, creepers, and vegetation by cutting at roots and allowing to dry as long as possible before removal. Remove loose soil and debris from open masonry joints to whatever depth they occur.

F. Preliminary Cleaning: Before beginning general cleaning, remove extraneous substances that are resistant to cleaning methods being used. Extraneous substances include paint, calking, asphalt, and tar.

1. Carefully remove heavy accumulations of material from surface of masonry with a sharp chisel. Do not scratch or chip masonry surface.
2. Remove paint and calking with alkaline paint remover.
    a. Comply with requirements for paint removal.
    b. Repeat application up to two times if needed.
3. Remove asphalt and tar with solvent-type paint remover.
    a. Apply only to asphalt and tar by brush without prewetting.
    b. Allow paint remover to remain on surface for 10 to 30 minutes.
    c. Rinse off with water using low-pressure spray.
    d. Repeat application if needed.

G. Water Application Methods:

1. Water Soak Application, for Stone: Soak stone surfaces by applying water continuously and uniformly to limited area for time indicated. Apply water at low pressures and low volumes in multiple fine sprays using perforated hoses or multiple spray nozzles. Erect a protective enclosure constructed of polyethylene sheeting to cover area being sprayed.
2. Spray Applications, for Brick and Stone: Unless otherwise indicated, hold spray nozzle at least 6 inches from surface of stone and apply water in horizontal back and forth sweeping motion, overlapping previous strokes to produce uniform coverage.

H. Steam Wash: Apply steam to masonry surfaces at pressures not exceeding 80 psi. Hold nozzle at least 6 inches from surface of masonry and apply steam in horizontal back and forth sweeping motion, overlapping previous strokes to produce uniform coverage.

I. Chemical Cleaner Application Methods: Apply chemical cleaners to masonry surfaces to comply with chemical cleaner manufacturer's written instructions; use brush or spray application methods, at Contractor's option. Do not spray apply at pressures exceeding 50 psi. Do not allow chemicals to remain on surface for periods longer than those indicated or recommended by manufacturer.

J. Rinse off chemical residue and soil by working upward from bottom to top of each treated area at each stage or scaffold setting. Periodically during each rinse, test pH of rinse water running off of cleaned area to determine that chemical cleaner is completely removed.

1. Apply neutralizing agent and repeat rinse, if necessary, to produce tested pH of between 6.7 and 7.5.

K. After cleaning is complete, remove protection no longer required. Remove tape and adhesive marks.

3.7 PAINT REMOVAL

A. Paint Removal with Alkaline Paste Paint Remover:

1. Apply paint remover to dry, painted masonry with brushes.
2. Allow paint remover to remain on surface for period recommended by manufacturer.
3. Rinse with water applied by low-pressure spray to remove chemicals and paint residue.
4. Repeat process, if necessary, to remove all paint.
5. Apply acidic cleaner to masonry, while surface is still wet, using low-pressure spray equipment or soft-fiber brush. Let cleaner remain on surface for period recommended by chemical cleaner manufacturer.
6. Rinse with cold water applied by low-pressure spray to remove chemicals and soil.

B. Paint Removal with Covered or Skin-Forming Alkaline Paint Remover:

1. Apply paint remover to dry, painted masonry with trowel, spatula, or as recommended by manufacturer.
2. Apply cover, if required by manufacturer, per manufacturer's written instructions.
3. Allow paint remover to remain on surface for period recommended by manufacturer or as determined in test panels.
4. Scrape off paint and remover and collect for disposal.
5. Rinse with water applied by low-pressure spray to remove chemicals and paint residue.
6. Use alkaline paste paint remover according to "Paint Removal with Alkaline Paste Paint Remover" Paragraph, if necessary, to remove remaining paint.
7. Apply acidic cleaner to masonry, while surface is still wet, using low-pressure spray equipment or soft-fiber brush. Let cleaner remain on surface for period recommended by chemical cleaner manufacturer.
8. Rinse with cold water applied by low-pressure spray to remove chemicals and soil.

C. Paint Removal with Solvent-Type Paint Remover:

1. Apply thick coating of paint remover to painted masonry with natural-fiber cleaning brush, deep-nap roller, or large paint brush.
2. Allow paint remover to remain on surface for period recommended by manufacturer. Agitate periodically with stiff-fiber brush.
3. Rinse with cold water applied by low-pressure spray to remove chemicals and paint residue.

3.8 MASONRY CLEANING

A. Cold-Water Wash: Use cold water applied by low-pressure spray.

B. Cold Water Soak:

1. Apply cold water by intermittent soaking.
2. Use perforated hoses or other means that will apply a fine water mist to entire surface being cleaned.
3. Apply water in cycles with at least 30 minutes between cycles.
4. Continue water application until surface encrustation has softened sufficiently to permit its removal by water wash, as indicated by cleaning tests.
5. Remove soil and softened surface encrustation from masonry with cold water applied by low-pressure spray.

C. Hot-Water Wash: Use hot water applied by low-pressure spray.

D. Steam Cleaning: Apply steam at pressures not exceeding 80 psi.

E. Detergent Cleaning:

1. Wet masonry with water applied by low-pressure spray.
2. Scrub masonry with detergent solution using medium-soft brushes until soil is thoroughly dislodged and can be removed by rinsing. Use small brushes to remove soil from mortar joints and crevices. Dip brush in solution often to ensure that adequate fresh detergent is used and that masonry surface remains wet.
3. Rinse with water applied by low-pressure spray to remove detergent solution and soil.
4. Repeat cleaning procedure above where required to produce cleaning effect established by mockup.

F. Mold, Mildew, and Algae Removal:

1. Wet masonry with water applied by low-pressure spray.
2. Apply mold, mildew, and algae remover by brush or low-pressure spray.
3. Scrub masonry with medium-soft brushes until mold, mildew, and algae are thoroughly dislodged and can be removed by rinsing. Use small brushes for mortar joints and crevices. Dip brush in mold, mildew, and algae remover often to ensure that adequate fresh cleaner is used and that masonry surface remains wet.
4. Rinse with water applied by low-pressure spray to remove mold, mildew, and algae remover and soil.
5. Repeat cleaning procedure above where required to produce cleaning effect established by mockup.

G. Nonacidic Gel Chemical Cleaning:

1. Wet masonry with water applied by low-pressure spray.
2. Apply nonacidic gel cleaner in 1/8-inch thickness by brush, working into joints and crevices. Apply quickly and do not brush out excessively so area will be uniformly covered with fresh cleaner and dwell time will be uniform throughout area being cleaned.
3. Let cleaner remain on surface for period indicated below:
   a. As recommended by chemical cleaner manufacturer.
   b. As established by mockup.
4. Remove bulk of nonacidic gel cleaner by squeegeeing into containers for disposal.
5. Rinse with water applied by low-pressure spray to remove chemicals and soil.
6. Repeat cleaning procedure above where required to produce cleaning effect established by mockup. Do not repeat more than once. If additional cleaning is required, use steam wash.

H. Nonacidic Liquid Chemical Cleaning:

1. Wet masonry with water applied by low-pressure spray.
2. Apply cleaner to masonry in two applications by brush. Let cleaner remain on surface for period indicated below:
   a. As recommended by chemical cleaner manufacturer.
   b. As established by mockup.
   c. Two to three minutes.
3. Rinse with water applied by low-pressure spray to remove chemicals and soil.

4. Repeat cleaning procedure above where required to produce cleaning effect established by mockup. Do not repeat more than once. If additional cleaning is required, use steam wash.

I. Mild Acidic Chemical Cleaning:

1. Wet masonry with cold water applied by low-pressure spray.
2. Apply cleaner to masonry in two applications by brush or low-pressure spray. Let cleaner remain on surface for period indicated below:
   a. As recommended by chemical cleaner manufacturer.
   b. As established by mockup.
   c. Two to three minutes.
3. Rinse with cold water applied by low-pressure spray to remove chemicals and soil.
4. Repeat cleaning procedure above where required to produce cleaning effect established by mockup. Do not repeat more than once. If additional cleaning is required, use steam wash.

3.9 REPOINTING MASONRY

A. Rake out and repoint mortar joints to the following extent:

1. All joints in areas indicated.
2. Joints where mortar is missing or where they contain holes.
3. Cracked joints where cracks can be penetrated at least 1/4 inch by a knife blade 0.027 inch thick.
4. Cracked joints where cracks are 1/8 inch or more in width and of any depth.
5. Joints where they sound hollow when tapped by metal object.
6. Joints where they are worn back 1/4 inch or more from surface.
7. Joints where they are deteriorated to point that mortar can be easily removed by hand.
8. Joints, other than those indicated as sealant-filled joints, where they have been filled with substances other than mortar.

B. Do not rake out and repoint joints where not required.

C. Rake out joints as follows:

1. Remove mortar from joints to depth of 2 times joint width, but not less than 1/2 inch or not less than that required to expose sound, unweathered mortar.
2. Remove mortar from masonry surfaces within raked-out joints to provide reveals with square backs and to expose masonry for contact with pointing mortar. Brush, vacuum, or flush joints to remove dirt and loose debris.
3. Do not spall edges of masonry units or widen joints. Replace or patch damaged masonry units as directed by Architect.
   a. Cut out mortar by hand with chisel and mallet. Do not use power-operated grinders without Architect's written approval based on submission by Contractor of a satisfactory quality-control program and demonstrated ability of operators to use tools without damaging masonry. Quality-control program shall include provisions for supervising performance and preventing damage due to worker fatigue.
   b. Cut out center of mortar bed joints using angle grinders with diamond-impregnated metal blades. Remove remaining mortar by hand with chisel and mallet. Strictly adhere to written quality-control program. Quality-control program shall include

provisions for demonstrating ability of operators to use tools without damaging masonry, supervising performance, and preventing damage due to worker fatigue.

D. Notify Architect of unforeseen detrimental conditions including voids in mortar joints, cracks, loose masonry units, rotted wood, rusted metal, and other deteriorated items.

E. Point joints as follows:

1. Rinse masonry-joint surfaces with water to remove dust and mortar particles. Time rinsing application so, at time of pointing, joint surfaces are damp but free of standing water. If rinse water dries, dampen masonry-joint surfaces before pointing.
2. Apply pointing mortar first to areas where existing mortar was removed to depths greater than surrounding areas. Apply in layers not greater than 3/8 inch until a uniform depth is formed. Fully compact each layer thoroughly and allow it to become thumbprint hard before applying next layer.
3. After low areas have been filled to same depth as remaining joints, point all joints by placing mortar in layers not greater than 3/8 inch. Fully compact each layer and allow to become thumbprint hard before applying next layer.
    a. Where existing bricks have worn or rounded edges, slightly recess finished mortar surface below face of masonry to avoid widened joint faces.
    b. Take care not to spread mortar over edges onto exposed masonry surfaces or to featheredge mortar.
4. When mortar is thumbprint hard, tool joints to match original appearance of joints. Remove excess mortar from edge of joint by brushing.

F. Cure mortar by maintaining in thoroughly damp condition for at least 72 hours including weekends and holidays.

1. Acceptable curing methods include covering with wet burlap and plastic sheeting, periodic hand misting, and periodic mist spraying using system of pipes, mist heads, and timers.
2. Adjust curing methods to ensure that pointing mortar is damp throughout its depth without eroding surface mortar.

G. Where repointing work precedes cleaning of existing masonry, allow mortar to harden at least 30 days before beginning cleaning work.

3.10 FINAL CLEANING

A. After mortar has fully hardened, thoroughly clean exposed masonry surfaces of excess mortar and foreign matter; use wood scrapers, stiff-nylon or -fiber brushes, and clean water, spray applied at low pressure.

1. Do not use metal scrapers or brushes.
2. Do not use acidic or alkaline cleaners.

B. Wash adjacent woodwork and other nonmasonry surfaces. Use detergent and soft brushes or cloths.

C. Clean masonry debris from roof; remove debris from gutters and downspouts. Rinse off roof and flush gutters and downspouts.

D. Sweep and rake adjacent pavement and grounds to remove masonry debris. Where necessary, pressure wash surfaces to remove mortar, dust, dirt, and stains.

3.11 FIELD QUALITY CONTROL

A. Inspectors: Owner will engage qualified independent inspectors to perform inspections and prepare test reports. Coordinate with inspectors and provide access. Allow inspectors use of lift devices and scaffolding, as needed, to perform inspections.

END OF SECTION

SECTION 040513

SITE MASONRY MORTARING AND GROUTING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes materials, labor, apparatus, tools, equipment, temporary construction, transportation, and services necessary for and incidental to performing the proper completion of Work as required to make a complete Site Masonry Mortaring & Grouting installation, as shown on the Contract Drawings, and as specified herein this Section.

B. Work under this Section consists of, but is not necessarily limited to, furnishing and installing the following:

1. Masonry Mortaring & Grouting materials, necessary for and as part of connecting the installation of Concrete Unit Masonry installation, Stone Masonry Veneer Assemblies installation, and Precast Architectural Concrete, as indicated on the Contract Drawings.

C. Related Documents: The following Documents contain requirements that relate to Work in this Section:

1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
2. Section 044213 “Stone Slabs, Blocks and Boulders”.
3. Section 096340 "Site Stone Paving".

1.2 DEFINITIONS AND APPLICABLE STANDARDS

A. References:

1. ASTM – American Society for Testing and Materials.
2. ANSI – American National Standards Institute.
3. UBC - Uniform Building Code.

B. Applicable Code: Uniform Building Code, latest edition.

1. The Code is hereby made a part of this Section and Masonry Work shall conform to applicable requirements therein except as otherwise specified herein or shown on the Contract Drawings. Nothing contained herein shall be construed as permitting Work that is contrary to Code requirements.

C. Definitions:

1. CMU – Concrete Masonry Unit.
2. pcf – pounds per cubic foot/feet (measurement).
3. psi – pounds per square inch (measurement).

1.3 SUBMITTALS

A. General: Refer to Division 01 for project submittal requirements and timelines. If provided in hardcopy submittal booklets submit each item in this Article in required copies with four (4) copies for review by Landscape Architect. Three (3) copies shall be returned (One for Client, one for Owner and one for Contractor) and one copy maintained by Landscape Architect. Provide one (1) sets of Material Samples for review by the Landscape Architect unless requested otherwise.

B. Submittal Booklets: Each Submittal Booklet under this Section shall be tabbed into specific sections, containing clearly identified (through yellow highlighter or other specific identification methods) and legible information on the following information indicated in this Article.

C. Electronic Submittals: Electronic Submittal shall be provided in a single bound file, PDF format preferred, unless otherwise noted in Division 01.

D. Product/Material Data. Submit accordingly per requirements under Section 034513 “Site Precast Architectural Concrete and Section 096341 “Site Stone Paving”.

1. Provide Mortar and Grout mix designs for Owner’s review and the Owner's Testing Laboratory approval at least seven (7) days before Concrete Unit Masonry, Precast Architectural Concrete, or Stone Masonry Veneer Assemblies placement commences.
2. Certificates: Show Mortar and Grout cement conforms to specified requirements.

E. Material Samples:

1. To be reviewed as part of the Field-Constructed Mock-Ups.

F. Scaled Shop Drawings: Not Required.

G. Field-Constructed Mock-ups:

1. Provide accordingly per requirements under Section 034513 “Site Precast Architectural Concrete and Section 096341 “Site Stone Paving”.

H. Qualification Data: Meet and submit accordingly per requirements under Section 034513 “Site Precast Architectural Concrete and Section 096341 “Site Stone Paving”.

I. Submittals under this Article will be rejected and returned without the benefit of review by the Landscape Architect if they are difficult to read due to insufficient scale, poor image quality, or poor drafting quality; or if all of the required information is missing or not presented in the format as requested.

J. No Work under this Section shall proceed until all information indicated herein this Article have been reviewed, accepted, and approved by the Landscape Architect, in writing.

1.4 QUALITY ASSURANCE AND CONTROL

A. Installer Qualifications: Engage an experienced Installer with experience in successfully demonstrating the installation of Masonry Mortaring and Grouting Work similar in material, design, and extent to that indicated for this Project, with a record of successful performance, and with sufficient production capacity to produce required units without causing delay in the Work.

B. Source Quality Control:

1. Masonry Mortaring and Grouting materials will be tested by the Owner's Testing Laboratory, as follows:

a. When full stresses are used in design for concrete masonry, Grout shall be tested for each 5,000-sq. ft. of wall area, but not less than one test per Scope, to show compliance with the compressive strength required.

1.5 DELIVERY, STORAGE AND HANDLING.

A. Provide new, unused materials indicated under this Section. Store and secure properly to prevent theft and damage.

B. Do not bring cementitious or other material to the site if it has become lumpy, caked, hardened or air slaked from absorption of moisture.

C. Deliver manufactured materials in original, unopened packages or containers with manufacturer's labels intact and legible.

D. Store materials off ground and under cover, away from damp surfaces and inclement weather.

E. Deliver and install materials so as to not delay Work, and install only after preparations for installation have been completed.

1.6 COORDINATION, SCHEDULING, AND OBSERVATIONS

A. Notify the Contractors performing Work related to installation of Work under this Section in ample time so as to allow sufficient time for them to perform their portion of Work and that progress of Work is not delayed. Verify conditions at the Project Site for Work that affects installation under this Section. Coordinate items of other trades to be furnished and set in place.

B. Field Measurements: Perform accordingly per requirements under Section 034513 “Site Precast Architectural Concrete and Section 096341 “Site Stone Paving”.

C. Perform installation operations only when weather is suitable in accordance with locally accepted practices.

D. Grades and Levels: Perform accordingly per requirements under Section 034513 “Site Precast Architectural Concrete and Section 096341 “Site Stone Paving”.

E. Construction Site Observations: Periodic site observations shall be made by the Landscape Architect during the installation of Work under this Section. The Contractor shall request, in writing, at least one (1) week in advance of the time when mandatory site observation(s) by the Landscape Architect are required.

1.7 SUBSTITUTIONS

A. Consideration: Materials to be considered equal to the Materials indicated herein this Section shall be reviewed by the Landscape Architect. Materials with equal performance characteristics produced by other Manufacturer’s and/or Distributors may be considered, providing deviations in dimensional size, color, composition, operation, and/or other characteristics do not change the design concept, aesthetic appearance, nor intended performance, as solely judged by the Landscape Architect. The burden of proof on product equality is on the Contractor.

B. Specific reference to Manufacturer's names and products specified herein are used as standards of quality. This implies no right to the Contractor to substitute other materials without prior written approval by the Landscape Architect for Work under this Section.

C. Materials substituted and installed by the Contractor, without prior written approval by the Landscape Architect, may be rejected. Contractor shall not be entitled to be compensated by the Owner where the Contractor has installed rejected substitutions without receiving prior written approval.

D. Contract Price: Substituted Materials under this Section shall not increase the Contract price.

PART 2 - PRODUCTS

2.1 MORTAR MATERIALS

A. Portland Cement: ASTM C150, Type V.

B. Hydrated Lime: ASTM C207, Type S.

C. Sand: ASTM C144. For joints less than 1/4-inch, use aggregate graded with one-hundred percent (100%) passing a No. 16 sieve.

D. Water: Suitable for drinking, clean, and free of harmful amounts of acid, alkalis, salts, or organic materials.

E. Admixtures:

1. Cold-Weather Admixture: Non-chloride, non-corrosive, accelerating admixture complying with ASTM C494, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.

   a. Products & Manufacturers: Subject to compliance with requirements, provide products by the following:

      1) *Accelguard 80*, Euclid Chemical Co.
      2) *Morset; Grace*, W.R. Grace & Co., Construction Products Division.
      3) Or equal, as approved by the Landscape Architect.

2. Latex Additive (water emulsion) described below, serving as replacement for part of or all gaging water, of type specifically recommended by latex additive manufacturer for use with job-mixed Portland cement and aggregate and not containing a retarder.

   a. Latex Additive: Styrene butadiene rubber.
   b. Latex Additive: Acrylic resin.

F. Color Pigments: Where required, when integrally colored mortar and grout is used, use natural or synthetic iron oxides and chromium oxides, compounded for use in mortar mixes. not to exceed five-percent (5%) of the weight of masonry cement or ten-percent (10%) of the weight of Portland cement in the Mortar. Use only pigments with record of satisfactory performance in Stone Masonry Veneer mortars.

1. Color to match Unit Masonry or existing on site elements of similar appearance or construction.
2. Products & Manufacturers: Subject to compliance with requirements, provide products by the following:

   a. *True Tone Mortar Colors*, Davis Colors.

b. *Centurion Pigments*, Lafarge Corporation.
c. *SGS Mortar Colors*, Solomon Grind-Chem Services, Inc.
d. Or equal, as approved by the Landscap4e Architect.

2.2 MORTAR MIXES

A. General: Comply with referenced standards and with manufacturers' written instructions for mix proportions, mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures needed to produce mortar of uniform quality and with optimum performance characteristics.

1. Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated. Do not use calcium chloride.
2. Mixing: Combine and thoroughly mix cementitious materials, water, and aggregates in a mechanical batch mixer, unless otherwise indicated. Discard mortar when it has reached initial set.
3. Comply with ASTM C270 and ICBO Report #ER-5403 for Type S Mortar.
4. Mortar shall be mixed as follows, with a total mixing time not less than ten (10) minutes.

   a. Place approximately half of required water and sand into mixer while running.
   b. Add cement and remainder of sand and water into mixer in that order and mix for a period of at least two (2) minutes.
   c. Add lime and continue mixing as long as needed to secure a uniform mass.
   d. Colored Pigmented Mortar: Select and proportion pigments with other ingredients to produce color required. Do not exceed pigment-to-cement ratio of 1-to-10, by weight.
   e. Mix proprietary mortar in accordance with Manufacturer’s instructions.

5. Use and place mortar in final position within 2-1/2-hours after mixing.
6. Type S Mortars for general Masonry: Products & Manufacturers: Subject to compliance with requirements, provide products by the following:

   a. *Mac High Absorbent Brick Mortar Polymer Modified (H.A.B. Poly) Type S*, Orco Blended Products, Inc.
   b. or equal, as approved by the Landscape Architect.

7. Veneer Bonding Mortars for Stone Masonry Veneer Assembli): Products & Manufacturers: Subject to compliance with requirements, provide products by the following:

   a. *VBM Poly300*, Orco Blended Products, Inc.
   b. or equal, as approved by the Landscape Architect.

2.3 GROUT MATERIALS

A. Portland Cement: ASTM C150, Type V.

B. Hydrated Lime: ASTM C207, Type S.

C. Aggregate: ASTM C404.

D. Water: Suitable for drinking, clean, and free of harmful amounts of acid, alkalis, salts, or organic materials.

E. Admixtures: When required, use only non-chloride based accelerators. Do not use antifreeze substances.

2.4 GROUT MIXES

A. General:

1. Minimum Compressive Strength: 2,000 PSI.
2. Materials for Grout shall be measured in suitable calibrated devices. After the addition of water, all materials shall be mixed for at least three (3) minutes in a drum type batch mixer. Mixing equipment and procedures shall produce Grout with the uniformity required for concrete by ASTM C94.
3. Colors: Submit Manufacturer's standard color range for selection by Landscape Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

A. NO WORK UNDER THIS SECTION SHALL COMMENCE UNTIL SUBMITTALS UNDER THIS SECTION HAVE BEEN REVIEWED ACCORDINGLY BY THE LANDSCAPE ARCHITECT.

B. Prior to commencing Work under this Section, Contractor shall examine previously installed Work from other trades and verify that such Work is complete and to the point where Work herein may commence properly. Do not proceed with Work until unsatisfactory conditions have been corrected.

C. Contractor shall notify the Landscape Architect, in writing, on the anticipated commencement date and length of duration of the Work installation herein this section.

3.2 INSTALLATION

A. Installation of Masonry Mortaring and Grouting within precast architectural concrete assemblies is specified under and 034513 "Site Precast Architectural Concrete".

B. Installation of Masonry Mortaring and Grouting within stone slab and block assemblies is specified under and 044213 "Stone Slabs, Blocks and Boulders".

C. Installation of Masonry Mortaring and Grouting within stone paving is specified under and 096340 "Site Stone Paving".

END OF SECTION

SECTION 042000

UNIT MASONRY

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Concrete masonry units.
2. Face brick.
3. Embedded flashing.
4. Stone trim units.
5. Installation of cast stone trim units.
6. Mortar and grout.
7. Reinforcing steel, masonry joint reinforcement, ties and anchors.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 047200 - CAST STONE MASONRY for cast stone units.
2. Section 061600 - SHEATHING for gypsum sheathing on cold-formed metal framing.
3. Section 072100 - THERMAL INSULATION for cavity wall insulation.
4. Section 072700 - AIR BARRIERS for membrane air barrier.
5. Section 078440 - FIRE-RESISTIVE JOINT SYSTEMS for fire-resistive joint systems openings in masonry walls and at heads of masonry walls.
6. Section 079200 - JOINT SEALANTS for sealing control and expansion joints in unit masonry.

1.3 SUBMITTALS

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

B. Shop Drawings: For the following:

1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
2. Stone Trim Units: Show sizes, profiles, and locations of each stone trim unit required.
3. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, “Details and Detailing of Concrete Reinforcement.”

C. Samples for Verification: For each type and color of the following:

1. Exposed concrete masonry units.
2. Face brick, in the form of straps of five or more bricks.
3. Pigmented mortar. Make Samples using same sand and mortar ingredients to be used on Project. Label Samples to indicate types and amounts of pigments used.
4. Stone trim.
5. Weep holes/vents.
6. Accessories embedded in masonry.

D. Qualification Data: For testing agency.

E. Material Certificates: Include statements of material properties indicating compliance with requirements including compliance with standards and type designations within standards. Provide for each type and size of the following:

1. Masonry units:

   a. Include material test reports substantiating compliance with requirements.
   b. For bricks, include size-variation data verifying that actual range of sizes falls within specified tolerances.
   c. For exposed brick, include material test report for efflorescence according to ASTM C 67.
   d. For masonry units used in structural masonry, include data and calculations establishing average net-area compressive strength of units.

2. Cementitious materials. Include brand, type, and name of manufacturer.
3. Mortar mixes. Include description of type and proportions of ingredients.
4. Grout mixes. Include description of type and proportions of ingredients.
5. Reinforcing bars.
6. Joint reinforcement.
7. Anchors, ties, and metal accessories.

F. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.

1. Include test reports, per ASTM C 780 for mortar mixes required to comply with property specification.
2. Include test reports, per ASTM C 1019 for grout mixes required to comply with compressive strength requirement.

G. Cold-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with cold-weather requirements.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency qualified according to ASTM C 1093 for testing indicated.

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 a single manufacturer for each cementitious component and from one source or producer for each aggregate.

D. Preconstruction Testing Service: The Owner will engage a qualified independent testing agency to perform preconstruction testing indicated below. Payment for these services will be made by the Owner. Retesting of materials that fail to meet specified requirements shall be done at Contractor's expense.

1. Prism Test: For each type of construction required, per ASTM C 1314.

E. Fire-Resistance Ratings: 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 other means, as acceptable to authorities having jurisdiction.

F. Sample Panels: Build sample panels to verify selections made under sample submittals and to demonstrate aesthetic effects. Comply with requirements in Division 01 for mockups.

1. Build sample panels for typical exterior and interior walls in sizes approximately 48 inches long by 48 inches high by full thickness.
2. Where masonry is to match existing, erect panels adjacent and parallel to existing surface.
3. Clean one-half of exposed faces of panels with masonry cleaner indicated.
4. Protect approved sample panels from the elements with weather-resistant membrane.
5. Approval of sample panels is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; aesthetic qualities of workmanship; and other material and construction qualities specifically approved by Architect in writing.

a. Approval of sample panels does not constitute approval of deviations from the Contract Documents contained in sample panels unless such deviations are specifically approved by Architect in writing.

G. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01. Agenda shall include protection of air barrier membrane during construction.

1.5 DELIVERY, STORAGE, AND HANDLING

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

B. Store 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 preblended, dry mortar mix in moisture-resistant containers designed for lifting and emptying into dispensing silo. Store preblended, dry mortar mix in delivery containers on

elevated platforms, under cover, and in a dry location or in a metal dispensing silo with weatherproof cover.

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

1.6 PROJECT CONDITIONS

A. Protection of Air Barrier Membrane: During construction, protect air barrier membrane from penetrations which allow air to pass through air barrier assemblies. Engage original installer to repair damage promptly using identical materials and methods of installation, and to the satisfaction of the Architect.

B. 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.
2. Where 1 wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe and hold cover in place.

C. 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.

D. 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 coverings on ground and over wall surface.
2. Protect sills, ledges, and projections from mortar droppings.
3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

E. 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.

F. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

PART 2 - PRODUCTS

2.1 MASONRY UNITS, GENERAL

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

2.2 CONCRETE MASONRY UNITS (CMUS)

A. Concrete Masonry Units: ASTM C 90, normal weight unless indicated otherwise manufactured to dimensions 3/8 inch less than nominal dimensions.

B. Shapes: Provide standard shapes indicated and as required for building configuration. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.

C. Decorative Concrete Masonry Units: ASTM C 90.

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2000 psi
2. Weight Classification: Normal weight.
3. Size (Width): Manufactured to dimensions specified in “Concrete Masonry Units” Paragraph above.
4. Pattern and Texture:

    a. Standard pattern, ground finish.

5. Colors: As selected by Architect from manufacturer’s full range.
6. Special Aggregate: Provide units made with aggregate matching aggregate in Architect’s sample.
7. 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. A Jandris & Sons
    b. Trenwyth Industries.
    c. Westbrook Concrete Block Co.

D. Integral Water Repellent: Provide units made with integral water repellent for exterior exposed units.

1. Integral Water Repellent: Liquid polymeric, integral water-repellent admixture that does not reduce flexural bond strength. Units made with integral water repellent, when tested as a wall assembly made with mortar containing integral water-repellent manufacturer’s mortar additive according to ASTM E 514, with test period extended to 24 hours, show no visible water or leaks on the back of test specimen. Available products include:

    a. ACM Chemistries: RainBlock
    b. Addiment Incorporated, a Div. of Grace Construction Products; Block Plus W-10.

c. GCP Applied Technologies (formerly W.R. Grace); Dry-Block.
d. BASF Construction Chemicals; Masterpel.

2.3 BRICK

A. Face Brick: ASTM C 216, Grade SW, Type FBS.

1. Trade Reference and Color: As selected by Architect.
2. Size (Actual Dimensions): As selected by Architect.
3. Initial Rate of Absorption: Less than 30 g/30 sq. in. per minute when tested per ASTM C 67.
4. Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced."
5. Where shown to "match existing," provide face brick matching color range, texture, and size of existing adjacent brickwork.

B. Building (Common) Brick where Concealed: ASTM C 62, Grade SW.

C. General: Provide shapes indicated and as follows:

1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.
2. Provide special shapes for applications where stretcher units cannot accommodate special conditions, including those at corners, movement joints, bond beams, sashes, and lintels.
3. Provide special shapes for applications requiring brick of size, form, color, and texture on exposed surfaces.
4. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.
5. Units which are sawn and less than one-half full size shall not be used.

2.4 STONE TRIM UNITS

A. Granite: Provide granite complying with ASTM C 615 and NBGQA's "Specifications for Architectural Granite" and as follows:

1. Varieties, Cut and Finish: As selected by Architect.

B. Limestone: Provide limestone complying with ASTM C 568 and ILI's "Indiana Limestone Handbook" and as follows:

1. Varieties, Cut and Finish: As selected by Architect.

C. Provide stone units accurately shaped, with exposed faces dressed true, and with beds and joints at right angles to faces.

1. For granite, comply with recommendations in NBGQA's "Specifications for Architectural Granite."
2. For limestone, comply with recommendations in ILI's "Indiana Limestone Handbook."

2.5 MORTAR AND GROUT MATERIALS

A. Regional Materials: Provide aggregate for mortar and grout, cement, and lime that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.

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

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

D. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes. Use only pigments with a record of satisfactory performance in masonry mortar.

1. Available Products:

a. LanXess; Bayferrox Iron Oxide Pigments.
b. Davis Colors; True Tone Mortar Colors.
c. Solomon Grind-Chem Services, Inc.; SGS Mortar Colors.

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

F. Aggregate for Grout: ASTM C 404.

G. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with concrete masonry units, containing integral water repellent by same manufacturer. Available products include:

1. Addiment Incorporated, a Div. of Grace Construction Products; Mortar Tite.
2. GCP Applied Technologies (formerly W.R. Grace); Dry-Block Mortar Admixture.
3. BASF Construction Chemicals; MasterPel Mortar Admixture.

H. Water: Potable.

2.6 REINFORCEMENT

A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60.

B. Masonry Joint Reinforcement, General: ASTM A 951.

1. Interior Walls: Mill-galvanized, carbon steel.
2. Exterior Walls: Hot-dip galvanized, carbon steel.
3. Wire Size and Spacing: As required by Code.
4. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units.

C. Masonry Joint Reinforcement for Multiwythe Masonry:

1. Ladder type with 1 side rod at each face shell of hollow masonry units more than 4 inches in width, plus 1 side rod at each wythe of masonry 4 inches or less in width.

2.7 TIES AND ANCHORS

A. Materials: Provide ties and anchors specified in subsequent paragraphs that are made from materials that comply with subparagraphs below, unless otherwise indicated.

1. Mill-Galvanized, Carbon-Steel Wire: ASTM A 82; with ASTM A 641/A 641M, Class 1 coating.
2. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82; with ASTM A 153/A 153M, Class B-2 coating.
3. Stainless-Steel Wire: ASTM A 580/A 580M, Type 316.
4. Galvanized Steel Sheet: ASTM A 653/A 653M, Commercial Steel, G60 zinc coating.
5. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
6. Stainless Steel Bars: ASTM A 276 or ASTM A 666, Type 304.

B. Adjustable Anchors for Connecting to Structure: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.

1. Anchor Section for Welding to Steel Frame: Crimped 1/4-inch-diameter, hot-dip galvanized steel. Mill-galvanized wire may be used at interior walls, unless otherwise indicated.

C. Partition Top Anchors: 0.097-inch-thick metal plate with 3/8-inch-diameter metal rod 6 inches long welded to plate and with closed-end plastic tube fitted over rod that allows rod to move in and out of tube. Fabricate from steel, hot-dip galvanized after fabrication.

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

E. Adjustable Masonry-Veneer Anchors:

1. General: Provide anchors that allow vertical adjustment but resist tension and compression forces perpendicular to plane of wall, for attachment over sheathing to wood or metal studs, with structural performance capable of withstanding a 100-lbf load in both tension and compression without deforming or developing play in excess of 0.05 inch.
2. Screw-Attached, Masonry-Veneer Anchors: Units equal to HB-213 Adustable Veneer Anchor by Hohmann & Barnard, Inc., consisting of a wire tie and a metal anchor section.

a. Anchor Section: Rib-stiffened, sheet metal plate with 9/32 inch diameter screw holes top and bottom, 2-3/4 inches wide by 3 inches high; with projecting tabs having slotted holes with 1-1/4 inch maximum allowable eccentricity, sized to prevent in-and-out movement beyond allowable tolerances, for inserting vertical legs of wire tie specially formed to fit anchor section.
b. Wire Ties: Rectangular-shaped wire ties fabricated from 0.188-inch-diameter, hot-dip galvanized steel wire.

F. Adjustable Masonry-Veneer Anchors:

1. General: Provide anchors that allow vertical adjustment but resist tension and compression forces perpendicular to plane of wall, for attachment over sheathing to wood or metal studs, with structural performance capable of withstanding a 100-lbf load in both tension and compression without deforming or developing play in excess of 0.05 inch.
2. Screw-Attached, Masonry-Veneer Anchors: Units equal to DW-10-X Veneer Anchoring System by Hohmann & Barnard, consisting of a wire tie and a metal anchor section:

a. Anchor Section: Gasketed sheet metal plate, 1-1/4 inches wide by 6 inches long, with screw holes top and bottom; top and bottom ends bent to form pronged legs of length to match thickness of insulation or sheathing; and raised rib-stiffened strap, 5/8 inch wide by 6 inches long, stamped into center to provide a slot between strap and plate for inserting wire tie. Provide anchor manufacturer's standard, self-adhering, modified bituminous gaskets manufactured to fit behind anchor plate and extend beyond pronged legs.
b. Fabricate sheet metal anchor sections and other sheet metal parts from 0.067-inch-thick, steel sheet, galvanized after fabrication.
c. Wire Ties: Triangular wire ties fabricated from 0.25-inch-diameter, hot-dip galvanized steel wire.

2.8 MISCELLANEOUS ANCHORS

A. Anchor Bolts: L-shaped 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/A 153M, Class C; of dimensions indicated.

2.9 EMBEDDED FLASHING MATERIALS

A. Metal Flashing: Provide metal flashing complying with Section 076200 - SHEET METAL FLASHING AND TRIM and as follows:

1. Stainless Steel: ASTM A 240/A 240M, Type 304, 0.016 inch (0.40 mm) thick.
2. Configuration: Provide continuous flashing including preformed outside, inside corners, and end dams with smooth uninterrupted soldered seams and hemmed edges to maintain continuity. See drawings for profiles required.

B. Solder and Sealants for Sheet Metal Flashings: As specified in Section 076200 – SHEET METAL FLASHING AND TRIM.

C. 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. Verify compatibility between flashing materials and substrates.

D. Transition Strips: Provide long-term compatible 6" wide transition strips to seal embedded flashing terminations to air barrier membrane.

E. Drip Edge: Provide type 316, 0.016 inch (0.40 mm) thick stainless steel drip edge plates with factory applied adhesive strip for all through-wall flashing conditions. Provide preformed outside and inside corner drip plate corners with smooth uninterrupted soldered seams and hemmed drip edges to maintain continuity. Custom sizes will be required see drawings for profiles required.

2.10 MISCELLANEOUS MASONRY ACCESSORIES

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

B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

C. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).

D. Weep/Vent Products: Free-draining mesh; made from polyethylene strands, full height and width of head joint and depth 1/8 inch less than depth of outer wythe; in color selected from manufacturer's standard.

E. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity. Provide 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 or equivalent. Available products:

1. Advanced Building Products Inc.; Mortar Break II.
2. Archovations, Inc.; CavClear Masonry Mat.
3. Hohmann & Barnard; MortarTrap.
4. Mortar Net USA, Ltd.; Mortar Net.

2.11 MASONRY CLEANERS

A. 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. Available Manufacturers:

a. Diedrich Technologies, Inc.
b. EaCo Chem, Inc.
c. ProSoCo, Inc.

2.12 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.

B. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.

1. Type N.

C. Pigmented Mortar: Use colored cement product. Pigments shall not exceed 10 percent of portland cement by weight.

D. Grout for Unit Masonry: Comply with ASTM C 476.

1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 1.15.1 in 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/C 143M.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
2. Verify that foundations are within tolerances specified.

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

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

3.2 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. Do not use units cut to less than one-half size.

E. Do not install concrete masonry units with more than 5 percent damage to the face. Do not install brick units which will show defects after installation.

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

G. Matching Existing Masonry: Match coursing, bonding, color, and texture of existing masonry.

H. 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.

3.3 LAYING MASONRY WALLS

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

B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in bond pattern indicated on Drawings; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs. Prior to installation review bond pattern with Architect.

C. Stopping and Resuming Work: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.

D. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

E. Fill space between steel frames and masonry solidly with mortar, unless otherwise indicated.

F. Fill cores in hollow concrete masonry units with grout 24 inches under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.

G. 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. Fasten partition top anchors to structure above and build into top of partition. Grout cells of CMUs solidly around plastic tubes of anchors and push tubes down into grout to provide 1/2-inch clearance between end of anchor rod and end of tube. Space anchors 48 inches o.c., unless otherwise indicated.

3. 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.
4. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Section 078440 – FIRE-RESISTIVE JOINT SYSTEMS.

3.4 MORTAR BEDDING AND JOINTING

A. Lay hollow brick and 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. Set stone trim units in full bed of mortar with full vertical joints. Fill dowel, anchor, and similar holes.

1. Clean soiled surfaces with fiber brush and soap powder and rinse thoroughly with clear water.
2. Allow cleaned surfaces to dry before setting.

D. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness, unless otherwise indicated.

E. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint), unless otherwise indicated.

3.5 CAVITY WALLS

A. Bond wythes of cavity walls together using one of the following methods:

1. Masonry Joint Reinforcement: Installed in horizontal mortar joints. Where one wythe is of clay masonry and the other of concrete masonry, use adjustable (two-piece) type reinforcement with continuous horizontal wire in facing wythe attached to ties to allow for differential movement regardless of whether bed joints align.
2. Masonry Veneer Anchors: Comply with requirements for anchoring masonry veneers.

B. Bond wythes of cavity walls together using bonding system indicated on Drawings.

C. 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.

D. Coordinate and allow access for air and vapor barrier membrane installed in cavity under Section 072700 - AIR BARRIERS.

3.6 MASONRY JOINT REINFORCEMENT

A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches. Space reinforcement not more than 16 inches o.c.

B. Interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.

C. Provide continuity at wall intersections by using prefabricated T-shaped units.

D. Provide continuity at corners by using prefabricated L-shaped units.

3.7 ANCHORING MASONRY TO STRUCTURAL MEMBERS

A. Anchor masonry to structural members where masonry abuts or faces structural members to comply with the following:

1. Provide an open space not less than 1 inch in width between masonry and structural member, unless otherwise indicated. Keep open space free of mortar and other rigid materials.
2. Anchor masonry to structural members with anchors embedded in masonry joints and attached to structure.
3. Space anchors as indicated, but not more than 24 inches o.c. vertically and 36 inches o.c. horizontally.

3.8 ANCHORING MASONRY VENEERS

A. Anchor masonry veneers with masonry-veneer anchors to comply with the following requirements:

1. Fasten screw-attached anchors through insulation and sheathing to wall framing and to concrete and masonry backup as applicable with metal fasteners of type indicated.
2. Embed tie sections in masonry joints. Provide air space indicated on the Drawings between back of masonry veneer and face of insulation.
3. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
4. Space anchors as required by Code.

3.9 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 using one of the following methods:

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.
2. Install preformed control-joint gaskets designed to fit standard sash block.
3. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar or rake out joint for application of sealant.

4. Install temporary foam-plastic filler in head joints and remove filler when unit masonry is complete for application of sealant.

C. Form expansion joints in brick made from clay or shale as follows:

1. Build flanges of metal expansion strips into masonry. Lap each joint 4 inches in direction of water flow. Seal joints below grade and at junctures with horizontal expansion joints if any.
2. Build flanges of factory-fabricated, expansion-joint units into masonry.
3. Build in compressible joint fillers where indicated.
4. 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 Section 079200 - JOINT SEALANTS.

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 Section 079200 - JOINT SEALANTS but not less than 3/8 inch.

1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.

3.10 LINTELS

A. Install steel lintels where indicated.

B. Provide minimum bearing of 8 inches at each jamb, unless otherwise indicated.

3.11 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.

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 multiwythe masonry walls, including cavity walls, extend flashing through outer wythe, turned up a minimum of 8 inches, and 1-1/2 inches into the inner wythe. Form 1/4-inch hook in edge of flashing embedded in inner wythe.
3. At masonry-veneer walls, extend flashing through veneer, across air space behind veneer, and up face of sheathing at least 8 inches; with upper edge covered with elastomeric membrane, lapping at least 4 inches.
4. 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.
5. Install air barrier transition strips to seal embedded flashings in masonry to air barrier membrane in accordance with Section 072700 – AIR BARRIERS.

C. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.

D. Install metal drip edge plate in accordance with architectural details and manufacturer's requirements.

E. 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.

F. Place cavity drainage material in cavities to comply with configuration requirements for cavity drainage material in Part 2 "Miscellaneous Masonry Accessories" Article.

G. Install vents in head joints in exterior wythes at spacing indicated.

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. 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.

3.13 FIELD QUALITY CONTROL

A. Inspectors: Owner will engage qualified independent inspectors to perform inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform inspections. Place grout only after inspectors have verified compliance of grout spaces and grades, sizes, and locations of reinforcement.

B. Testing Agency: Engage a qualified independent testing and inspecting agency to perform field tests and inspections indicated below and prepare test reports. Retesting of materials failing to comply with specified requirements shall be done at Contractor's expense.

C. Testing Frequency: One set of tests for each 5000 sq. ft. of wall area or portion thereof. Test types as determined by the independent testing and inspection agency.

3.14 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, around penetrations and 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 stone and 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 concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.
6. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
7. Clean stone trim to comply with stone supplier's written instructions.

3.15 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 31 - 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 the Site.

END OF SECTION

SECTION 042200

CONCRETE MASONRY UNITS

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. Concrete masonry units.
2. Decorative concrete masonry units.
3. Pre-faced concrete masonry units.
4. Mortar and grout.
5. Steel reinforcing bars.
6. Masonry joint reinforcement.
7. Ties and anchors.
8. Embedded flashing.
9. Miscellaneous masonry accessories.
10. Masonry-cell insulation.

B. Related Sections:

1. Section 033000 "Cast-in-Place Concrete" for dovetail slots for masonry anchors.
2. Section 051200 "Structural Steel Framing" for installing anchor sections of adjustable masonry anchors for connecting to structural-steel frame.
3. Refer to other Architectural Sections for water repellents applied to concrete unit masonry, sheet metal flashing and trim, reglets for masonry joints, and unit paving for exterior concrete unit masonry paving.

1.3 DEFINITIONS

A. CMU(s): Concrete masonry unit(s).

B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.4 PERFORMANCE REQUIREMENTS

A. Provide unit masonry that develops indicated net-area compressive strengths at 28 days.

1. Determine net-area compressive strength of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.
2. Determine net-area compressive strength of masonry by testing masonry prisms according to ASTM C 1314.

1.5 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Owner will engage a qualified independent testing agency to perform preconstruction testing indicated below. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.

1. Concrete Masonry Unit Test: For each type of unit required, according to ASTM C 140 for compressive strength.
2. Mortar Test (Property Specification): For each mix required, according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91 for air content.
3. Mortar Test (Property Specification): For each mix required, according to ASTM C 780 for compressive strength.
4. Grout Test (Compressive Strength): For each mix required, according to ASTM C 1019.
5. Prism Test: For each type of construction required, according to ASTM C 1314.

1.6 ACTION SUBMITTALS

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

B. LEED Submittals:

1. Product Certificates for Credit MR 5: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

C. Shop Drawings: For the following:

1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
2. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement."
3. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.

D. Samples for Initial Selection:

1. Decorative CMUs, in the form of small-scale units.
2. Pre-faced CMUs.
3. Colored mortar.
4. Weep holes/vents.

E. Samples for Verification: For each type and color of the following:

1. Exposed & Decorative CMUs.
2. Pre-faced CMUs.
3. Pigmented and colored-aggregate mortar. Make Samples using same sand and mortar ingredients to be used on Project.
4. Accessories embedded in masonry.

1.7 INFORMATIONAL SUBMITTALS

A. List of Materials Used in Constructing Mockups: List generic product names together with manufacturers, manufacturers' product names, model numbers, lot numbers, batch numbers, source of supply, and other information as required to identify materials used. Include mix proportions for mortar and grout and source of aggregates.

1. Submittal is for information only. Neither receipt of list nor approval of mockup constitutes approval of deviations from the Contract Documents unless such deviations are specifically brought to the attention of Architect and approved in writing.

B. Qualification Data: For testing agency.

C. Material Certificates: For each type and size of the following:

1. Masonry units.

a. Include data on material properties.
b. For masonry units used in structural masonry, include data and calculations establishing average net-area compressive strength of units.

2. Cementitious materials. Include brand, type, and name of manufacturer.
3. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
4. Grout mixes. Include description of type and proportions of ingredients.
5. Reinforcing bars.
6. Joint reinforcement.
7. Anchors, ties, and metal accessories.

D. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.

1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91 for air content.
2. Include test reports, according to ASTM C 1019, for grout mixes required to comply with compressive strength requirement.

E. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.

F. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.8 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM C 1093 for testing indicated.

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, from single source from 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 single manufacturer for each cementitious component and from single source or producer for each aggregate.

D. Masonry Standard: Comply with ACI 530.1/ASCE 6/TMS 602 unless modified by requirements in the Contract Documents.

E. Sample Panels: Build sample panels to verify selections made under sample submittals and to demonstrate aesthetic effects. Comply with requirements in Section 014000 "Quality Requirements" for mockups.

1. Build sample panels for typical exterior wall in sizes approximately 48 inches (1200 mm) long by 36 inches (900 mm) high by full thickness.
2. Where masonry is to match existing, erect panels adjacent and parallel to existing surface.
3. Protect approved sample panels from the elements with weather-resistant membrane.
4. Approval of sample panels is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; aesthetic qualities of workmanship; and other material and construction qualities specifically approved by Architect in writing.

    a. Approval of sample panels does not constitute approval of deviations from the Contract Documents contained in sample panels unless such deviations are specifically approved by Architect in writing.

F. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockup of typical wall area as shown on Drawings.
2. Build mockups for typical exterior wall in sizes approximately 48 inches (1200 mm) long by 36 inches (900 mm) high by full thickness, including face and backup wythes and accessories.

    a. Include a sealant-filled joint at least 16 inches (400 mm) long in each mockup.
    b. Include lower corner of window opening at upper corner of exterior wall mockup. Make opening approximately 12 inches (300 mm) wide by 16 inches (400 mm) high.
    c. Include through-wall flashing installed for a 24-inch (600-mm) length in corner of exterior wall mockup approximately 16 inches (400 mm) down from top of mockup, with a 12-inch (300-mm) length of flashing left exposed to view (omit masonry above half of flashing).

3. Protect accepted mockups from the elements with weather-resistant membrane.
4. 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.

5. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

G. Preinstallation Conference: Conduct conference at Project site to comply with Architectural requirements in plans and specifications.

1.9 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 preblended, dry mortar mix in moisture-resistant containers designed for use with dispensing silos. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in covered weatherproof dispensing silos.

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

1.10 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 (600 mm) down both sides of walls 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 three 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 coverings on ground and over wall surface.
2. Protect sills, ledges, and projections from mortar droppings.
3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

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 (4 deg C) and higher and will remain so until masonry has dried, but not less than 7 days after completing cleaning.

E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

PART 2 - PRODUCTS

2.1 MASONRY UNITS, GENERAL

A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects will be exposed in the completed Work.

B. Fire-Resistance Ratings: Where indicated, provide units that comply with requirements for fire-resistance ratings indicated as determined by testing according to ASTM E 119, by equivalent masonry thickness, or by other means, as acceptable to authorities having jurisdiction.

2.2 CONCRETE MASONRY UNITS

A. Regional Materials: CMUs shall be manufactured within 500 miles (800 km) of Project site from aggregates and cement that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles (800 km) of Project site.

B. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.

1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
2. Provide square-edged units for outside corners unless otherwise indicated.

C. Integral Water Repellent: Provide units made with integral water repellent where indicated.

1. Integral Water Repellent: Liquid polymeric, integral water-repellent admixture that does not reduce flexural bond strength. Units made with integral water repellent, when tested according to ASTM E 514 as a wall assembly made with mortar containing integral water-repellent manufacturer's mortar additive, with test period extended to 24 hours, shall show no visible water or leaks on the back of test specimen.

a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

1) ACM Chemistries, Inc.; RainBloc.
2) BASF Aktiengesellschaft; Rheopel Plus.
3) Grace Construction Products, W. R. Grace & Co. - Conn.; Dry-Block.

D. CMUs: ASTM C 90.

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 1900 psi.
2. Density Classification: Normal weight unless otherwise indicated.
3. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.
4. Exposed Faces: Provide color and texture matching the range represented by Architect's sample.
5. Faces to Receive Plaster: Where units are indicated to receive a direct application of plaster, provide textured-face units made with gap-graded aggregates.

E. Concrete Building Brick: ASTM C 55.

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 4050 psi (27.92 MPa).
2. Density Classification: Normal weight.
3. Size (Actual Dimensions): 3-5/8 inches (92 mm) wide by high by 7-5/8 inches (194 mm) long unless noted otherwise.

F. Decorative CMUs: ASTM C 90.

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

a.Featherlite or equal.

2. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 1900 psi.
3. Density Classification: Normal weight.
4. Size (Width): Manufactured to dimensions specified in "CMUs" Paragraph.
5. Pattern and Texture: by Architect.
6. Colors: As selected by Architect from manufacturer's full range.
7. Special Aggregate: Provide units made with aggregate matching aggregate in Architect's sample.

G. Pre-faced CMUs: Lightweight hollow concrete units complying with ASTM C 90, with manufacturer's standard smooth resinous facing complying with ASTM C 744.

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

   a.Featherlite or equal.

2. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 1900 psi.
3. Size: Manufactured to dimensions specified in "CMUs" Paragraph, but with pre-faced surfaces having 1/16-inch- (1.5-mm-) wide returns of facing to create 1/4-inch- (6.5-mm-) wide mortar joints with modular coursing.
4. Colors and Patterns: As selected by Architect from manufacturer's full range.

2.3 MASONRY LINTELS

A. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam CMUs 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.

2.4 MORTAR AND GROUT MATERIALS

A. Regional Materials: Aggregate for mortar and grout, cement, and lime shall be extracted, harvested, or recovered, as well as manufactured, within 500 miles (800 km) of Project site.

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

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

D. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.

E. Masonry Cement: ASTM C 91.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   a. Lehigh Cement Company; Lehigh Masonry Cement or equal.

F. Mortar Cement: ASTM C 1329.

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

   a. Lafarge North America Inc.; Lafarge Mortar Cement or equal.

G. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C 979. Use only pigments with a record of satisfactory performance in masonry mortar.

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

   a. Davis Colors; True Tone Mortar Colors or equal.
   b. Lanxess Corporation; Bayferrox Iron Oxide Pigments or equal.
   c. Solomon Colors, Inc.; SGS Mortar Colors or equal.

H. Colored Cement Product: Packaged blend made from portland cement and hydrated lime masonry cement or mortar cement and mortar pigments, all complying with specified requirements, and containing no other ingredients.

1. Colored Portland Cement-Lime Mix:

a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

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

2. Colored Masonry Cement:

a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

1) Capital Materials Corporation; Flamingo Color Masonry Cement.
2) Cemex S.A.B. de C.V.; Richcolor Masonry Cement.
3) Essroc, Italcementi Group; Brixment-in-Color.
4) Holcim (US) Inc.; Rainbow Mortamix Custom Color Masonry Cement.
5) Lafarge North America Inc.; U.S. Cement Custom Color Masonry Cement.
6) Lehigh Cement Company; Lehigh Custom Color Masonry Cement.
7) National Cement Company, Inc.; Coosa Masonry Cement.

3. Formulate blend as required to produce color indicated or, if not indicated, as selected from manufacturer's standard colors.
4. Pigments shall not exceed 10 percent of portland cement by weight.
5. Pigments shall not exceed 5 percent of masonry cement or mortar cement by weight.

I. Aggregate for Mortar: ASTM C 144.

1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
2. For joints less than 1/4 inch (6 mm) thick, use aggregate graded with 100 percent passing the No. 16 (1.18-mm) sieve.
3. White-Mortar Aggregates: Natural white sand or crushed white stone.
4. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.

J. Aggregate for Grout: ASTM C 404.

K. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.

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

a. Euclid Chemical Company (The); Accelguard 80.
b. Grace Construction Products, W. R. Grace & Co. - Conn.; Morset.
c. Sonneborn Products, BASF Aktiengesellschaft; Trimix-NCA.

L. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with CMUs, containing integral water repellent by same manufacturer.

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

a. ACM Chemistries, Inc.; RainBloc for Mortar.
b. BASF Aktiengesellschaft; Rheopel Mortar Admixture.
c. Grace Construction Products, W. R. Grace & Co. - Conn.; Dry-Block Mortar Admixture.

M. Water: Potable.

2.5 REINFORCEMENT

A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60 .

B. Masonry Joint Reinforcement, General: ASTM A 951/A 951M.

1. Interior Walls: Hot-dip galvanized, carbon steel.
2. Exterior Walls: Hot-dip galvanized, carbon steel.
3. Wire Size for Side Rods: 0.148-inch (3.77-mm) diameter.
4. Wire Size for Cross Rods: 0.148-inch (3.77-mm) diameter.
5. Wire Size for Veneer Ties: 0.148-inch (3.77-mm) diameter.
6. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches (407 mm) o.c.
7. Provide in lengths of not less than 10 feet (3 m), with prefabricated corner and tee units.

C. Masonry Joint Reinforcement for Single-Wythe Masonry: Either ladder or truss type with single pair of side rods.

2.6 TIES AND ANCHORS

A. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated.

1. Mill-Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M; with ASTM A 641/A 641M, Class 1 coating.
2. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M; with ASTM A 153/A 153M, Class B-2 coating.
3. Stainless-Steel Wire: ASTM A 580/A 580M, Type 304.
4. Galvanized Steel Sheet: ASTM A 653/A 653M, Commercial Steel, G60 (Z180) zinc coating.
5. Steel Sheet, Galvanized after Fabrication: ASTM A 1008/A 1008M, Commercial Steel, with ASTM A 153/A 153M, Class B coating.
6. Stainless-Steel Sheet: ASTM A 666, Type 304.
7. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
8. Stainless-Steel Bars: ASTM A 276 or ASTM A 666, Type 304.

B. Adjustable Anchors for Connecting to Structural Steel Framing: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.

1. Anchor Section for Welding to Steel Frame: Crimped 1/4-inch- (6.35-mm-) diameter, hot-dip galvanized steel wire.
2. Tie Section: Triangular-shaped wire tie, sized to extend within 1 inch (25 mm) of masonry face, made from 0.187-inch- (4.76-mm-) diameter, hot-dip galvanized steel wire.

C. Adjustable Anchors for Connecting to Concrete: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.

1. Connector Section: Dovetail tabs for inserting into dovetail slots in concrete and attached to tie section; formed from 0.060-inch- (1.52-mm-) thick, steel sheet, galvanized after fabrication.

a. 0.064-inch- (1.63-mm-) thick, galvanized sheet may be used at interior walls unless otherwise indicated.

2. Tie Section: Triangular-shaped wire tie, sized to extend within 1 inch (25 mm) of masonry face, made from 0.187-inch- (4.76-mm-) diameter, hot-dip galvanized steel wire.
3. Corrugated Metal Ties: Metal strips not less than 7/8 inch (22 mm) wide with corrugations having a wavelength of 0.3 to 0.5 inch (7.6 to 12.7 mm) and an amplitude of 0.06 to 0.10 inch (1.5 to 2.5 mm) made from 0.060-inch- (1.52-mm-) thick, steel sheet, galvanized after fabrication with dovetail tabs for inserting into dovetail slots in concrete and sized to extend to within 1 inch (25 mm) of masonry face.

    a. 0.064-inch- (1.63-mm-) thick, galvanized sheet may be used at interior walls unless otherwise indicated.

D. Partition Top anchors: 0.105-inch- (2.66-mm-) thick metal plate with 3/8-inch- (9.5-mm-) diameter metal rod 6 inches (152 mm) long welded to plate and with closed-end plastic tube fitted over rod that allows rod to move in and out of tube. Fabricate from steel, hot-dip galvanized after fabrication.

E. Rigid Anchors: Fabricate from steel bars 1-1/2 inches (38 mm) wide by 1/4 inch (6.35 mm) thick by 24 inches (610 mm) long, with ends turned up 2 inches (51 mm) or with cross pins unless otherwise indicated.

1. Corrosion Protection: Hot-dip galvanized to comply with ASTM A 153/A 153M.

2.7 MISCELLANEOUS ANCHORS

A. Unit Type Inserts in Concrete: Cast-iron or malleable-iron wedge-type inserts.

B. Dovetail Slots in Concrete: Furnish dovetail slots with filler strips, of slot size indicated, fabricated from 0.034-inch (0.86-mm), galvanized steel sheet.

C. Anchor Bolts: L-shaped steel bolts complying with ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153/A 153M, Class C; of dimensions indicated.

D. Postinstalled Anchors: Torque-controlled expansion anchors.

1. Load Capacity: Capable of sustaining, 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.
2. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5 unless otherwise indicated.
3. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 (A1) stainless-steel bolts, ASTM F 593 (ASTM F 738M), and nuts, ASTM F 594 (ASTM F 836M).

2.8 EMBEDDED FLASHING MATERIALS

A. Flashing: Reference Architectural specifications for all flashing manufacturers and flashing installation proceedures.

2.9 MISCELLANEOUS MASONRY ACCESSORIES

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

B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 or PVC, complying with ASTM D 2287, Type PVC-65406 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

C. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).

D. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and hold reinforcing bars in center of cells. Units are formed from 0.148-inch (3.77-mm) steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.

1. Products: Subject to compliance with requirements, available products 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.

2.10 MASONRY-CELL INSULATION

A. Reference Architectural specifications.

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. Use masonry cement or mortar unless otherwise indicated.
3. For exterior masonry, use masonry cement or mortar.
4. For reinforced masonry, use portland cement-lime or masonry cement.
5. 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. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.

1. For masonry below grade or in contact with earth, use Type S.
2. For reinforced masonry, use Type S.
3. For mortar parge coats, use Type S.
4. For interior non-load-bearing partitions, use Type N.

D. Pigmented Mortar: Use colored cement product or select and proportion pigments with other ingredients to produce color required. Do not add pigments to colored cement products.

1. Pigments shall not exceed 10 percent of portland cement by weight.
2. Pigments shall not exceed 5 percent of masonry cement by weight.
3. Mix to match Architect's sample.
4. Application: Use pigmented mortar for exposed mortar joints with the following units:

a. Decorative CMUs.
b. Pre-faced CMUs.
c. Concrete facing brick.
d. Cast stone trim units.

E. Colored-Aggregate Mortar: Produce required mortar color by using colored aggregates and natural color or white cement as necessary to produce required mortar color.

1. Mix to match Architect's sample.
2. Application: Use colored aggregate mortar for exposed mortar joints with the following units:

a. Decorative CMUs.
b. Pre-faced CMUs.
c. Concrete facing brick.
d. Cast stone trim units.

F. Grout for Unit Masonry: Comply with ASTM C 476.

1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 1.15.1 in ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.
2. Proportion grout in accordance with ASTM C 476, paragraph 4.2.2 for specified 28-day compressive strength indicated, but not less than 2000 psi (14 MPa).
3. Provide grout with a slump of 8 to 11 inches (203 to 279 mm) as measured according to ASTM C 143/C 143M.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
2. Verify that foundations are within tolerances specified.
3. Verify that reinforcing dowels are properly placed.

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

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

3.2 INSTALLATION, GENERAL

A. Build chases and recesses to accommodate items specified in this and other Sections.

B. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.

C. 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.

3.3 TOLERANCES

A. Dimensions and Locations of Elements:

1. For dimensions in cross section or elevation do not vary by more than plus 1/2 inch (12 mm) or minus 1/4 inch (6 mm).

2. For location of elements in plan do not vary from that indicated by more than plus or minus 1/2 inch (12 mm).
3. For location of elements in elevation do not vary from that indicated by more than plus or minus 1/4 inch (6 mm) in a story height or 1/2 inch (12 mm) total.

B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls do not vary from level by more than 1/4 inch in 10 feet (6 mm in 3 m), or 1/2 inch (12 mm) maximum.
2. 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 (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2 inch (12 mm) maximum.
3. For vertical lines and surfaces do not vary from plumb by more than 1/4 inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (9 mm in 6 m), or 1/2 inch (12 mm) maximum.
4. 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 (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2 inch (12 mm) maximum.
5. For lines and surfaces do not vary from straight by more than 1/4 inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (9 mm in 6 m), or 1/2 inch (12 mm) maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet (6 mm in 3 m), or 1/2 inch (12 mm) maximum.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm), with a maximum thickness limited to 1/2 inch (12 mm).
2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch (3 mm).
3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch (9 mm) or minus 1/4 inch (6 mm).
4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm).

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 (100-mm) horizontal face dimensions at corners or jambs.

C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 4-inches (100-mm). Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch (100-mm) 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 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. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

G. 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.

H. Fill cores in hollow CMUs with grout 24 inches (600 mm) under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

I. 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. Fasten partition top anchors to structure above and build into top of partition. Grout cells of CMUs solidly around plastic tubes of anchors and push tubes down into grout to provide 1/2-inch (13-mm) clearance between end of anchor rod and end of tube. Space anchors 48 inches (1200 mm) o.c. unless otherwise indicated.
3. 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.
4. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Section 078446 "Fire-Resistive Joint Systems."

3.5 MORTAR BEDDING AND JOINTING

A. Lay hollow CMUs 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. Set cast-stone trim units in full bed of mortar with full vertical joints. Fill dowel, anchor, and similar holes.

1. Clean soiled surfaces with fiber brush and soap powder and rinse thoroughly with clear water.
2. Allow cleaned surfaces to dry before setting.
3. Wet joint surfaces thoroughly before applying mortar.

D. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

E. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.

3.6 MASONRY JOINT REINFORCEMENT

A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch (16 mm) on exterior side of walls, 1/2 inch (13 mm) elsewhere. Lap reinforcement a minimum of 6 inches (150 mm).

1. Space reinforcement not more than 16 inches (406 mm) o.c.
2. Space reinforcement not more than 8 inches (203 mm) o.c. in foundation walls and parapet walls.
3. Provide reinforcement not more than 8 inches (203 mm) above and below wall openings and extending 12 inches (305 mm) beyond openings in addition to continuous reinforcement.

B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.

C. Provide continuity at wall intersections by using prefabricated T-shaped units.

D. Provide continuity at corners by using prefabricated L-shaped units.

E. Cut and bend reinforcing units as directed by manufacturer for continuity at corners, returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.7 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE

A. Anchor masonry to structural steel and concrete where masonry abuts or faces structural steel or concrete to comply with the following:

1. Provide an open space not less than 1/2 inch (13 mm) wide between masonry and structural steel or concrete unless otherwise indicated. Keep open space free of mortar and other rigid materials.
2. Anchor masonry with anchors embedded in masonry joints and attached to structure.
3. Space anchors as indicated, but not more than 24 inches (610 mm) o.c. vertically and 36 inches (915 mm) o.c. horizontally.

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 using one of the following methods:

1. Fit bond-breaker strips into hollow contour in ends of CMUs on one side of control joint. Fill resultant core with grout and rake out joints in exposed faces for application of sealant.
2. Install preformed control-joint gaskets designed to fit standard sash block.
3. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar or rake out joint for application of sealant.
4. Install temporary foam-plastic filler in head joints and remove filler when unit masonry is complete for application of sealant.

3.9 LINTELS

A. Provide masonry lintels where shown and where openings of more than 12 inches (305 mm) for brick-size units and 24 inches (610 mm) for block-size units are shown without structural steel or other supporting lintels.

B. Provide minimum bearing of 8 inches (200 mm) at each jamb unless otherwise indicated.

3.10 FLASHING

A. General: Install embedded flashing in masonry at lintels, ledges, other obstructions to downward flow of water in wall, and where indicated. Reference architectural specifications for installation instructions.

B. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.

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 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 (1520 mm).

3.12 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform tests and inspections. Retesting of materials that fail to meet specified requirements shall be done at Contractor's expense.

B. Inspections: Level 1 special inspections according to the "International Building Code."

1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
3. Place grout only after inspectors have verified proportions of site-prepared grout.

C. Testing Prior to Construction: One set of tests.

D. Testing Frequency: One set of tests for each 5000 sq. ft. (464 sq. m) of wall area or portion thereof.

E. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C 140 for compressive strength.

F. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C 780.

G. Mortar Test (Property Specification): For each mix provided, according to ASTM C 780. Test mortar for mortar air content and compressive strength.

H. Grout Test (Compressive Strength): For each mix provided, according to ASTM C 1019.

I. Prism Test: For each type of construction provided, according to ASTM C 1314 at 7 days and at 28 days.

3.13 PARGING

A. Parge exterior faces of below-grade masonry walls, where indicated, in 2 uniform coats to a total thickness of 3/4 inch (19 mm). Dampen wall before applying first coat and scarify first coat to ensure full bond to subsequent coat.

B. Use a steel-trowel finish to produce a smooth, flat, dense surface with a maximum surface variation of 1/8 inch per foot (3 mm per 300 mm). Form a wash at top of parging and a cove at bottom.

C. Damp-cure parging for at least 24 hours and protect parging until cured.

3.14 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 stone and 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 concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.

3.15 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 (100 mm) 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 Section 312000 "Earth Moving."
3. Do not dispose of masonry waste as fill within 18 inches (450 mm) 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.

END OF SECTION 042200

SECTION 044213

STONE SLABS, BLOCKS AND BOULDERS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes materials, labor, apparatus, tools, equipment, temporary construction, transportation, and services necessary for and incidental to performing the proper completion of Work as required to make a complete Site Stone Slabs, Blocks and Boulder Installations, as shown on the Contract Drawings, and as specified herein this Section.

B. Work under this Section consists of, but is not necessarily limited to, furnishing and installing the following:

1. Stone material selection (field, quarry or stone yard).
2. Stone fabrication and finishing.
3. Layout, alignment and elevation establishment.
4. Machine placement of stone.
5. Hand placement of stone.

C. Related Sections:

1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
2. Section 040513 “Site Masonry Mortaring and Grouting”.
3. Section 055013 “Site Miscellaneous Metal Fabrications”.
4. Section 321323 “Cast in Place Concrete for Landscape Elements”.
5. Section 312219 "Landscape Fine Grading".

1.2 SUBMITTALS:

A. General: Refer to Division 01 for project submittal requirements and timelines. If provided in hardcopy submittal booklets submit each item in this Article in required copies with four (4) copies for review by Landscape Architect. Three (3) copies shall be returned (One for Client, one for Owner and one for Contractor) and one copy maintained by Landscape Architect. Provide one (1) sets of Material Samples for review by the Landscape Architect unless requested otherwise.

B. Submittal Booklets: Each Submittal Booklet under this Section shall be tabbed into specific sections, containing clearly identified (through yellow highlighter or other specific identification methods) and legible information on the following information indicated in this Article.

C. Electronic Submittals: Electronic Submittal shall be provided in a single bound file, PDF format preferred, unless otherwise noted in Division 01.

D. Stone Samples for Verification: Sets for each color, grade, finish, and variety of stone required; not less than 12 inches square. Include two (2) or more samples in each set showing the full range of variations in appearance characteristics expected in completed Work.

E. Forms: Submit data with complete illustrations and/or descriptions for the following:

1. Stone: Source, color, and general character and sizes.
2. Shop Drawings: Provide Plan, Elevation and Sections as needed to convey actual sizes of each type, finish or size of each material specified on a scaled, legible drawing of minimum 8.5” x 11” size per drawing.
3. Field Selection: Field Selection of actual stones will not occur until submittals obtain approvals.

1.3 QUALITY ASSURANCE AND CONTROL

A. Contractor shall have a minimum of ten (10) years similar successful rockwork installation and stone project experience.

B. Supplier shall be capable of supplying stone in the quantities and sizes shown and quarried from a single area of quarry such that all stone for any use shall match each other.

C. Filed Selection shall occur upon approval of submittals and selected products will be photographed noting existing conditions prior to loading, haul off or excavation/extraction.

D. MOCKUPS

1. Provide only for Limestone Ribbon Wall System as described in Contract Drawings or at min 0ne (1) full size unit of wall system with finishes required on all sides to receive finishes.
2. Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
3. Build mockups of oversized stone walls demonstrating typical joints, texture, color, and standard of workmanship.
4. Locate mockups in the locations indicated, or if not indicated, as directed by Landscape Architect or General Contractor
5. Notify Landscape Architect 7 days in advance of the dates and times when mockups will be constructed.
6. Mockup shall include the various wall depth conditions in a minimum 15’ wide by 5’ high mockup.
7. Maintain mockups during construction in an undisturbed condition as a standard for judging completed work.

    a. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups un less Landscape Architect specifically approves such deviations.
    b. Approved mockups may become part of the completed work if undisturbed at time of substantial completion.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING: Store materials well protected from inclement weather, and admixture of foreign material.

PART 2 - PRODUCTS

2.1 STONE SLABS AND BLOCKS:

A. Stone shall be comprised from natural stone blocks or slabs to match character, shape, size and finishes as noted on contract documents.

1. Neither breadth nor thickness of any piece shall be less than one-third (1/3) its length. Gradations as hereinafter designated shall govern the on-site distribution.

2. Stones shall be free from soil, organic matter and each load shall be reasonably graded from the smallest to the largest size specified. Stones smaller than the smallest size specified shall not exceed the amount of the smallest size of each load.
3. Control of gradation will be visual inspection. The Owner reserves the right of rejection based upon approved samples.
4. Refer to drawings for stone sizes, shapes, finishes and quantities.

2.2 STONE: GENERAL

A. Reference Contract Drawings for stone size, finish, layout and jointing, and material schedules.

B. Provide stone that is free of cracks, seams, and starts impairing structural integrity or function.

C. Provide stone from a single quarry for each variety of stone required.

1. Provide matched blocks extracted from contiguous locations in a single bed of quarry stratum unless stone from blocks randomly selected for aesthetic effect is approved by Architect.

D. Quarry stone in a manner to ensure as-quarried block orientations yield finished stone with required characteristics.

2.3 STONE FABRICATION:

A. General: Shop fabricate stone slabs, blocks and boulders (if required) in sizes and shapes required to comply with requirements indicated, including details on Contract Drawings and Shop Drawings.

2.4 STONE BASE FOUNDATION:

A. Concrete Sub-Slab Conditions: Per Section 321313 “Landscape Architectural Cement Concrete Paving” or 321323 “Cast-In Place Concrete for Landscape Elements” and details in the Contract Documents.

B. Compacted Aggregate Sub-Base Conditions: Texas Department of Transportation specification: TXDOT Flex Base #247, Grade B, Type 2 Base Material. Compact to 95% density.

2.5 STONE SUB-DRAINAGE: Refer to Section 334300 "Landscape Drainage".

2.6 STONE SEALANT

A. Penetrating Sealant:

1. General: Penetrating Sealant shall be an invisible, water-based Penetrating Sealant, used to protect exterior Unit Paving installations. Sealant shall be a clear, non-flammable, UV-stabilized, non-yellowing solution which cures to reduce staining, soiling, discoloration, efflorescence, and acts as a invisible water-repellant coating, formulated to impart water repellence and dirt reduction to Unit Paving surfaces with no change in the surface appearance. Sealant shall react with carbon dioxide, and atmospheric moisture to form a penetrating water, dirt and mildew repellent barrier within 24 hours. Moisture absorption rate shall be low to reduce visible surface changes for up to ten (10) years.
2. Products & Manufacturers: Subject to compliance with requirements, provide products by one (1) of the following:

a. SLX100, Prosoco, Inc.

b. or equal, as approved by the Landscape Architect.

3. Provide sealer mock-up for final sealer approval on all colors of selected stone prior to installation.

PART 3 - EXECUTION

3.1 EXAMINATION

A. NO WORK UNDER THIS SECTION SHALL COMMENCE UNTIL SUBMITTALS UNDER THIS SECTION HAVE BEEN REVIEWED ACCORDINGLY BY THE LANDSCAPE ARCHITECT.

B. Prior to commencing Work under this Section, Contractor shall examine previously installed Work from other trades and verify that such Work is complete and to the point where Work herein may commence properly. Do not proceed with Work until unsatisfactory conditions have been corrected.

C. Contractor shall notify the Landscape Architect, in writing, on the anticipated commencement date and length of duration of the Work installation herein this section.

3.2 LAYOUT: Layout all areas on approved rough grade for limits of stone installation. Proceed no further without approval of the Landscape Architect.

3.3 PREPARATION

A. Vacuum clean concrete substrates to remove dirt, dust, debris, and loose particles.

B. Remove substances from concrete substrates that could impair mortar bond, including curing and sealing compounds, form oil, and laitance.

C. Clean stone surfaces that have become dirty or stained by removing soil, stains, and foreign materials before setting. Clean stone by thoroughly scrubbing with fiber brushes and then drenching with clear water. Use only mild cleaning compounds that contain no caustic or harsh materials or abrasives.

3.4 INSTALLATION TOLERANCES

A. Variation in Line: For position shown in plan for edges of paving and ramps, steps, changes in color or finish, and continuous joint lines, do not exceed 1/8 inch in 96 inches, 1/4 inch in 20 feet, or 3/8 inch maximum.

B. Variation in Surface Plane of Flooring: Do not exceed 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 3/8 inch maximum from level or slope indicated.

C. Variation in Joint Width: Do not vary joint thickness more than 1/16 inch or one-fourth of the nominal joint width, whichever is less.

D. Variation in Plane between Adjacent Units (Lipping): Do not exceed 1/32-inch difference between planes of adjacent units.

3.5 INSTALLING STONE WITH MORTAR BED

A. Saturate concrete with clean water several hours before placing any setting bed. Remove surface water about one hour before placing setting bed.

B. Apply cement-paste slush coat over surface of concrete about 15 minutes before placing setting bed. Limit area of slush coat to avoid its drying out before placing setting bed. Do not exceed 1/16-inch thickness for cement-paste slush coat.

C. Apply mortar setting bed over cement-paste slush coat immediately after slush coat has been applied. Spread and screed setting bed to uniform thickness at subgrade elevations required for accurate setting of stone to finished grades indicated.

D. Mix and place only as much mortar setting bed as can be covered with stone before initial set. Cut back, bevel edge, remove, and discard setting-bed material that has reached initial set before placing stone.

E. Place stone before initial set of cement occurs. Immediately before placing stone on setting bed, apply uniform 1/16-inch thick, slurry bond coat to bed or to back of each stone unit with a flat trowel.

F. Tamp and beat stone with a wooden block or rubber mallet to obtain full contact with setting bed and to bring finished surfaces within indicated tolerances. Set each unit in a single operation before initial set of mortar; do not return to areas already set and disturb stone for purposes of realigning finished surfaces or adjusting joints.

3.6 MACHINE PLACED BLOCKS/BOULDERS/SLABS:

A. Stone Block/Boulders/Slabs shall be placed upon an approved sub-grade bed or sub-slab/footing (and slope, if required) so as to produce a well-keyed mass of rock with the least practicable amount of void spaces. Rocks shall be placed aligned or on axis at noted/dimensioned locations and oriented as shown on drawings.

B. Use approved shims as required to align and level stone as required.

C. Blocks, Boulders and Slabs shall be set under observation of the landscape architect. All necessary leveling and adjustments shall be a part of this work.

D. Clean limestone blocks/slabs by light washing to remove excess soil and construction dust unless otherwise noted (moss or vegetation surfacing).

3.7 GROUTING STONE

A. Grout stone joints to comply with ANSI A108.10 and manufacturer's written instructions.

B. Grout joints as soon as possible after initial set of setting bed. Force grout into joints, taking care not to smear grout on adjoining stone and other surfaces. After initial set of grout, finish joints by tooling to produce a slightly concave polished joint, free from drying cracks.

C. Cure grout by maintaining in a damp condition for 7 days, except as otherwise recommended by latex additive manufacturer.

3.8 ADJUSTING AND CLEANING

A. Remove and replace stone of the following description:

1. Broken, chipped, stained, or otherwise damaged stone. Stone may be repaired if methods and results are approved by Landscape Architect.
2. Defective joints.
3. Stone and joints not matching approved samples and mockups.

4. Stone not complying with other requirements indicated herein including but not limited to structural and finishing requirements.

B. Replace in a manner that results in stone matching approved samples and mockups, complying with other requirements, and showing no evidence of replacement.

C. In-Progress Cleaning: Clean stone as work progresses. Remove mortar fins and smears before tooling joints.

D. Clean stone after setting and grouting are complete. Use procedures recommended by stone fabricator for types of application and materials.

3.9 PROTECTION

A. Prohibit traffic from coming in contact or vicinity of stone installations.

B. Protect stone during construction with non-staining kraft paper and additional materials of a protective quality (plywood, barricades, etc.) that are non-damaging in application or non-staining with weather exposures.. Where adjoining areas require construction work access, cover stone with a minimum of 3/4-inch untreated plywood over non-staining kraft paper.

END OF SECTION

SECTION 044300

STONE MASONRY

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Stone masonry anchored to concrete backup and to cold-formed metal framing and sheathing.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 061600 - SHEATHING for gypsum sheathing on cold-formed metal framing.
2. Section 072100 - THERMAL INSULATION for cavity insulation and air barrier membrane system.
3. Section 079200 - JOINT SEALANTS for sealing control and expansion joints in unit masonry.

1.3 SUBMITTALS

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

1. For stone varieties proposed for use on Project, include test data indicating compliance with physical properties specified or required by referenced ASTM standards.

B. Samples for Initial Selection: For colored mortar and other items involving color selection.

C. Samples for Verification:

1. For each stone type indicated. Include at least five samples in each set for each type of stone, exhibiting extremes of the full range of color and other visual characteristics expected in completed Work.
2. Pigmented mortar. Make Samples using same sand and mortar ingredients to be used on Project. Label Samples to indicate types and amounts of pigments used.
3. Weep holes/vents.
4. Accessories embedded in masonry.

D. Qualification Data: For qualified Installer.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs experienced stonemasons and stone fitters.

B. Source Limitations for Stone: Obtain each variety of stone, regardless of finish, from one quarry with resources to provide materials of consistent quality in appearance and physical properties.

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

D. Sample Panels: Build sample panels to verify selections made under sample submittals and to demonstrate aesthetic effects. Comply with requirements in Division 01 for mockups.

1. Build sample panels for typical exterior walls in sizes approximately 48 inches long by 48 inches high by full thickness.
2. Where masonry is to match existing, erect panels adjacent and parallel to existing surface.
3. Clean one-half of exposed faces of panels with masonry cleaner indicated.
4. Protect approved sample panels from the elements with weather-resistant membrane.
5. Approval of sample panels is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; aesthetic qualities of workmanship; and other material and construction qualities specifically approved by Designer in writing.

    a. Approval of sample panels does not constitute approval of deviations from the Contract Documents contained in sample panels unless such deviations are specifically approved by Designer in writing.

E. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01. Agenda shall include protection of air barrier membrane during construction.

1.5 COORDINATION

A. General: Masonry tie anchors shall be installed during initial mobilization, prior to the application of spray-foam air barrier insulation/membrane. Masonry work shall commence with second mobilization after insulation/membrane has been applied, cured, inspected and touched-up.

1.6 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 preblended, dry mortar mix in moisture-resistant containers designed for lifting and emptying into dispensing silo. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in a metal dispensing silo with weatherproof cover.

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

1.7 PROJECT CONDITIONS

A. Protection of Air Barrier Membrane: During construction, protect air barrier membrane from penetrations which allow air to pass through air barrier assemblies. Engage original installer to repair damage promptly using identical materials and methods of installation, and to the satisfaction of the Architect.

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

1. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.

C. Stain Prevention: Immediately remove mortar and soil to prevent them from staining the face of stone masonry.

1. Protect base of walls from rain-splashed mud and mortar splatter by coverings spread on the ground and over the wall surface.
2. Protect sills, ledges, and projections from mortar droppings.
3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
4. Turn scaffold boards near the wall on edge at end of each day to prevent rain from splashing mortar and dirt on completed stone 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 stone masonry damaged by frost or 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: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

PART 2 - PRODUCTS

2.1 STONE, GENERAL

A. Varieties and Sources: Subject to compliance with requirements, provide one of the stone varieties specified for each stone type in Part 2 "Stone Types" Article.

B. Match Architect's samples for variety, color, finish, and other stone characteristics relating to aesthetic effects.

C. Provide stone that is free of cracks, seams, and starts impairing structural integrity or function.

D. Provide stone from a single quarry for each variety of stone required.

E. Quarry stone in a manner to ensure that as-quarried block orientations yield finished stone with required characteristics.

F. Make stone slabs available for Architect to examine for appearance characteristics.

1. Architect will select aesthetically acceptable slabs and will indicate aesthetically unacceptable slabs and portions of slabs.
2. Segregate slabs selected for use on Project and mark backs indicating approval.
3. Mark and photograph aesthetically unacceptable portions of slabs as directed by Architect.

2.2 STONE TYPES

A. Granite: Provide granite complying with ASTM C 615 and NBGQA's "Specifications for Architectural Granite" and as follows:

1. Varieties, Cut and Finish: As selected by Architect.

B. Limestone: Provide limestone complying with ASTM C 568 and ILI's "Indiana Limestone Handbook" and as follows:

1. Varieties, Cut and Finish: As selected by Architect.

C. Marble: Provide marble complying with ASTM C 503 and as follows:

1. Varieties, Cut and Finish: As selected by Architect.

2.3 MORTAR MATERIALS

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

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

C. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes. Use only pigments with a record of satisfactory performance in masonry mortar.

1. Available Products:

a. LanXess; Bayferrox Iron Oxide Pigments.
b. Davis Colors; True Tone Mortar Colors.
c. Solomon Grind-Chem Services, Inc.; SGS Mortar Colors.

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

E. Aggregate for Grout: ASTM C 404.

F. Water: Potable.

2.4 VENEER ANCHORS

A. Materials:

1. Stainless-Steel Wire: ASTM A 580/A 580M, Type 316.
2. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 316.

B. Size: Sufficient to extend at least halfway, but not less than 1-1/2 inches, through stone masonry and with at least 5/8-inch cover on outside face.

C. Adjustable Anchors for Connecting to Structure: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.

1. Anchor Section for Welding to Steel Frame: Crimped 1/4-inch-diameter, hot-dip galvanized steel. Mill-galvanized wire may be used at interior walls, unless otherwise indicated.

D. Partition Top Anchors: 0.097-inch-thick metal plate with 3/8-inch-diameter metal rod 6 inches long welded to plate and with closed-end plastic tube fitted over rod that allows rod to move in and out of tube. Fabricate from steel, hot-dip galvanized after fabrication.

E. Adjustable Masonry-Veneer Anchors:

1. General: Provide anchors that allow vertical adjustment but resist tension and compression forces perpendicular to plane of wall, for attachment over sheathing to wood or metal studs, with structural performance capable of withstanding a 100-lbf load in both tension and compression without deforming or developing play in excess of 0.05 inch.
2. Screw-Attached, Masonry-Veneer Anchors: Provide BL-407 Brick Veneer Anchoring System, manufactured by Blok-Lok. Anchor shall be stainless steel sheet, tie shall be stainless steel 3/16 in. wire tie. Units consisting of a wire tie section and a metal anchor section complying with the following requirements:
   a. Pintle Shape: Rectangular.
   b. Pintle Length: As required to extend 1-1/2 in. into masonry wythe of veneer face.
   c. Anchor Section: L-shaped plate section with 9/32 in. diameter holes for connecting screws. Eyelets for pintle insertion with 1-1/4 in. maximum allowable eccentricity, sized to prevent in-and-out movement beyond allowable tolerances.

2.5 MISCELLANEOUS ANCHORS

A. Anchor Bolts: L-shaped 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/A 153M, Class C; of dimensions indicated.

2.6 EMBEDDED FLASHING MATERIALS

A. Metal Flashings: Furnished under Section 076200 - SHEET METAL FLASHING AND TRIM.

2.7 MISCELLANEOUS MASONRY ACCESSORIES

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

B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

C. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).

D. Weep/Vent Products: Free-draining mesh; made from polyethylene strands, full height and width of head joint and depth 1/8 inch less than depth of outer wythe; in color selected from manufacturer's standard.

E. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity. Provide sheets, full-depth of cavity extending full height of cavity. Available products:

1. Advanced Building Products Inc.; Mortar Break II.
2. Archovations, Inc.; CavClear Masonry Mat.
3. Dayton Superior Corporation, Dur-O-Wal Division; Polytite MortarStop.
4. Mortar Net USA, Ltd.; Mortar Net.

F. Dampproofing for Limestone: Provide cementitious formulations that are recommended by ILI and that are nonstaining to stone, compatible with joint sealants, and noncorrosive to anchors and attachments.

2.8 MASONRY CLEANERS

A. 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. Available Manufacturers:

a. Diedrich Technologies, Inc.
b. EaCo Chem, Inc.
c. ProSoCo, Inc.

2.9 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.

B. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.

1. For masonry below grade or in contact with earth, use Type M.
2. For reinforced masonry, use Type S.
3. For exterior, above-grade, load-bearing and non-load-bearing walls and parapet walls; for interior load-bearing walls; for interior non-load-bearing partitions; and for other applications where another type is not indicated, use Type N.

C. Pigmented Mortar: Use colored cement product. Pigments shall not exceed 10 percent of portland cement by weight.

D. Grout for Unit Masonry: Comply with ASTM C 476.

1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 1.15.1 in 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/C 143M.

2.10 FABRICATION

A. Fabricate stone to comply with sizes, shapes, and tolerances recommended by applicable stone association or, if none, by stone source, for faces, edges, beds, and backs.

1. For limestone, comply with recommendations in ILI's "Indiana Limestone Handbook."

B. Cut stone to produce pieces of thickness, size, and shape indicated, including details on Drawings. Dress joints (bed and vertical) straight and at right angle to face unless otherwise indicated.

C. Cut and drill sinkages and holes in stone for anchors and supports.

D. Carefully inspect stone at quarry or fabrication plant for compliance with requirements for appearance, material, and fabrication. Replace defective units before shipment.

1. Clean sawed backs of stone to remove rust stains and iron particles.

E. Gage backs of stones for adhered veneer if more than 81 sq. in. (522 sq. cm) in area.

F. Thickness of Stone: Provide thickness indicated, but not less than the following:

1. Thickness: 4 inches plus or minus 1/4 inch. Thickness does not include projection of pitched faces.

G. Shape stone for type of masonry (pattern) as indicated on the Drawings.

H. Finish exposed faces and edges of stone to comply with requirements indicated for finish and to match approved samples and mockups.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces indicated to receive stone masonry, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine substrate to verify that dovetail slots, inserts, reinforcement, veneer anchors, flashing, and other items installed in substrates and required for or extending into stone masonry are correctly installed.

C. Examine wall framing, sheathing, and insulation/air barrier membrane to verify that stud locations are suitable for spacing of veneer anchors and that installation will result in a weatherproof covering.

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

3.2 PREPARATION

A. Clean dirty or stained stone surfaces by removing soil, stains, and foreign materials before setting. Clean stone by thoroughly scrubbing with fiber brushes and then drenching with clear water. Use only mild cleaning compounds that contain no caustic or harsh materials or abrasives.

3.3 SETTING OF STONE MASONRY, GENERAL

A. Perform necessary field cutting and trimming as stone is set.

1. Use power saws to cut stone that is fabricated with saw-cut surfaces. Cut lines straight and true, with edges eased slightly to prevent snipping.

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

C. Arrange stones in range ashlar pattern with course heights as indicated, random lengths, and uniform joint widths, with offset between vertical joints as indicated.

D. Arrange stones with color and size variations uniformly dispersed for an evenly blended appearance.

E. Set stone to comply with requirements indicated on Drawings. Install supports, fasteners, and other attachments indicated or necessary to secure stone masonry in place. Set stone accurately in locations indicated with edges and faces aligned according to established relationships and indicated tolerances.

F. Maintain uniform joint widths except for variations due to different stone sizes and where minor variations are required to maintain bond alignment if any. Lay walls with joints not less than 1/4 inch at narrowest points or more than 1/2 inch at widest points.

G. Coat limestone with cementitious dampproofing as follows:

1. Stone at Grade: Beds, joints, and back surfaces to at least 12 inches (300 mm) above finish-grade elevations.
2. Stone Extending below Grade: Beds, joints, back surfaces, and face surfaces below grade.
3. Allow cementitious dampproofing formulations to cure before setting dampproofed stone. Do not damage or remove dampproofing in the course of handling and setting stone.

3.4 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.

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 multiwythe masonry walls, including cavity walls, extend flashing through outer wythe, turned up a minimum of 8 inches, and 1-1/2 inches into the inner wythe. Form 1/4-inch hook in edge of flashing embedded in inner wythe.
3. At masonry-veneer walls, extend flashing through veneer, across air space behind veneer, and up face of sheathing at least 8 inches; with upper edge covered with elastomeric membrane, lapping at least 4 inches.
4. 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.

C. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.

D. Install weep holes in head joints in exterior wythes of first course of masonry immediately above embedded flashing and as follows:

1. Use open head joints to form weep holes.
2. Space weep holes 24 inches o.c., unless otherwise indicated.

E. Place cavity drainage material in cavities to comply with configuration requirements for cavity drainage material in Part 2 "Miscellaneous Masonry Accessories" Article.

F. Install vents in head joints in exterior wythes at spacing indicated.

3.5 CONSTRUCTION TOLERANCES

A. Variation from Plumb: For vertical lines and surfaces, do not exceed 1/4 inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (10 mm in 6 m), or 1/2 inch in 40 feet (13 mm in 12 m) or more. For external corners, expansion joints, control joints, and other conspicuous lines, do not exceed 1/4 inch in 20 feet (6 mm in 6 m) or 1/2 inch in 40 feet (13 mm in 12 m) or more.

B. Variation from Level: For bed joints and lines of exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines, do not exceed 1/4 inch in 20 feet (6 mm in 6 m) or 1/2 inch in 40 feet (13 mm in 12 m) or more.

C. Variation of Linear Building Line: For position shown in plan, do not exceed 1/2 inch in 20 feet (13 mm in 6 m) or 3/4 inch in 40 feet (19 mm in 12 m) or more.

D. Variation in Mortar-Joint Thickness: Do not vary from joint size range indicated.

3.6 INSTALLATION OF ANCHORED STONE MASONRY

A. Anchor stone masonry to unit masonry with veneer anchors unless otherwise indicated. Embed anchors in unit masonry mortar joints or grouted cells for distance at least one-half of unit masonry thickness.

B. Anchor stone masonry to stud framing with screw-attached veneer anchors unless otherwise indicated.

C. Space anchors not more than 16 inches o.c. vertically and 24 inches o.c. horizontally. Install additional anchors within 12 inches of openings, sealant joints, and perimeter at intervals not exceeding 12 inches.

D. Set stone in full bed of mortar with full head joints unless otherwise indicated. Build anchors into mortar joints as stone is set.

E. Rake out joints for pointing with mortar to depth of not less than 1/2 inch before setting mortar has hardened. Rake joints to uniform depths with square bottoms and clean sides.

3.7 POINTING

A. Prepare stone-joint surfaces for pointing with mortar by removing dust and mortar particles. Where setting mortar was removed to depths greater than surrounding areas, apply pointing mortar in layers not more than 3/8 inch (10 mm) deep until a uniform depth is formed.

B. Point stone joints by placing and compacting pointing mortar in layers not more than 3/8 inch (10 mm) deep. Compact each layer thoroughly and allow to become thumbprint hard before applying next layer.

C. Tool joints, when pointing mortar is thumbprint hard, with a smooth jointing tool to produce the following joint profile:

1. Joint Profile: As indicated.

3.8 ADJUSTING AND CLEANING

A. Remove and replace stone masonry of the following description:

1. Broken, chipped, stained, or otherwise damaged stone. Stone may be repaired if methods and results are approved by Architect.
2. Defective joints.
3. Stone masonry not matching approved samples and mockups.
4. Stone masonry not complying with other requirements indicated.

B. Replace in a manner that results in stone masonry matching approved samples and mockups, complying with other requirements, and showing no evidence of replacement.

C. In-Progress Cleaning: Clean stone masonry as work progresses. Remove mortar fins and smears before tooling joints.

D. Final Cleaning: After mortar is thoroughly set and cured, clean stone masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on mockup; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before cleaning stone masonry.
3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent, polyethylene film, or waterproof masking tape.
4. Wet wall surfaces with water before applying cleaner; remove cleaner promptly by rinsing thoroughly with clear water.
5. Clean limestone masonry to comply with recommendations in ILI's "Indiana Limestone Handbook."

3.9 EXCESS MATERIALS AND WASTE

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 31 - 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 the Site.

END OF SECTION

SECTION 047200

CAST STONE MASONRY

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Cast stone trim**.**

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 042000 - UNIT MASONRY for cast stone trim installation.

1.3 DEFINITIONS

A. Cast Stone: Architectural precast concrete building units intended to simulate natural cut stone.

1.4 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for cast stone units.

B. Shop Drawings: Show fabrication and installation details for cast stone units. Include dimensions, details of reinforcement and anchorages if any, and indication of finished faces.

1. Include building elevations showing layout of units and locations of joints and anchors.

C. Samples for Verification:

1. For each color and texture of cast stone required, 10 inches square in size.
2. For colored mortar. Make Samples using same sand and mortar ingredients to be used on Project. Label Samples to indicated types and amounts of pigments used.

D. Mockup Samples: Furnish sample units for each color and texture of cast stone required, as indicated on Drawings for installation in mockups.

E. Qualification Data: For manufacturer.

1. Include copies of material test reports for completed projects, indicating compliance of cast stone with ASTM C 1364.

F. Quality-Control Plan: Manufacturer's written quality-control plan that includes all elements of the Cast Stone Institute's "Quality Control Procedures Required for Plant Inspection."

1. Provide copies of documentation showing compliance with quality-control plan as requested by Architect.

G. Material Test Reports: For each mix required to produce cast stone, based on testing according to ASTM C 1364, including test for resistance to freezing and thawing.

1. Provide test reports based on testing within previous two years.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer of cast stone units similar to those indicated for this Project, with sufficient production capacity to manufacture required units.

1. Manufacturer is a producing member of the Cast Stone Institute or has on file and follows a written quality-control plan approved by Architect that includes all elements of the Cast Stone Institute's "Quality Control Procedures Required for Plant Inspection."

B. Testing Agency Qualifications: An independent testing agency qualified according to ASTM E 329 for testing indicated, as documented according to ASTM E 548.

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

1.6 TESTING

A. Tests shall conform to methods described herein, and shall be performed by an testing laboratory selected by the manufacturer and approved by the Owner. Tests shall be made at the manufacturer's expense. Pieces of stone taken for testing shall be replaced by manufacturer without charge. The testing laboratory shall submit copies of test results to both the Architect and the manufacturer.

B. Testing shall be done using 6 in. x 12 in. cylinders in accordance with ASTM C 31, ASTM C 39, and ASTM C 642.

C. Testing may be performed using 2 in. x 2 in. cubes, provided that the size of the largest aggregate in the design mix is 5/8 in. or smaller, in accordance with ASTM C 170 and C 97.

D. The Architect will select representative pieces of Cast Stone at random per each 500 cubic feet for testing.

E. Test results shall be determined by the average of three specimens per test.

1.7 DELIVERY, STORAGE, AND HANDLING

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

B. Pack, handle, and ship cast stone units in suitable packs or pallets.

1. Lift with wide-belt slings; do not use wire rope or ropes that might cause staining. Move cast stone units, if required, using dollies with wood supports.
2. Store cast stone units on wood skids or pallets with nonstaining, waterproof covers. Arrange to distribute weight evenly and to prevent damage to units. Ventilate under covers to prevent condensation.

C. Store installation materials on elevated platforms, under cover, and in a dry location.

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

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers:

1. Continental Cast Stone East, West Berlin, NJ 08091.
2. MGA Cast Stone, New Gloucester, ME 04260.
3. Sun Precast Co., Inc., Beaver Springs, PA 17812.

2.2 CAST STONE MATERIALS

A. General: Comply with ASTM C 1364 and the following:

1. Color and Texture: Match Architect's Sample.
2. Sizes: As indicated on Drawings.
3. Provide units with factory finish at exposed faces.

B. Portland Cement: ASTM C 150, Type I, containing not more than 0.60 percent total alkali when tested according to ASTM C 114.

1. Color: White or Gray.

C. Coarse Aggregates: Granite, quartz, or limestone complying with ASTM C 33; gradation as needed to produce required textures and colors as needed to produce required cast stone colors.

D. Fine Aggregates: Natural sand or crushed stone complying with ASTM C 33, gradation as needed to produce required textures and colors as needed to produce required cast stone colors.

E. 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. The amount of pigment shall not exceed 10% by weight of the cement used.

F. Admixtures: Do not use admixtures unless specified or approved in writing by Architect.

G. Reinforcement: Deformed steel bars complying with ASTM A 615/A 615M. Use galvanized or epoxy-coated reinforcement when covered with less than 1-1/2 inches of cast stone material.

1. Epoxy Coating: ASTM A 775/A 775M.
2. Galvanized Coating: ASTM A 767/A 767M.

H. Embedded Anchors and Other Inserts: Fabricated from stainless steel complying with ASTM A 240/A 240M, ASTM A 276, or ASTM A 666, Type 304.

I. Provide cast stone units complying with ASTM C 1364.

1. Provide units that are resistant to freezing and thawing as determined by laboratory testing according to ASTM C 666, Procedure A, as modified by ASTM C 1364.

J. Fabricate units with sharp arris and details accurately reproduced with indicated texture on all exposed surfaces, unless otherwise indicated.

1. Slope exposed horizontal surfaces 1:12, unless otherwise indicated.
2. Provide raised fillets at backs of sills and at ends indicated to be built into jambs.
3. Provide drips on projecting elements, unless otherwise indicated.

K. Fabrication Tolerances:

1. Variation in Cross Section: Do not vary from indicated dimensions by more than 1/8 inch.
2. Variation in Length: Do not vary from indicated dimensions by more than 1/360 of the length of unit or 1/8 inch, whichever is greater, but in no case by more than 1/4 inch.
3. Warp, Bow, and Twist: Not to exceed 1/360 of the length of unit or 1/8 inch, whichever is greater.
4. Location of Grooves, False Joints, Holes, Anchorages, and Similar Features: Do not vary from indicated position by more than 1/8 inch on formed surfaces of units and 3/8 inch on unformed surfaces.

L. Cure units by one of the following methods:

1. Cure units with steam in enclosed curing room at temperature of 105 deg F or above and 95 to 100 percent relative humidity for 6 hours.
2. Cure units with dense fog and water spray in enclosed warm curing room at 95 to 100 percent relative humidity for 24 hours.
3. Cure units to comply with one of the following:

a. Not less than 5 days at mean daily temperature of 70 deg F or above.
b. Not less than 6 days at mean daily temperature of 60 deg F or above.
c. Not less than 7 days at mean daily temperature of 50 deg F or above.
d. Not less than 8 days at mean daily temperature of 45 deg F or above.

M. Acid etch units after curing to remove cement film from surfaces to be exposed to view.

2.3 ACCESSORIES

A. Anchors: Type and size indicated, fabricated from stainless steel complying with ASTM A 240/A 240M, ASTM A 276, or ASTM A 666, Type 304.

B. Dowels: Round stainless-steel bars complying with ASTM A 276, Type 304, and 1/2-inch (12-mm) diameter.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Part of the Work of Section 042000 – UNIT MASONRY.

END OF SECTION

SECTION 054000

COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Exterior non-load-bearing wall framing.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 055000 - METAL FABRICATIONS for masonry shelf angles and connections.
2. Section 061600 - SHEATHING for exterior sheathing applied to cold-formed metal framing.
3. Section 092110 - GYPSUM BOARD ASSEMBLIES for interior non-load-bearing, metal-stud framing and ceiling-suspension assemblies.
4. Section 092120 - GYPSUM BOARD SHAFT-WALL ASSEMBLIES for interior non-load-bearing, metal-stud-framed, shaft-wall assemblies.

1.3 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design framing, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Provide cold-formed metal framing capable of withstanding design loads within limits and under conditions indicated.

1. Design Loads: As required by code.
2. Deflection Limits: Design framing systems to withstand design loads within deflections greater than the following:

a. Exterior Non-Load-Bearing Framing:

1) Horizontal deflection of l/240 of the wall height for metal panel systems.
2) Horizontal deflection of l/240 of the wall height for EIFS systems.
3) Horizontal deflection of 1/600 of the wall height for masonry systems.

3. Design framing systems to provide for movement of framing members without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and

anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F.

4. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load, plus superimposed dead load, deflection of primary building structure.

C. Cold-Formed Steel Framing, General: Design according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions."

1. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.

D. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

1.4 SUBMITTALS

A. Product Data: For each type of cold-formed metal framing product and accessory indicated.

B. Shop Drawings: Show layout, spacings, sizes, thicknesses, and types of cold-formed metal framing; fabrication; and fastening and anchorage details, including mechanical fasteners. Show reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.

1. Shop drawings shall be signed and sealed by a professional engineer currently licensed in the project location.

C. Delegated-Design Submittal: For framing indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

D. Welding certificates.

E. Qualification Data: For professional engineer.

F. Product Test Reports: From a qualified testing agency, unless otherwise stated, indicating that each of the following complies with requirements, based on evaluation of comprehensive tests for current products:

1. Steel sheet.
2. Expansion anchors.
3. Power-actuated anchors.
4. Mechanical fasteners.
5. Vertical deflection clips.
6. Miscellaneous structural clips and accessories.

1.5 QUALITY ASSURANCE

A. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data by a qualified professional engineer.

B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of cold-formed metal framing that are similar to those indicated for this Project in material, design, and extent.

C. Product Tests: Mill certificates or data from a qualified independent testing agency, or in-house testing with calibrated test equipment indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, ductility, and metallic-coating thickness.

D. 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."

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."

1. Comply with AISI's "Standard for Cold-Formed Steel Framing - Truss Design."
2. Comply with AISI's "Standard for Cold-Formed Steel Framing - Header Design."

F. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

1.6 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. Available Manufacturers: Subject to compliance with requirements, manufacturers offering cold-formed metal framing that may be incorporated into the Work include, but are not limited to, the following:

1. California Expanded Metals Co. (CEMCO).
2. ClarkDietrich Building Systems.
3. EB Metal U.S.
4. Marino\WARE.
5. Super Stud Building Products Inc.

2.2 MATERIALS

A. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:

1. Grade: As required by structural performance.
2. Coating: G90.

B. Steel Sheet for Vertical Deflection Clips: ASTM A 653/A 653M, structural steel, zinc coated, of grade and coating as follows:

1. Grade: As required by structural performance.
2. Coating: G90 (Z275).

2.3 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: 0.0538 inch (16 gauge).

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: Matching steel studs.
2. Flange Width: 1-1/4 inches.

C. Vertical Deflection Clips: Manufacturer's standard clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.

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. ClarkDietrich Building Systems.
b. MarinoWARE, a division of Ware Industries.
c. The Steel Network, Inc.

2.4 FRAMING 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.

2.5 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. Anchor Bolts: ASTM F 1554, threaded carbon-steel bolts, and carbon-steel nuts; and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153/A 153M, Class C.

C. 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.

1. Acceptable Manufacturers: Kwik-Bolt 3 by Hilti, Inc., TruBolt Wedge Anchor by ITW Red Head or Power-Stud by Powers Fasteners.

D. 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.

E. 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.

F. Welding Electrodes: Comply with AWS standards.

2.6 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

1. Provide interior, field-applied primer with a VOC content of 250 g/L or less.

B. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

1. Basis of Design: Sika; SikaGrout 212.
2. VOC Content: 0 g/L.

C. Shims: Load bearing, high-density multimonomer plastic, nonleaching.

D. Sill Sealer Gaskets: Closed-cell foam, 1/4 inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance.

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

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 sill 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 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.

D. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.

E. 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.

F. Do not bridge building expansion and control joints with cold-formed metal framing. Independently frame both sides of joints.

G. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's standard punched openings.

H. 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.

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. Testing: Engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Field and shop welds will be subject to testing and inspecting.

C. Testing agency will report test results promptly and in writing to Contractor and Architect.

D. Remove and replace work where test results indicate that it does not comply with specified requirements.

E. 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.

END OF SECTION

SECTION 055000

METAL FABRICATIONS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following. Requirements for materials, hot-dip galvanizing, and shop-applied primers are included with each item as applicable.

1. Loose steel bearing and leveling plates, including bearing plates for steel joists, galvanized at exterior locations and in exterior walls.
2. Galvanized steel lintels with shop-applied primer at exterior locations.
3. Steel lintels with shop-applied zinc-rich primer at interior locations.
4. Galvanized shelf angles with shop applied primer at exterior locations.
5. Shelf angles with zinc-rich shop-applied primer at interior locations.
6. Steel elevator machine beams.
7. Steel support angles for elevator door sills.
8. Cants in elevator hoistways made from sheet steel.
9. Miscellaneous steel framing and supports:

    a. Steel framing and supports with shop applied primer for operable partitions.
    b. Galvanized steel framing and supports for overhead doors.
    c. Galvanized steel framing and supports for mechanical and electrical equipment.
    d. Steel framing and supports for applications where framing and supports are not specified in other Sections; galvanized at exterior locations and in exterior walls.
    e. Prefinished slotted steel channel support framing.
    f. Steel framing and supports with shop-applied primer for countertops.
    g. Steel framing and supports for toilet partitions.

10. Ladders:

    a. Steel ladders to all roof levels, galvanized at exterior locations.
    b. Steel ladders at interior locations, shop-primed.
    c. Steel ladder safety cages, galvanized at exterior locations.
    d. Steel ships' ladders with shop-applied primer.
    e. Steel elevator pit ladders.
    f. Alternating tread devices.

11. Miscellaneous steel trim including steel angle corner guards, steel edgings, and loading-dock edge angles, galvanized at exterior locations and in exterior walls.
12. Galvanized steel bollards with shop-applied primer.

13. Galvanized pipe guards with shop-applied primer.
14. Steel floor plate and frame.
15. Cast gray iron nosings.
16. Cast gray iron wheel guards.
17. Cast gray iron downspout boots.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 051200 - STRUCTURAL STEEL FRAMING for structural steel items.
2. Section 055100 - METAL STAIRS AND RAILINGS for steel stairs, handrails, and guardrails.
3. Section 055300 - METAL GRATINGS for metal bar gratings
4. Section 099000 - PAINTING AND COATING for field painting work of this section.
5. Section 102210 - WIRE MESH PARTITIONS for interior wire mesh partitions.
6. Section 118129 - FACILITY FALL PROTECTION for metal anchors at rooftop.

1.3 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design ladders and miscellaneous framing and supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance of Ladders: Provide ladders capable of withstanding the effects of loads and stresses within limits and under conditions specified in ANSI A14.3.

C. Thermal Movements: Provide exterior metal fabrications that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

1.4 SUBMITTALS

A. Product Data: For each product.

B. Shop Drawings: Show fabrication and installation details for metal fabrications.

1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
2. Provide templates for anchors and bolts specified for installation under other Sections.
3. Where fabrications are to receive sprayed-on fireproofing, include statement that primer is compatible with fireproofing proposed for use.

C. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

D. Welding certificates.

E. Qualification Data: For professional engineer.

1.5 QUALITY ASSURANCE

A. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data by a qualified professional engineer.

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

C. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."
2. AWS D1.2, "Structural Welding Code--Aluminum."
3. AWS D1.3, "Structural Welding Code--Sheet Steel."
4. AWS D1.6, "Structural Welding Code--Stainless Steel."

D. 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.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating metal fabrications without field measurements. Coordinate wall and other contiguous construction to ensure that actual dimensions correspond to established dimensions.
2. Provide allowance for trimming and fitting at site.

1.7 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. 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.

C. 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 FERROUS METALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 304 at interior, Type 316L at exterior.

C. Stainless-Steel Bars and Shapes: ASTM A 276, Type 304 at interior, Type 316L at exterior.

D. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.

E. Steel Tubing: ASTM A 500, cold-formed steel tubing.

F. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.

1. Provide Schedule 80 pipe for bollards.

G. Slotted Channel Framing: Cold-formed metal channels with continuous slot complying with MFMA-4.

1. Basis of Design: Unistrut Corp.

H. Cast Iron: ASTM A 48/A 48M, Class 30, unless another class is indicated or required by structural loads.

2.2 NONFERROUS METALS

A. Aluminum Plate and Sheet: ASTM B 209/B 209M, Alloy 6061-T6.

B. Aluminum Extrusions: ASTM B 221/221M, Alloy 6063-T6.

C. Aluminum-Alloy Rolled Tread Plate: ASTM B 632/B 632M, Alloy 6061-T6.

D. Aluminum Castings: ASTM B 26/B 26M, Alloy 443.0-F.

2.3 FASTENERS

A. General: Unless otherwise indicated, provide Type 316 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. Anchor Bolts: ASTM F 1554, Grade 36. Provide hot-dip or mechanically deposited, zinc-coated anchor bolts where item being fastened is indicated to be galvanized.

C. 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.

D. 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. Anchors shall have an ICC-ES report with approval for use in cracked concrete.

1. Acceptable Manufacturers: Kwik-Bolt TZ by Hilti, Inc., TruBolt Wedge Anchor by ITW Red Head, Power-Stud+ by Powers Fasteners, or Strong Bolt by Simpson.

E. Slotted-Channel Inserts: Cold-formed, hot-dip galvanized-steel box channels (struts) complying with MFMA-4, 1-5/8 by 7/8 inches by length indicated with anchor straps or studs not less than 3 inches long at not more than 8 inches o.c. Provide with temporary filler and tee-head bolts, complete with washers and nuts, all zinc-plated to comply with ASTM B 633, Class Fe/Zn 5, as needed for fastening to inserts.

2.4 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

C. Zinc-Rich Primer: Urethane zinc-rich primer compatible with topcoat Specified in Section 099000 - PAINTS AND COATINGS.

1. Basis of Design: Tnemec; Series 394 PerimePrime.
2. VOC Content: 250 g/L or less.

D. Galvanizing Repair Paint: High-zinc-dust-content (95% by weight) paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

1. Available Products: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Duncan Galvanizing; ZiRP.
   b. ZRC Worldwide; Galvilite Galvanizing Repair, low VOC type.
2. VOC Content: 250 g/L or less.

E. Isolation Coating (Bituminous Paint): ASTM D 1187, cold-applied asphalt emulsion, VOC compliant, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

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.

1. Available Products: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Dayton Superior; 1107 Advantage Grout.
   b. Sika; SikaGrout 212.
2. VOC Content: 0 g/L.

2.5 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. 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.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work true to line and level with accurate angles and surfaces and straight edges.

E. 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.

F. 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.

G. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

I. 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.

2.6 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.

2.7 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.

2.8 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-inchbolts, 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. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete.

C. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

2.9 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. Fabricate units from slotted channel framing where indicated.
2. Furnish inserts if units are installed after concrete is placed.

C. Fabricate supports for operable partitions 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 hanger rods; locate holes where indicated on operable partition Shop Drawings.

2.10 METAL LADDERS

A. General:

1. Comply with ANSI A14.3, unless otherwise indicated.
2. For elevator pit ladders, comply with ASME A17.1.
3. Support each ladder at top and bottom and not more than 60 inches o.c. with welded or bolted brackets, made from same metal as ladder.

4. Provide nonslip surfaces on top of each rung, either by coating rung with aluminum-oxide granules set in epoxy-resin adhesive or by using a type of manufactured rung filled with aluminum-oxide grout.

2.11 LADDER SAFETY CAGES

A. General:

1. Fabricate ladder safety cages to comply with ANSI A14.3. Assemble by welding or with stainless-steel fasteners.
2. Provide primary hoops at tops and bottoms of cages and spaced not more than 20 feet o.c. Provide secondary intermediate hoops spaced not more than 48 inches o.c. between primary hoops.
3. Fasten assembled safety cage to ladder rails and adjacent construction by welding or with stainless-steel fasteners, unless otherwise indicated.

2.12 METAL SHIPS' LADDERS

A. Provide metal ships' ladders where indicated. Fabricate of open-type construction with channel or plate stringers, pipe and tube railings, and bar grating treads, unless otherwise indicated. Provide brackets and fittings for installation.

2.13 ALTERNATING TREAD DEVICES

A. Alternating Tread Devices: Fabricate alternating tread devices to comply with ICC's International Building Code. Fabricate of open-type construction with channel or plate stringers and pipe and tube railings unless otherwise indicated. Provide brackets and fittings for installation.

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

a. Lapeyre Stair Inc.
b. Precision Ladders, LLC.
c. Vestil Manufacturing Company.

2. Fabricate from steel and assemble by welding or with stainless-steel fasteners.
3. Comply with applicable railing requirements in Section 055100 - METAL STAIRS AND RAILINGS.

B. Galvanize exterior steel alternating tread devices, including treads, railings, brackets, and fasteners.

2.14 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.

2.15 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.

2.16 METAL BOLLARDS

A. Fabricate metal bollards from Schedule 80 steel pipe.

B. Fabricate bollards with 3/8-inch-thick steel baseplates for bolting to concrete slab. Drill baseplates at all 4 corners for 3/4-inch anchor bolts.

1. Where bollards are to be anchored to sloping concrete slabs, angle baseplates for plumb alignment of bollards.

2.17 PIPE GUARDS

A. Fabricate pipe guards from 3/8-inch-thick by 12-inch--wide steel plate, bent to fit flat against the wall or column at both ends and to fit around pipe with 2-inch clearance between pipe and pipe guard. Drill each end for two 3/4-inch anchor bolts.

2.18 METAL FLOOR PLATE

A. Fabricate from rolled-steel floor plate of minimum 1/4 inch steel unless thicker units are required for anticipated loadings.

B. Include steel angle stiffeners, and fixed and removable sections as indicated.

C. Provide flush steel bar drop handles for lifting removable sections, one at each end of each section.

2.19 ABRASIVE METAL NOSINGS

A. Cast-Metal Units: 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.

B. Drill for mechanical anchors and countersink. Locate not more than 4 inches from ends and not more than 12 inches o.c., evenly spaced between ends, unless otherwise indicated. Provide closer spacing if recommended by manufacturer.

C. Apply isolation coating to concealed bottoms, sides, and edges of cast-metal units set into concrete.

2.20 CAST-IRON WHEEL GUARDS

A. Provide wheel guards of 3/4-inch-thick, hollow-core, gray-iron castings; of size and shape indicated. Provide holes for countersunk anchor bolts and grouting.

2.21 METAL DOWNSPOUT BOOTS

A. Provide downspout boots made from cast gray iron in heights indicated with inlets of size and shape to suit downspouts.

2.22 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish metal fabrications after assembly.

2.23 STEEL PRIMERS AND FINISHES

A. 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 Urethane Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
2. Interiors (SSPC Zone 1A): SSPC-SP 7, "Brush Off Blast Cleaning."
3. Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and those to be field welded, embedded in concrete or masonry, unless otherwise indicated. Extend priming of partially embedded members to a depth of 2 inches.
4. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
5. Comply with SSPC-PA 2, "Measurement of Dry Coating Thickness with magnetic Gages."

B. Zinc-Rich Primer: Urethane zinc-rich primer compatible with topcoat Specified in Section 099000 - PAINTS AND COATINGS.

1. Basis of Design: Tnemec; Series 394 PerimePrime.
2. VOC Content: 340 g/L or less.

2.24 HOT-DIP GALVANIZING

A. Hot-Dip Galvanizing: For steel exposed to the elements, weather or corrosive environments and other steel indicated to be galvanized, provide coating for iron and steel fabrications applied by the hot-dip process.

1. Basis-of-Design: Duragalv by Duncan Galvanizing.
2. Comply with ASTM A 123 for fabricated products and ASTM A 153 for hardware.
3. Provide thickness of galvanizing specified in referenced standards.
4. Galvanizing bath shall contain special high grade zinc and other earthly materials.
5. Fill vent holes after galvanizing, if applicable, and grind smooth.

2.25 HOT-DIP GALVANIZING AND FACTORY-APPLIED PRIMER

A. Hot-Dip Galvanizing: For steel exposed to the elements, weather or corrosive environments and other steel indicated to be galvanized, provide coating for iron and steel fabrications applied by the hot-dip process.

1. Basis-of-Design: Duragalv by Duncan Galvanizing.
2. Comply with ASTM A 123 for fabricated products and ASTM A 153 for hardware.
3. Provide thickness of galvanizing specified in referenced standards.
4. Galvanizing bath shall contain special high grade zinc and other earthly materials.
5. Fill vent holes after galvanizing, if applicable, and grind smooth.

B. Factory-Applied Primer over Galvanized Steel: Provide factory-applied prime coat, certified OTC/VOC compliant less than 2.8 lbs/gal. and conforming to EPA and local requirements. Apply primer within 12 hours after galvanizing at the same galvanizer's plant in a controlled environment meeting applicable environmental regulations and as recommended by the primer coating manufacturer. Primer coat shall exhibit a rugosity (smoothness) not greater than 4 rug (16-20 microns of variation) when measured by a profilometer over a 1 inch straight line on the surface of architectural and structural elements that are less than 24 pounds per running foot. Profilometer shall be capable of operating in 1 micron increments. Blast cleaning of the surface is unacceptable for surface preparation. Primer shall have a minimum two year re-coat window for application of finish coat. Coatings must meet or exceed the following performance criteria as stipulated by the coatings manufacturer:

1. Basis-of-Design: Primergalv by Duncan Galvanizing.
2. Abrasion Resistance: ASTM D 4060 (CS17 Wheel, 1,000 grams load).1kg load, 200 mg loss.
3. Adhesion: ASTM D4541, 1050 psi.
4. Corrosion Weathering: ASTM D5894, 13 cycles, 4,368 hours; rating 10 per ASTM D714 for blistering and rating 7 per ASTM D610 for rusting.
5. Direct Impact Resistance: ASTM D2794, 160 in. lbs.
6. Flexibility: Method: ASTM D522, 180 degree bend, 1 inch mandrel, passes.
7. Pencil Hardness: ASTM D3363, 3B.
8. Moisture Condensation Resistance: ASTM D4585, 100 degrees F, 2000 hours; passes, no cracking or delamination.
9. Dry Heat Resistance: Method: ASTM D2485, 250 degrees F.
10. Warranty: Provide galvanizer's warranty that materials will be free from 10 percent or more visible rust for a period of 20 years.

2.26 HOT-DIP GALVANIZING AND FACTORY-APPLIED ARCHITECTURAL FINISH

A. Hot-Dip Galvanizing: For steel exposed to the elements, weather or corrosive environments and other steel indicated to be galvanized, provide coating for iron and steel fabrications applied by the hot-dip process.

1. Basis-of-Design: Duragalv by Duncan Galvanizing.
2. Comply with ASTM A 123 for fabricated products and ASTM A 153 for hardware.
3. Provide thickness of galvanizing specified in referenced standards.
4. Galvanizing bath shall contain special high grade zinc and other earthly materials.
5. Fill vent holes after galvanizing, if applicable, and grind smooth.

B. Architectural Finish Over Hot-Dip Galvanizing: For steel exposed to the elements, weather or corrosive environments and other steel indicated to be galvanized, provide coating over hot-dip galvanizing.

1. Basis-of-Design: Colorgalv by Duncan Galvanizing.
2. Primer coat shall be factory-applied polyamide epoxy primer. Apply primer within 12 hours after galvanizing at the same galvanizer's plant in a controlled environment meeting applicable environmental regulations and as recommended by the primer coating manufacturer.
3. Finish coat shall be factory-applied color-pigmented architectural finish. Apply finish coating at the galvanizer's plant, in a controlled environment meeting applicable environmental regulations and as recommended by the finish coating manufacturer. Finish coat shall exhibit a rugosity (smoothness) not greater than 4 rug (16-20 microns of variation) when measured by a profilometer over a 1 inch straight line on the surface of architectural and structural elements that are less than 24 pounds per running foot. Profilometer shall be capable of operating in 1 micron increments.
4. Coatings shall be certified OTC/VOC compliant and conform to applicable regulations and EPA standards.
5. Apply the galvanizing, primer, and coating within the same facility and provide single-source responsibility for galvanizing, priming and finish coating.
6. Clean galvanized surface to create an acceptable profile for coatings. Galvanizer shall certify that performance will be met without blast cleaning and coating will be applied within 12 hours of galvanizing at the galvanizer's plant. If blasted, galvanizer shall certify that rugosity standards are met.
7. Primer shall meet or exceed the following performance criteria:

    a. Abrasion Resistance per ASTM D 4060 (CS17 Wheel, 1,000 grams load),1kg Load: 200 mg loss.
    b. Adhesion per ASTM D4541: 1050 psi.
    c. Corrosion Weathering per ASTM D5894, 13 Cycles, 4,368 Hours: Rating 10 per ASTM D714 for blistering; Rating 7 per ASTM D610 for rusting.
    d. Direct Impact Resistance per ASTM D2794: 160 in. lbs.
    e. Flexibility per ASTM D522, 180º Bend, 1 in. Mandrel: Passes.
    f. Pencil Hardness per ASTM D3363: 3B.
    g. Moisture Condensation Resistance per ASTM D4585, 100º F, 2000 Hours: Passes, no cracking or delamination.
    h. Dry Heat Resistance per ASTM D2485: 250º F.

8. Topcoat shall meet or exceed the following performance criteria:

    a. Abrasion Resistance per ASTM D 4060, CS17 Wheel, 1,000 Cycles 1kg Load: 87.1 mg loss.
    b. Adhesion per ASTM D 4541: 1050 psi.
    c. Direct Impact Resistance per ASTM D2794: >28 in. pounds.
    d. Indirect Impact Resistance per ASTM D2794: 12-14 in. pounds.
    e. Dry Heat Resistance per ASTM D2485: 200° F.
    f. Salt Fog Resistance per ASTM B 117 9,000 Hours: Rating 10 per ASTM D714 for blistering.
    g. Flexibility per ASTM D522, 180° Bend, 1/8 in. Mandrel: Passes.
    h. Pencil Hardness per ASTM D3363: 2H.
    i. Moisture Condensation Resistance per ASTM D4585, 100° F, 1000 Hours: No blistering or delamination Xenon Arc Test per ASTM D 4798: Pass 300 hours

2.27 STAINLESS-STEEL FINISHES

A. Remove tool and die marks and stretch lines or blend into finish.

B. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.

C. Bright, Directional Satin Finish: No. 4.

D. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

2.28 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. As-Fabricated Finish: AA-M10 (Mechanical Finish: as fabricated, unspecified).

C. 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 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag bolts, wood screws, and other connectors.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

F. Corrosion Protection: Coat concealed surfaces of steel that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of isolation coating.

3.2 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.

3.3 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

B. Anchor supports for operable partitions securely to and rigidly brace from building structure.

3.4 INSTALLING PIPE BOLLARDS

A. Anchor bollards to existing construction with anchor bolts. Provide four 3/4-inch bolts at each bollard unless otherwise indicated.

1. Embed anchor bolts at least 4 inches in concrete.

B. Fill bollards solidly with concrete, mounding top surface to shed water.

3.5 INSTALLING PIPE GUARDS

A. Provide pipe guards at exposed vertical pipes in parking garage where not protected by curbs or other barriers. Install by bolting to wall or column with expansion anchors. Provide four 3/4-inch bolts at each pipe guard. Mount pipe guards with top edge 26 inches above driving surface.

3.6 INSTALLING NOSINGS, TREADS, AND THRESHOLDS

A. Center nosings on tread widths.

B. For nosings embedded in concrete steps or curbs, align nosings flush with riser faces and level with tread surfaces.

C. Seal thresholds exposed to exterior with elastomeric sealant complying with Section 079200 - JOINT SEALANTS to provide a watertight installation.

3.7 INSTALLING CAST-IRON WHEEL GUARDS

A. Anchor wheel guards to concrete or masonry construction to comply with manufacturer's written instructions. Fill cores solidly with concrete.

3.8 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. Touch-Up and Repair for Galvanized Surfaces: For damaged and field-welded metal coated surfaces, clean welds, bolted connections and abraded areas.

1. For galvanized surfaces, apply organic zinc repair paint complying with requirements of ASTM A 780, modified to 95 percent zinc in dry film. Thickness of applied galvanizing repair paint shall be not less than coating thickness required by ASTM A 123 or A 153 as applicable. Touch-up of galvanized surfaces with silver paint, brite paint, or aluminum paints is not acceptable.
2. For factory-applied finish coatings, field-touch-up shall be performed by factory approved personnel. Touch-up shall be such that repair is not visible from a distance of 6 feet.
3. A touch-up repair kit or touchup instructions shall be provided to the Owner for each type of factory-applied finish.

END OF SECTION

SECTION 055013

SITE MISCELLANEOUS METAL FABRICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Unit Paving Edge Retainers
2. Miscellaneous Structural Steel
3. Miscellaneous Retention Steel Plates and Angles
4. Bearing or Leveling Plates

B. Products furnished, but not installed, under this Section:

1. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.
2. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.

C. Related Sections:

1. Section 044213 “Stone Slabs, Blocks and Boulders”.
2. Section 055214 “Site Guard and Hand Railings”
3. Section 057013 “Site Ornamental Metal”.
4. Section 062013 “Site Finish Carpentry”.
5. Section 096341 “Site Stone Paving”.
6. Section 321313 “Landscape Architectural Concrete Paving”.
7. Section 321316 “Decorative Cement Concrete Paving”.
8. Section 321323 "Cast-in-Place Concrete for Landscape Elements".

1.3 PERFORMANCE REQUIREMENTS

A. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

1.4 SUBMITTALS

A. General: Refer to Division 01 for project submittal requirements and timelines. If provided in hardcopy submittal booklets submit each item in this Article in required copies with four (4) copies for review by Landscape Architect. Three (3) copies shall be returned (One for Client, one for Owner and one for Contractor) and one copy maintained by Landscape Architect.

Provide one (1) sets of Material Samples for review by the Landscape Architect unless requested otherwise.

B. Submittal Booklets: Each Submittal Booklet under this Section shall be tabbed into specific sections, containing clearly identified (through yellow highlighter or other specific identification methods) and legible information on the following information indicated in this Article.

C. Electronic Submittals: Electronic Submittal shall be provided in a single bound file, PDF format preferred, unless otherwise noted in Division 01.

D. Product Data: For the following:

1. Miscellaneous structural steel
2. Prefabricated building elements.
3. Paint products.

E. Shop Drawings: Show fabrication and installation details for all metal fabrications.

1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.

F. Mill Certificates: Signed by manufacturers of stainless-steel certifying that products furnished comply with requirements.

G. Welding certificates.

H. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.6, "Structural Welding Code - Stainless Steel."

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

1.7 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorages and steel weld plates and angles for casting into concrete. 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 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

2.2 FERROUS METALS

A. Recycled Content of Steel Products: Provide products with average recycled content of steel products complying with the Landscape Architects requirements for steel.

B. Unless otherwise specified by the structural engineer, provide steel complying with the following:

1. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
2. Steel Tubing: ASTM A 500, cold-formed steel tubing.

2.3 FASTENERS

A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use.

B. Anchors, General: Anchors capable of sustaining, 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.

C. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; 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, all hot-dip galvanized per ASTM F 2329.

2.4 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.

C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

D. Nonshrink, Metallic Grout: Factory-packaged, ferrous-aggregate grout complying with ASTM C 1107, specifically recommended by manufacturer for heavy-duty exterior loading applications.

E. Concrete: Comply with requirements in Division 03 Section "Landscape Cast-in-Place Concrete" for normal-weight, air-entrained, concrete with a minimum 28-day compressive strength of 3000 psi.

2.5 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. 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.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work with accurate angles and surfaces and straight edges.

E. 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.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.

G. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

I. 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.

1. 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.

2.6 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.

C. Galvanize miscellaneous framing and supports where indicated.

D. Prime miscellaneous framing and supports with zinc-rich primer where indicated.

2.7 UNIT PAVER RETAINERS

A. Fabricate retainers from steel angles or plates of sizes indicated and for attachment to concrete framing or slabs. Provide slotted holes as indicated on the drawings for noted field adjustments.

1. Provide mitered and welded units at corners.
2. Provide open joints in retainers at expansion and control joints. Make open joint approximately 1/2 inch larger than expansion or control joint to each side of joint.

B. Galvanize retainers after all holes, slots or punches have been applied to unit.

C. Furnish wedge-type concrete inserts, complete with fasteners, to attach retainers to cast-in-place concrete.

2.8 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.

C. Prime plates with zinc-rich primer.

2.9 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 no fewer than two integrally welded steel strap anchors for embedding in concrete.

2.10 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish metal fabrications after assembly.

C. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.11 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.

1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.

B. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.

1. Shop prime with zinc-rich primer as indicated.

C. Preparation for Shop Priming: Prepare surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning requirements indicated below:

1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

D. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting..

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

PART 3 - EXECUTION

3.1 EXAMINATION

A. NO WORK UNDER THIS SECTION SHALL COMMENCE UNTIL SUBMITTALS UNDER THIS SECTION HAVE BEEN REVIEWED ACCORDINGLY BY THE LANDSCAPE ARCHITECT.

B. Prior to commencing Work under this Section, Contractor shall examine previously installed Work from other trades and verify that such Work is complete and to the point where Work herein may commence properly. Do not proceed with Work until unsatisfactory conditions have been corrected.

C. Contractor shall notify the Landscape Architect, in writing, on the anticipated commencement date and length of duration of the Work installation herein this section.

3.2 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

F. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

G. Install pipe or bent steel columns on concrete footings with grouted baseplates. Position and grout column baseplates as specified in "Installing Bearing and Leveling Plates" Article.

3.3 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. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.4 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 to be identified and addressed as required immediately to lessen oxidation or decommission of metals.

C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION

SECTION 055100

METAL STAIRS AND RAILINGS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Preassembled steel stairs with concrete filled treads.
2. Steel railings, handrails and guardrails, interior and exterior.
3. Steel mesh infill panels.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 055000 - METAL FABRICATIONS for metal treads and nosings not installed in metal stairs.
2. Section 057300 - DECORATIVE METAL RAILINGS for aluminum, stainless steel and glass railings.
3. Section 061000 - ROUGH CARPENTRY for wood blocking for anchoring railings.
4. Section 092110 - GYPSUM BOARD ASSEMBLIES for metal backing for anchoring railings.
5. Section 099000 - PAINTING AND COATING for field painting work of this section.

1.3 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design stairs and railings, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance of Stairs: Provide metal stairs capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Uniform Load and Concentrated Loads: As required by Code.
2. Stair Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.
3. Limit deflection of treads, platforms, and framing members to L/360 or 1/4 inch, whichever is less.

C. Structural Performance of Railings: Provide railings capable of withstanding the effects of gravity loads and Code required loads and stresses within limits and under conditions indicated.

D. Seismic Performance: Provide metal stairs capable of withstanding the effects of earthquake motions determined according to Code.

1.4 SUBMITTALS

A. Product Data: For each product.

1. Manufacturer's product lines of railings assembled from standard components.
2. Grout, anchoring cement, and paint products.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Provide templates for anchors and bolts specified for installation under other Sections.
2. Shop drawings shall be signed and sealed by a professional engineer currently licensed in the project location.

C. Delegated-Design Submittal: For stairs and railings indicated to comply with performance requirements and design criteria, including structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

D. Welding certificates.

E. Qualification Data: For professional engineer.

1.5 QUALITY ASSURANCE

A. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data by a qualified professional engineer.

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

C. Installer Qualifications: Fabricator of products.

D. NAAMM Stair Standard: Comply with "Recommended Voluntary Minimum Standards for Fixed Metal Stairs" in NAAMM AMP 510, "Metal Stairs Manual," for class of stair designated, unless more stringent requirements are indicated.

1. Preassembled Stairs: Commercial class.
2. Industrial Type Stairs: Industrial class.
3. Ornamental Stairs: Architectural class.

E. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."
2. AWS D1.3, "Structural Welding Code--Sheet Steel."
3. AWS D1.6, "Structural Welding Code--Stainless Steel."

1.6 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorages for metal stairs. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

C. Coordinate locations of hanger rods and struts with other work so that they will not encroach on required stair width and will be within the fire-resistance-rated stair enclosure.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces, unless otherwise indicated. For components exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

2.2 FERROUS METALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Steel Tubing: ASTM A 500 (cold formed) or ASTM A 513, Type 5 (mandrel drawn).

C. Steel Bars for Grating Treads: ASTM A 36/A 36M or steel strip, ASTM A 1011/A 1011M or ASTM A 1018/A 1018M.

D. Wire Rod for Grating Crossbars: ASTM A 510.

E. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.

F. Uncoated, Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M either commercial steel, Type B, or structural steel, Grade 30, unless another grade is required by design loads.

G. Galvanized Steel Sheet: ASTM A 653/A 653M, G90 coating, either commercial steel, Type B, or structural steel, Grade 33, unless another grade is required by design loads.

H. Woven-Wire Mesh, Carbon Steel: Intermediate-crimp, square pattern, 2-inch woven-wire mesh, made from 0.135-inch nominal diameter wire complying with ASTM A 510.

2.3 FASTENERS

A. General: Provide zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 25 for exterior use, and Class Fe/Zn 5 where built into exterior walls. Select fasteners for type, grade, and class required.

2.4 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Shop Primers: Provide primers that comply with Section 099000 - PAINTING AND COATING.

C. Zinc-Rich Primer: Complying with SSPC-Paint 20 or SSPC-Paint 29 and compatible with topcoat.

1. Provide interior, field-applied primer with a VOC content of 250 g/L or less.

D. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

1. Provide interior, field-applied primer with a VOC content of 250 g/L or less.

E. Isolation Coating (Bituminous Paint): ASTM D 1187, cold-applied asphalt emulsion, VOC compliant, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

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.

1. Basis of Design: Sika; SikaGrout 212.
2. VOC Content: 0 g/L.

G. Concrete Materials and Properties: Comply with requirements in Section 033000 - CAST-IN-PLACE CONCRETE for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi, unless otherwise indicated.

2.5 FABRICATION, GENERAL

A. Provide complete stair assemblies, including metal framing, hangers, struts, railings, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.

1. Join components by welding, unless otherwise indicated.
2. Use connections that maintain structural value of joined pieces.
3. Fabricate treads and platforms of exterior stairs so finished walking surfaces slope to drain.

B. Preassembled Stairs: Assemble stairs in shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch, unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

D. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

E. Form exposed work true to line and level with accurate angles and surfaces and straight edges.

F. Weld connections 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. Weld exposed corners and seams continuously, unless otherwise indicated.
5. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

G. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise indicated. Locate joints where least conspicuous.

H. Comply with “Guideline 1: Joint Finishes”, by National Ornamental & Miscellaneous Metals Association (NOMMA), as follows:

1. Typical Railing: Type 2 or better, unless otherwise indicated.
2. Service Stair Railing: Type 3 or better, unless otherwise indicated.
3. Ornamental Railing: Type 1.

I. Fabricate joints that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

2.6 STEEL-FRAMED STAIRS

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. Alfab, Inc.
2. American Stair, Inc.
3. Worthington Metal Fabricators, formerly Sharon Companies Ltd. (The).

B. Stair Framing:

1. Fabricate stringers of steel plates or channels. Provide closures for exposed ends of stringers.
2. Construct platforms of steel plate or channel headers and miscellaneous framing members as needed to comply with performance requirements.
3. Weld stringers to headers; weld framing members to stringers and headers.
4. Where stairs are enclosed by gypsum board or shaft-wall assemblies, provide hanger rods or struts to support landings from floor construction above or below. Locate hanger rods and struts where they will not encroach on required stair width and will be within the fire-resistance-rated stair enclosure.
5. Where masonry walls support metal stairs, provide temporary supporting struts designed for erecting steel stair components before installing masonry.

C. Metal-Pan Stairs: Form risers, subtread pans, and subplatforms to configurations shown from steel sheet of thickness needed to comply with performance requirements but not less than 0.0677 inch.

1. Steel Sheet: Uncoated hot-rolled steel sheet, unless otherwise indicated.
2. Directly weld metal pans to stringers; locate welds on top of subtreads where they will be concealed by concrete fill. Do not weld risers to stringers.
3. Shape metal pans to include nosing integral with riser.
4. Provide subplatforms of configuration indicated or, if not indicated, the same as subtreads. Weld subplatforms to platform framing.

D. Metal Bar-Grating Stairs: Form treads and platforms to configurations shown from metal bar grating; fabricate to comply with NAAMM MBG 531, "Metal Bar Grating Manual."

1. Fabricate treads and platforms from welded steel grating with openings in gratings no more than 1/2 inch in least dimension.
2. Surface: Serrated.
3. Finish: Galvanized.
4. Fabricate grating treads with rolled-steel floor plate nosing and with steel angle or steel plate carrier at each end for stringer connections. Secure treads to stringers with bolts.
5. Fabricate grating platforms with nosing matching that on grating treads. Provide toeplates at open-sided edges of grating platforms. Weld grating to platform framing.

2.7 STEEL RAILINGS

A. General: Fabricate railings to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of tube, post spacings, and anchorage, but not less than that needed to withstand indicated loads.

B. Welded Connections: Fabricate railings with welded connections. Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.

C. Form changes in direction of railings as detailed on the Drawings.

D. Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

E. Close exposed ends of railing members with prefabricated end fittings.

F. Provide wall returns at ends of wall-mounted handrails, unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch or less.

G. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, end closures, flanges, miscellaneous fittings, and anchors for interconnecting components and for attaching to other work. Furnish inserts and other anchorage devices for connecting to concrete or masonry work.

1. Connect posts to stair framing by direct welding, unless otherwise indicated.
2. For galvanized railings, provide galvanized fittings, brackets, fasteners, sleeves, and other ferrous-metal components.
3. For nongalvanized railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves, except galvanize anchors embedded in exterior masonry and concrete construction.

H. Fillers: Provide fillers made from steel plate, or other suitably crush-resistant material, where needed to transfer wall bracket loads through wall finishes to structural supports. Size fillers to suit wall finish thicknesses and to produce adequate bearing area to prevent bracket rotation and overstressing of substrate.

2.8 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish metal stairs after assembly.

2.9 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.
3. Fill vent and drain holes that will be exposed in finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.
4. Handrails: Galvanizing shall exhibit a rugosity (smoothness) not greater than 4 rug (16-20 microns of variation) when measured by a profilometer over a 1 inch straight line on the surface of the railings.

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 products:

1. Exterior Stairs (SSPC Zone 1B): SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
2. Interior Stairs (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."

C. Apply shop primer to uncoated surfaces of metal stair components, 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.

2.10 STAINLESS-STEEL FINISHES

A. Remove tool and die marks and stretch lines or blend into finish.

B. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.

C. Bright, Directional Satin Finish: No. 4.

D. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.

C. Install metal stairs by welding stair framing to steel structure or to weld plates cast into concrete, unless otherwise indicated.

D. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

E. 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.

F. 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.

G. Place and finish concrete fill for treads and platforms to comply with Section 033000 - CAST-IN-PLACE CONCRETE.

1. Install abrasive nosings with anchors fully embedded in concrete. Center nosings on tread width.

3.2 INSTALLING STEEL RAILINGS

A. Adjust railing systems before anchoring to ensure matching alignment at abutting joints. Space posts at spacing indicated or, if not indicated, as required by design loads. Plumb posts in each direction. Secure posts and rail ends to building construction as follows:

1. Anchor posts to steel by welding directly to steel supporting members.
2. Anchor handrail ends to concrete and masonry with steel round flanges welded to rail ends and anchored with postinstalled anchors and bolts.

B. Attach handrails to wall with wall brackets. Provide bracket with 1-1/2-inch clearance from inside face of handrail and finished wall surface. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads. Secure wall brackets to building construction as follows:

1. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt.
2. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
3. For hollow masonry anchorage, use toggle bolts.
4. For wood stud partitions, use hanger or lag bolts set into wood backing between studs. Coordinate with carpentry work to locate backing members.
5. For steel-framed gypsum board assemblies, fasten brackets directly to steel framing or concealed steel reinforcements using self-tapping screws of size and type required to support structural loads.

3.3 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 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. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION

SECTION 055214

SITE GUARD AND HAND RAILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes materials, labor, apparatus, tools, equipment, temporary construction, transportation, and services necessary for and incidental to performing the proper completion of Work as required to make a complete metal Pipe and Tube Railing assemblies and installations, as shown on the Contract Drawings, and as specified herein this Section.

B. Work under this Section consists of, but is not necessarily limited to, furnishing and installing the following:

1. Stainless steel pipe, bar and tubular railings.

C. Related Documents: The following Documents contain requirements that relate to Work in this Section:

1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
2. Section 055013 “Site Miscellaneous Metal Fabrications".
3. Section 096341 “Site Stone Paving”.
4. Section 321313 “Landscape Architectural Cement Concrete Paving”.
5. Section 321316 “Decorative Concrete Paving”.

1.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design railings, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. General: In engineering railings to withstand structural loads indicated, determine allowable design working stresses of railing materials based on the following:

1. Steel: 72 percent of minimum yield strength.
2. Aluminum: The lesser of minimum yield strength divided by 1.65 or minimum ultimate tensile strength divided by 1.95.
3. Stainless Steel: 60 percent of minimum yield strength.

C. Structural Performance: Railings shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails and Top Rails of Guards:

a. Uniform load of 75 lb./ ft. applied in any direction.
b. Concentrated load of 200 lb. applied in any direction.
c. Uniform and concentrated loads need not be assumed to act concurrently.

2. Infill of Guards:

a. Concentrated load of 50 lb. applied horizontally on an area of 1 sq. ft.
b. Infill load and other loads need not be assumed to act concurrently.

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.

1. Temperature Change: 120 deg F ambient; 180 deg F, material surfaces.

E. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1.3 SUBMITTALS

A. General: Refer to Division 01 for project submittal requirements and timelines. If provided in hardcopy submittal booklets submit each item in this Article in required copies with four (4) copies for review by Landscape Architect. Three (3) copies shall be returned (One for Client, one for Owner and one for Contractor) and one copy maintained by Landscape Architect. Provide one (1) sets of Material Samples for review by the Landscape Architect unless requested otherwise.

B. Submittal Booklets: Each Submittal Booklet under this Section shall be tabbed into specific sections, containing clearly identified (through yellow highlighter or other specific identification methods) and legible information on the following information indicated in this Article.

C. Electronic Submittals: Electronic Submittal shall be provided in a single bound file, PDF format preferred, unless otherwise noted in Division 01.

D. Provide two (2) sets of Material Samples (if any) for review by the Landscape Architect.

E. Submittals under this Article will be rejected and returned without the benefit of review by the Landscape Architect if they are difficult to read due to insufficient scale, poor image quality, or poor drafting quality; or if all of the required information is missing or not presented in the format as requested.

F. Product Data: For the following:

1. Manufacturer's product lines of mechanically connected railings.
2. Fabricator’s product lines of welded, connected railings.
3. Railing brackets.
4. Grout, anchoring cement, and paint products.

G. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

H. Samples for Initial Selection: For products involving selection of color, texture, or design, including mechanical finishes on stainless steel.

I. Samples for Verification: For each type of exposed finish required.

1. Sections of each distinctly different linear railing member, including handrails, top rails, posts, and balusters.
2. Fittings and brackets.

3. Assembled Sample of railing system, made from full-size components, including top rail, post, handrail, and infill. Sample need not be full height.

    a. Show method of finishing connecting members at intersections.

J. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified professional engineer testing agency.

B. Mill Certificates: Signed by manufacturers of stainless-steel products certifying that products furnished comply with requirements.

C. Welding certificates.

D. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.

E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, according to ASTM E 894 and ASTM E 935.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of railing from single source from single manufacturer.

B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

C. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
3. AWS D1.6, "Structural Welding Code - Stainless Steel."

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and step systems and other construction contiguous with metal fabrications by field measurements before fabrication.

1.7 COORDINATION AND SCHEDULING

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorages for railings. 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.

C. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

2.2 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.

2.3 STEEL AND IRON

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Tubing: ASTM A 500 (cold formed)

C. Pipe: ASTM A 53/A 53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.

1. Provide galvanized finish for exterior installations and where indicated.

D. Plates, Shapes, and Bars: ASTM A 36/A 36M.

2.4 STAINLESS STEEL

A. Tubing: ASTM A 554, Grade MT 304.

B. Pipe: ASTM A 312/A 312M, Grade TP 304.

C. Castings: ASTM A 743/A 743M, Grade CF 8 or CF 20.

D. Plate and Sheet: ASTM A 240/A 240M or ASTM A 666, Type 316L.

2.5 FASTENERS

A. General: Provide the following:

1. Ungalvanized-Steel Railings: Plated steel fasteners complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5 for zinc coating.
2. Hot-Dip Galvanized Railings: Type 304 stainless-steel or hot-dip zinc-coated steel fasteners complying with ASTM A 153/A 153M or ASTM F 2329 for zinc coating.
3. Aluminum Railings: Type 304 stainless-steel fasteners.
4. Stainless-Steel Railings: Type 304 stainless-steel fasteners.

B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.

C. Fasteners for Interconnecting Railing Components:

1. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless otherwise indicated.
2. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless exposed fasteners are unavoidable or are the standard fastening method for railings indicated.
3. Provide tamper-resistant flat-head machine screws for exposed fasteners unless otherwise indicated.

D. Post-Installed Anchors: Torque-controlled expansion anchors capable of sustaining, 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 Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.
2. Material for Exterior Locations and Where Stainless Steel is Indicated: Alloy Group 1 (A1) stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.

2.6 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

1. For [aluminum] [and] [stainless-steel] railings, provide type and alloy as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.

B. Low-Emitting Materials: Paints and coatings shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Etching Cleaner for Galvanized Metal: Complying with MPI#25.

D. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

E. Shop Primers: Provide primers that comply with Section 09 9113 "Exterior Painting".

F. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.

1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

G. Shop Primer for Galvanized Steel: Water based galvanized metal primer complying with MPI#134.

H. Epoxy Intermediate Coat: Complying with MPI #77 and compatible with primer and topcoat.

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

a. Those approved by Landscape Architect submitted by contractor.

I. 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.

J. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.

1. Water-Resistant Product: At exterior locations provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior use.

2.7 FABRICATION

A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.

B. Assemble railings 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.

C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

D. Form work true to line and level with accurate angles and surfaces.

E. Fabricate connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.

G. Connections: Fabricate railings with either welded or non-welded connections unless otherwise indicated.

H. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.

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 flux immediately.
4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.

I. Welded Connections for Aluminum Pipe: Fabricate railings to interconnect members with concealed internal welds that eliminate surface grinding, using manufacturer's standard system of sleeve and socket fittings.

J. Nonwelded Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.

1. Fabricate splice joints for field connection using an epoxy structural adhesive if this is manufacturer's standard splicing method.

K. Form changes in direction as follows:

1. As detailed.
2. Or approved by submittal shop drawings.

L. Bend 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 of components.

M. Close exposed ends of railing members with prefabricated end fittings.

N. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch or less.

O. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.

1. At brackets and fittings fastened to plaster or gypsum board partitions, provide crush-resistant fillers, or other means to transfer loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.

P. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.

Q. For railing posts set in concrete, provide stainless-steel sleeves not less than 6 inches long with inside dimensions not less than 1/2 inch greater than outside dimensions of post, with metal plate forming bottom closure.

2.8 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.

2.9 STEEL AND IRON FINISHES

A. Galvanized Railings:

1. Hot-dip galvanize exterior steel and iron railings, including hardware, after fabrication.
2. Hot-dip galvanize indicated steel and iron railings, including hardware, after fabrication.
3. Comply with ASTM A 123/A 123M for hot-dip galvanized railings.
4. Comply with ASTM A 153/A 153M for hot-dip galvanized hardware.
5. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
6. Fill vent and drain holes that will be exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.

B. For galvanized railings, provide hot-dip galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.

C. Preparing Galvanized Railings for Shop Priming: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with etching cleaner.

D. For nongalvanized steel railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves, except galvanize anchors to be embedded in exterior concrete or masonry.

E. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with requirements indicated below:

1. Exterior Railings: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
2. Railings Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
3. Railings Indicated to Receive Primers Specified in Section 099600 "High-Performance Coatings": SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
4. Other Railings: SSPC-SP 3, "Power Tool Cleaning."

F. Primer Application: Apply shop primer to prepared surfaces of railings unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.

G. Shop-Painted Finish: Comply with Section 099113 "Exterior Painting."

1. Color: As selected by Architect from manufacturer's full range.

H. High-Performance Coating: Apply epoxy intermediate and polyurethane topcoats to prime-coated surfaces. Comply with coating manufacturer's written instructions and with requirements in SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting. Apply at spreading rates recommended by coating manufacturer.

1. Color selected by Architect from manufacturer's full range.

2.10 STAINLESS-STEEL FINISHES

A. Remove tool and die marks and stretch lines, or blend into finish.

B. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.

C. 180-Grit Polished Finish: Oil-ground, uniform, directionally textured finish.

D. 320-Grit Polished Finish: Oil-ground, uniform, fine, directionally textured finish.

E. Polished and Buffed Finish: Oil-ground, 180-grit finish followed by buffing.

F. Directional Satin Finish: No. 4.

G. Dull Satin Finish: No. 6.

H. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

PART 3 - EXECUTION

3.1 EXAMINATION

A. NO WORK UNDER THIS SECTION SHALL COMMENCE UNTIL SUBMITTALS UNDER THIS SECTION HAVE BEEN REVIEWED ACCORDINGLY BY THE LANDSCAPE ARCHITECT.

B. Prior to commencing Work under this Section, Contractor shall examine previously installed Work from other trades and verify that such Work is complete and to the point where Work herein may commence properly. Do not proceed with Work until unsatisfactory conditions have been corrected.

C. Contractor shall notify the Landscape Architect, in writing, on the anticipated commencement date and length of duration of the Work installation herein this section.

D. Examine concrete and stone assemblies, where reinforced, to verify that locations of reinforcements have been clearly marked for Installer and placed such that coring for installations will not compromise reinforcements. Locate reinforcements and mark locations if not already done. Contact landscape Architect if conflicts arise.

3.2 INSTALLATION, GENERAL

A. Fit exposed connections together to form tight, hairline joints.

B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.

1. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
2. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.

C. Corrosion Protection: Coat concealed surfaces of aluminum that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

D. Adjust railings before anchoring to ensure matching alignment at abutting joints.

E. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.3 RAILING CONNECTIONS

A. Nonwelded Connections: Use mechanical or adhesive joints for permanently connecting railing components. Seal recessed holes of exposed locking screws using plastic cement filler colored to match finish of railings.

B. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article whether welding is performed in the shop or in the field.

C. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending 2 inches beyond joint on either side, fasten internal sleeve securely to one side, and locate joint within 6 inches of post.

3.4 ANCHORING POSTS

A. Use metal sleeves preset and anchored into concrete for installing posts. After posts have been inserted into sleeves, fill annular space between post and sleeve with non-shrink, nonmetallic grout mixed and placed to comply with anchoring material manufacturer's written instructions.

B. Form or core-drill holes not less than 5 inches deep and 3/4 inch larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with non-shrink, nonmetallic grout mixed and placed to comply with anchoring material manufacturer's written instructions.

C. Cover anchorage joint with flange of same metal as post.

D. Leave anchorage joint exposed with anchoring material flush with adjacent surface.

E. Anchor posts to metal surfaces with oval flanges, angle type, or floor type as required by conditions, connected to posts and to metal supporting members as follows:

1. For aluminum pipe railings, attach posts using fittings designed and engineered for this purpose.
2. For stainless-steel pipe railings, weld flanges to post and bolt to supporting surfaces.
3. For steel pipe railings, weld flanges to post and bolt to metal supporting surfaces.

F. Install removable railing sections, where indicated, in slip-fit metal sockets cast in concrete.

3.5 ATTACHING RAILINGS

A. Anchor railing ends at walls with round flanges anchored to wall construction and per details.

B. Anchor railing ends to metal surfaces with flanges bolted to metal surfaces and per details.

C. Attach railings to wall with wall brackets. Provide brackets with 1-1/2-inch clearance from inside face of handrail and finished wall surface. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.

D. Secure wall brackets and railing end flanges to building construction as follows:

1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
2. For hollow masonry anchorage, use toggle bolts.

3. For wood stud partitions, use hanger or lag bolts set into studs or wood backing between studs. Coordinate with carpentry work to locate backing members.
4. For steel-framed partitions, use hanger or lag bolts set into fire-retardant-treated wood backing between studs. Coordinate with stud installation to locate backing members.
5. For steel-framed partitions, use self-tapping screws fastened to steel framing or to concealed steel reinforcements.
6. For steel-framed partitions, use toggle bolts installed through flanges of steel framing or through concealed steel reinforcements.

3.6 ADJUSTING AND CLEANING

A. Clean [aluminum] [and] [stainless steel] by washing thoroughly with clean water and soap and rinsing with clean water.

B. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed 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.

C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

3.7 PROTECTION

A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

END OF SECTION

SECTION 055300

METAL GRATINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Metal bar gratings at areaways.
2. Metal frames and supports for gratings.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 051200 - STRUCTURAL STEEL FRAMING for structural-steel framing system components.
2. Section 055100 - METAL STAIRS AND RAILINGS for stairs fabricated with metal bar grating treads and platforms

1.3 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design gratings, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Gratings shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated.

1. Floors: Uniform load of 250 lbf/sq. ft. or concentrated load of 3000 lbf, whichever produces the greater stress.
2. Sidewalks and Vehicular Driveways, Subject to Trucking: Uniform load of 250 lbf/sq. ft. or concentrated load of 8000 lbf, whichever produces the greater stress.
3. Limit deflection to L/360 or 1/4 inch, whichever is less.

C. Seismic Performance: Provide gratings capable of withstanding the effects of earthquake motions determined according to ASCE/SEI 7.

1.4 SUBMITTALS

A. Product Data: For each product.

1. Including clips and anchorage devices for gratings.

2. Paint products.

B. Shop Drawings: Include plans, sections, details, and attachments to other work.

C. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

D. Qualification Data: For qualified professional engineer.

E. Mill Certificates: Signed by manufacturers of stainless-steel sheet certifying that products furnished comply with requirements.

F. Welding certificates.

G. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.

1.5 QUALITY ASSURANCE

A. Metal Bar Grating Standards: Comply with NAAMM MBG 531, "Metal Bar Grating Manual" and NAAMM MBG 532, "Heavy-Duty Metal Bar Grating Manual."

B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

C. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.3, "Structural Welding Code - Sheet Steel."

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with gratings by field measurements before fabrication.

1.7 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorages for gratings, grating frames, and supports. 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 FERROUS METALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Steel Bars for Bar Gratings: ASTM A 36/A 36M or steel strip, ASTM A 1011/A 1011M or ASTM A 1018/A 1018M.

C. Wire Rod for Bar Grating Crossbars: ASTM A 510.

D. Uncoated Steel Sheet: ASTM A 1011/A 1011M, structural steel, Grade 30.

E. Galvanized-Steel Sheet: ASTM A 653/A 653M, structural quality, Grade 33, with G90 coating.

F. Expanded-Metal Carbon Steel: ASTM F 1267, Class 1.

G. Expanded-Metal Galvanized Steel: ASTM F 1267, Class 2, Grade A.

2.2 FASTENERS

A. General: Unless otherwise indicated, provide Type 316 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.

1. Provide stainless-steel fasteners for fastening aluminum.
2. Provide stainless steel fasteners for fastening stainless steel.

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. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563; and, where indicated, flat washers.

1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.

D. Plain Washers: Round, ASME B18.22.1.

E. Lock Washers: Helical, spring type, ASME B18.21.1.

F. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors capable of sustaining, 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 Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.

2.3 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy that is welded.

B. Shop Primers: Provide primers that comply with Section 099000 - PAINTING AND COATING.

C. Zinc-Rich Primer: Complying with SSPC-Paint 20 or SSPC-Paint 29 and compatible with topcoat.

1. Provide interior, field-applied primer with a VOC content of 250 g/L or less.

D. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

1. Provide interior, field-applied primer with a VOC content of 250 g/L or less.

E. Isolation Coating (Bituminous Paint): ASTM D 1187, cold-applied asphalt emulsion, VOC compliant, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.4 FABRICATION

A. Shop Assembly: Fabricate grating sections in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Cut, drill, and punch material 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.

C. Form from materials of size, thickness, and shapes indicated, but not less than that needed to support indicated loads.

D. Fit exposed connections accurately together to form hairline joints.

E. Welding: Comply with AWS recommendations and 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.

F. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space the anchoring devices to secure gratings, frames, and supports rigidly in place and to support indicated loads.

1. Fabricate toeplates to fit grating units and weld to units in shop unless otherwise indicated.
2. Fabricate toeplates for attaching in the field.
3. Toeplate Height: 4 inches unless otherwise indicated.

2.5 METAL BAR GRATINGS

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

1. Alabama Metal Industries Corporation; a Gibraltar Industries company.
2. Fisher & Ludlow; Division of Harris Steel Limited.
3. IKG Industries; a division of Harsco Corporation.
4. Ohio Gratings, Inc.

B. Removable Grating Sections: Fabricate with banding bars attached by welding to entire perimeter of each section. Include anchors and fasteners of type indicated or, if not indicated, as recommended by manufacturer for attaching to supports.

C. Fabricate cutouts in grating sections for penetrations indicated. Arrange cutouts to permit grating removal without disturbing items penetrating gratings.

1. Edge-band openings in grating that interrupt four or more bearing bars with bars of same size and material as bearing bars.

D. Do not notch bearing bars at supports to maintain elevation.

E. Frames and Supports for Metal Gratings: Fabricate from metal shapes, plates, and bars of welded construction to sizes, shapes, and profiles indicated and as necessary to receive gratings. Miter and weld connections for perimeter angle frames. Cut, drill, and tap units to receive hardware and similar items.

1. Unless otherwise indicated, fabricate from same basic metal as gratings.
2. Equip units indicated to be cast into concrete or built into masonry with integrally welded anchors. Unless otherwise indicated, space anchors 24 inches o.c. and provide minimum anchor units in the form of steel straps 1-1/4 inches wide by 1/4 inch thick by 8 inches long.

F. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Finish gratings, frames, and supports after assembly.

G. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.

1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing gratings to in-place construction. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing gratings. Set units accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.

C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete or masonry.

D. Fit exposed connections accurately together to form hairline joints.

1. 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 for bolted or screwed field connections.

E. Attach toeplates to gratings by welding at locations indicated.

F. 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.

G. 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.

3.2 INSTALLING METAL BAR GRATINGS

A. General: Install gratings to comply with recommendations of referenced metal bar grating standards that apply to grating types and bar sizes indicated, including installation clearances and standard anchoring details.

B. Attach removable units to supporting members with type and size of clips and fasteners indicated or, if not indicated, as recommended by grating manufacturer for type of installation conditions shown.

C. Attach nonremovable units to supporting members by welding where both materials are same; otherwise, fasten by bolting as indicated above.

3.3 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 shop-painted surfaces.

1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 09 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

SECTION 057013

SITE ORNAMENTAL METAL

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 Bands

B. Related Sections:

1. Section 044213 “Stone Slabs, Blocks and Boulders”.
2. Section 055013 “Site Miscellaneous Metal Fabrication”.
3. Section 096341 “Site Stone Paving”.
4. Section 321313 “Landscape Architectural Concrete Paving”.
5. Section 321316 “Decorative Cement Concrete Paving”.
6. Section 321323 "Cast-in-Place Concrete for Landscape Elements".

1.3 PERFORMANCE REQUIREMENTS

A. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

1.4 SUBMITTALS

A. General: Refer to Division 01 for project submittal requirements and timelines. If provided in hardcopy submittal booklets submit each item in this Article in required copies with four (4) copies for review by Landscape Architect. Three (3) copies shall be returned (One for Client, one for Owner and one for Contractor) and one copy maintained by Landscape Architect. Provide one (1) sets of Material Samples for review by the Landscape Architect unless requested otherwise.

B. Submittal Booklets: Each Submittal Booklet under this Section shall be tabbed into specific sections, containing clearly identified (through yellow highlighter or other specific identification methods) and legible information on the following information indicated in this Article.

C. Electronic Submittals: Electronic Submittal shall be provided in a single bound file, PDF format preferred, unless otherwise noted in Division 01.

D. Product Data: For each product used in ornamental metal, including finishing materials and methods.

1. Include product data for sealers and joint caulking.

E. Shop Drawings: Show fabrication and installation of ornamental metal.

1. Include plans, elevations, component details, and attachments to other Work. Indicate materials and profiles of each ornamental metal member, fittings, joinery, finishes, fasteners, anchorages, and accessory items.

F. Samples for Initial Selection: Fabricator's samples showing the full range of colors and finish characteristics available for each item indicated below:

1. Ornamental metal bands

G. Samples for Verification: For each profile and pattern of fabricated metal and for each type of metal finish required, prepared on metal of same thickness and alloy indicated for the Work. If finishes involve normal color and texture variations, include sample sets, consisting of two or more units, showing the full range of variations expected.

1. Include 6-inch (6”) long samples of linear shapes.
2. Include full-size samples of anchorage materials, clamps, etc.

H. Welding Certificates: Copies of certificates for welding procedures and personnel.

I. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Arrange for installation of ornamental metal specified in this Section by the same firm that fabricated it.

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

C. Organic-Coating Applicator Qualifications: A firm experienced in successfully applying organic coatings of type indicated to aluminum extrusions and employing competent control personnel to conduct continuing, effective quality-control program to ensure compliance with requirements.

D. Anodic Finisher Qualifications: A firm experienced in successfully applying anodic finishes of type indicated and employing competent control personnel to conduct continuing, effective quality-control program to ensure compliance with requirements.

E. Testing Agency Qualifications: An independent testing agency with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548.

F. Welding Standards: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."

2. AWS D1.2, "Structural Welding Code--Aluminum."
3. AWS D1.3, "Structural Welding Code--Sheet Steel."

G. Mockups: Refer to Contract Drawings for Mock-up requirements or provide at minimum as noted below. Before installing ornamental metal bands construct 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 completed Work.

1. Locate mockups in the location indicated or, if not indicated, as directed by Landscape Architect.
2. Build mockups as follows:

    a. Refer to Contract Drawings for size and layout of mock-up and required setting locations.

3. Notify Architect 7 days in advance of the dates and times when mockups will be constructed.
4. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.

    a. Approval of mockups does not constitute approval of deviations from Contract Documents contained in mockups, unless such deviations are specifically approved by Architect in writing.
    b. Approved mockups in an undisturbed condition at the time of Substantial Completion may become part of the completed Work.

1.6 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 excelsior to ensure that products will not be cracked or otherwise damaged.

1.7 PROJECT CONDITIONS

A. Field Measurements: Where ornamental metal is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.8 COORDINATION

A. Coordinate installation of anchorages and steel structures 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. 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. Baldwin Metals Company, Inc.
2. Brasden Steel, Inc.
3. Quality Metal Works, LLC.
4. Others upon approval by Landscape Architect.

2.2 METALS

A. General: Provide metals free from surface blemishes where exposed to view in finished unit. Exposed-to-view surfaces exhibiting pitting, seam marks, roller marks, stains, discolorations, or other imperfections on finished units are not acceptable.

B. Stainless Steel: Grade and type designated below for each form required:

1. Tubing: ASTM A 554, Grade MT 304.
2. Tubing: ASTM A 554, Grade MT 316.
3. Sheet, Strip, Plate, and Flat Bar: ASTM A 666, Type 304.
4. Sheet, Strip, Plate, and Flat Bar: ASTM A 666, Type 316.
5. Bars and Shapes: ASTM A 276, Type 304.
6. Bars and Shapes: ASTM A 276, Type 316.

2.3 FERROUS METALS

A. Recycled Content of Steel Products: Provide products with average recycled content of steel products complying with the Landscape Architects requirements for steel.

B. Unless otherwise specified by the structural engineer, provide steel complying with the following:

1. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
2. Steel Tubing: ASTM A 500, cold-formed steel tubing.

2.4 MISCELLANEOUS MATERIALS

A. Welding Electrodes and Filler Metal: Type and alloy of filler metal and electrodes as recommended by producer of metal to be welded, complying with applicable AWS specifications, and as required for color match, strength, and compatibility in fabricated items.

B. Fasteners: Use fasteners of same basic metal as fastened metal, unless otherwise indicated. Do not use metals that are corrosive or incompatible with materials joined.

1. Provide concealed fasteners for interconnecting ornamental metal components and for attaching them to other work, unless otherwise indicated.
2. Provide concealed fasteners for interconnecting ornamental metal components and for attaching them to other work, unless exposed fasteners are unavoidable or are the standard fastening method.
3. Provide Phillips flat-head machine screws for exposed fasteners, unless otherwise indicated.

C. Cast-in-Place and Postinstalled Anchors: Anchors of type indicated below, 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.

1. Cast-in-place anchors.
2. Chemical anchors.
3. Expansion anchors.

D. 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.

E. Shop Primer for Galvanized Steel: Zinc-dust, zinc-oxide primer formulated for priming zinc-coated steel and for compatibility with finish paint systems indicated, and complying with SSPC-Paint 5.

2.5 FABRICATION, GENERAL

A. Form ornamental metal to required shapes and sizes, with true curves, lines, and angles. Provide components in sizes and profiles indicated, but not less than that needed to comply with requirements indicated for structural performance.

B. Provide necessary rebates, lugs, and brackets to assemble units and to attach to other work. Drill and tap for required fasteners, unless otherwise indicated. Use concealed fasteners where possible.

C. Comply with AWS for recommended practices in shop welding and brazing. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed joints of all flux, and dress all exposed and contact surfaces.

D. Mill joints to a tight, hairline fit. Cope or miter corner joints. Form joints exposed to weather to exclude water penetration.

E. 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.

F. Finish exposed surfaces to smooth, sharp, well-defined lines and arris.

G. 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.

2.6 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.

2.7 STAINLESS-STEEL FINISHES

A. Remove or blend tool and die marks and stretch lines into finish.

B. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.

C. Provide approved surface texture finish (submittals) over entire exposed plate surfaces.

D. Bright, Cold-Rolled, Unpolished Finish: No. 2B finish.

E. Bright, Directional Polish: No. 4 finish.

F. Satin, Directional Polish: No. 6 finish.

G. Satin, Reflective, Directional Polish: No. 7 finish.

H. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

2.8 IRON AND STEEL FINISHES

A. Galvanizing: Hot-dip galvanize products made from rolled, pressed, and forged steel shapes, castings, plates, bars, and strips indicated to be galvanized to comply with ASTM A 123.

1. Hot-dip galvanize iron and steel hardware indicated to be galvanized to comply with ASTM A 153/A 153M.

B. Fill vent and drain holes that will be exposed in finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.

C. Preparation for Shop Priming: After galvanizing, thoroughly clean ornamental metal of grease, dirt, oil, flux, and other foreign matter, and treat with metallic-phosphate process.

D. 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 ornamental metal:

1. Exteriors (SSPC Zone 1B): SSPC-SP 6, "Commercial Blast Cleaning."
2. Interiors (SSPC Zone 1A): SSPC-SP 7, "Brush-off Blast Cleaning."

E. Factory-Primed Finish: Apply air-dried primer immediately after cleaning and pretreatment, to provide a minimum dry film thickness of 2 mils (0.05 mm) per applied coat, to surfaces that will be exposed after assembly and installation, and to concealed, nongalvanized surfaces.

F. Powder-Coated Finish: Prepare, treat, and coat nongalvanized ferrous metal to comply with resin manufacturer's written instructions and as follows:

1. Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 6, "Commercial Blast Cleaning."
2. Treat prepared metal with iron-phosphate pretreatment, rinse, and seal surfaces.
3. Apply thermosetting polyester or acrylic urethane powder coating with cured-film thickness not less than 1.5 mils (0.04 mm).

G. Powder-Coated Finish: Prepare, treat, and coat galvanized metal to comply with resin manufacturer's written instructions and as follows:

1. Prepare galvanized metal by thoroughly removing grease, dirt, oil, flux, and other foreign matter.
2. Treat prepared metal with zinc-phosphate pretreatment, rinse, and seal surfaces.
3. Apply thermosetting polyester or acrylic urethane powder coating with cured-film thickness not less than 1.5 mils (0.04 mm).

PART 3 - EXECUTION

3.1 EXAMINATION

A. NO WORK UNDER THIS SECTION SHALL COMMENCE UNTIL SUBMITTALS UNDER THIS SECTION HAVE BEEN REVIEWED ACCORDINGLY BY THE LANDSCAPE ARCHITECT.

B. Prior to commencing Work under this Section, Contractor shall examine previously installed Work from other trades and verify that such Work is complete and to the point where Work herein may commence properly. Do not proceed with Work until unsatisfactory conditions have been corrected.

C. Contractor shall notify the Landscape Architect, in writing, on the anticipated commencement date and length of duration of the Work installation herein this section.

3.2 INSTALLATION, GENERAL

A. Provide anchorage devices and fasteners where necessary for securing 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 any 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.

1. Retain protective coverings intact; remove coverings simultaneously from similarly finished items to preclude non-uniform oxidation and discoloration.

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 aluminum that will be in contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and to prepare test reports if deemed appropriate.

B. Testing agency will report test results promptly and in writing to Contractor and Architect.

3.4 CLEANING

A. Clean aluminum and stainless steel by washing thoroughly with clean water and soap and rinsing with clean water.

B. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material.

C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

3.5 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 the 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

SECTION 057300

DECORATIVE METAL RAILINGS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Decorative metal (ornamental) railings.
2. Glass-supported railings.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 055100 - METAL STAIRS AND RAILINGS for other steel stairs, handrails, and guardrails.
2. Section 061000 - ROUGH CARPENTRY for wood blocking for anchoring railings.
3. Section 088000 - GLAZING for glass at decorative railings.
4. Section 092110 - GYPSUM BOARD ASSEMBLIES for metal backing for anchoring railings.

1.3 DEFINITIONS

A. Railings: Guards, handrails, and similar devices used for protection of occupants at open-sided floor areas, pedestrian guidance and support, visual separation, or wall protection.

1.4 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design railings, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. General: In engineering railings to withstand structural loads indicated, determine allowable design working stresses of railing materials based on the following:

1. Aluminum: The lesser of minimum yield strength divided by 1.65 or minimum ultimate tensile strength divided by 1.95.
2. Stainless Steel: 60 percent of minimum yield strength.
3. Steel: 72 percent of minimum yield strength.
4. Glass: 25 percent of mean modulus of rupture (50 percent probability of breakage), as listed in "Mechanical Properties" in AAMA's Aluminum Curtain Wall Series No. 12, "Structural Properties of Glass."

C. Structural Performance of Railings: Provide railings capable of withstanding the effects of gravity loads and Code required loads and stresses within limits and under conditions indicated.

1. Glass-Supported Railings: Support each section of top rail by a minimum of three glass panels or by other means so top rail will remain in place if any one panel fails.

D. Thermal Movements: Provide exterior railings that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

E. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1.5 SUBMITTALS

A. Product Data: For each product.

1. Manufacturer's product lines of railings assembled from standard components.
2. Grout, anchoring cement, and paint products.

B. Shop Drawings: Show layout, spacings, sizes, thicknesses, and types of metal railings; fabrication; and fastening and anchorage details, including mechanical fasteners. Include plans, elevations, sections, details, and attachments to other work.

C. Delegated-Design Submittal: For railing products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

D. Samples for Verification: For each type of exposed finish required.

1. Sections of each distinctly different linear railing member, including handrails, top rails, posts, and balusters.
2. Each type of glass required.
3. Fittings and brackets.
4. Welded connections.
5. Assembled Samples of railing systems, made from full-size components, including top rail, post, handrail, and infill. Show method of finishing members at intersections. Samples need not be full height.

E. Mill Certificates: Signed by manufacturers of stainless-steel products certifying that products furnished comply with requirements.

F. Welding certificates.

G. Qualification Data: For professional engineer.

1.6 QUALITY ASSURANCE

A. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data by a qualified professional engineer.

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

C. Installer Qualifications: Fabricator of products.

D. Source Limitations: Obtain each type of railing through one source from a single manufacturer.

E. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.2, "Structural Welding Code--Aluminum."
3. AWS D1.6, "Structural Welding Code--Stainless Steel."

F. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.

1. Build mockups for each form and finish of railing consisting of two posts, top rail, infill area, and anchorage system components that are full height and are not less than 24 inches in length.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with railings 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.

1.8 COORDINATION AND SCHEDULING

A. Coordinate installation of anchorages for railings. 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. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Aluminum Ornamental Railings:

a. Blum, Julius & Co., Inc.
b. Blumcraft, A Division of C.R. Laurence Co., Inc.
c. Braun, J. G., Company; a division of the Wagner Companies.
d. HDI Railing Systems.
e. Livers Bronze Co.
f. Wagner, R & B, Inc.; a division of the Wagner Companies.

2. Stainless-Steel Ornamental Railings:

a. Blum, Julius & Co., Inc.
b. Blumcraft, A Division of C.R. Laurence Co., Inc.
c. HDI Railing Systems.
d. Livers Bronze Co.
e. Wagner, R & B, Inc.; a division of the Wagner Companies.

3. Glass-Supported Railings:

a. Blum, Julius & Co., Inc.
b. Blumcraft, A Division of C.R. Laurence Co., Inc.
c. HDI Railing Systems.
d. Livers Bronze Co.

4. Stainless-Steel and Cable Ornamental Railings:

a. Cable Connection (The).
b. Carl Stahl DecorCable, Inc.
c. Feeney Wire Rope & Rigging.
d. Hayn Enterprises, LLC.
e. Johnson Marine Architectural Fittings.

2.2 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

B. Brackets, Flanges, and Anchors: Same metal and finish as supported rails, unless otherwise indicated.

1. Provide cast-metal brackets with flange tapped for concealed anchorage to threaded hanger bolt.
2. Provide either formed- or cast-metal brackets with predrilled hole for exposed bolt anchorage.

3. Provide extruded-aluminum brackets with interlocking pieces that conceal anchorage. Locate set screws on bottom of bracket.

2.3 ALUMINUM

A. Aluminum, General: Provide alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with strength and durability properties for each aluminum form required not less than that of alloy and temper designated below.

B. Extruded Bars and Shapes, Including Extruded Tubing: ASTM B 221/B 221M, Alloy 6063-T5/T52.

C. Extruded Structural Pipe and Round Tubing: ASTM B 429, Alloy 6063-T6.

1. Provide Standard Weight (Schedule 40) pipe, unless otherwise indicated.

D. Drawn Seamless Tubing: ASTM B 210, Alloy 6063-T832.

E. Plate and Sheet: ASTM B 209, Alloy 6061-T6.

F. Die and Hand Forgings: ASTM B 247, Alloy 6061-T6.

G. Castings: ASTM B 26/B 26M, Alloy A356.0-T6.

2.4 STAINLESS STEEL

A. Tubing: ASTM A 554, Grade MT 304 at interior locations and 316L at exterior locations.

B. Pipe: ASTM A 312, Grade TP 304 at interior locations and 316L at exterior locations.

C. Castings: ASTM A 743, Grade CF 8 or CF 20.

D. Plate and Sheet: ASTM A 666, Type 304 at interior locations and 316L at exterior locations.

E. Wire Rope: 1 x 19 wire rope made from wire complying with ASTM A 492, Type 316.

F. Wire-Rope Fittings: Connectors of types indicated, fabricated from stainless steel, and with capability to sustain, without failure, a load equal to minimum breaking strength of wire rope with which they are used.

2.5 STEEL AND IRON

A. Tubing: ASTM A 500/A 500M (cold formed) or ASTM A 513.

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. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M, unless otherwise indicated.

2.6 GLASS AND GLAZING MATERIALS

A. Glass: Provide as specified in Section 088000 - GLAZING; with polished and eased edges where exposed.

2.7 FASTENERS

A. General: Provide the following:

1. Aluminum Components: Type 316 stainless-steel fasteners.
2. Stainless-Steel Components: Type 316 stainless-steel fasteners.
3. Uncoated Steel Components: Plated-steel fasteners complying with ASTM B 633, Class Fe/Zn 25 for electrodeposited zinc coating where concealed; Type 304 stainless-steel fasteners where exposed.
4. Galvanized-Steel Components: Plated-steel fasteners complying with ASTM B 633, Class Fe/Zn 25 for electrodeposited zinc coating.
5. Dissimilar Metals: Type 316 stainless-steel fasteners.

B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.

C. Provide concealed fasteners for interconnecting railing components and for attaching railings to other work, unless exposed fasteners are the standard fastening method for railings indicated.

D. Anchors: Provide 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.

2.8 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

1. For aluminum railings, provide type and alloy as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.

B. Isolation Coating (Bituminous Paint): ASTM D 1187, cold-applied asphalt emulsion, VOC compliant, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

C. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

1. Basis of Design: Sika; SikaGrout 212.
2. VOC Content: 0 g/L.

2.9 FABRICATION

A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.

B. Assemble railings 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.

C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch, unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

D. Form work true to line and level with accurate angles and surfaces.

E. Fabricate connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.

G. Form changes in direction as detailed on the Drawings and as standard with system selected.

H. Comply with “Guideline 1: Joint Finishes”, by National Ornamental & Miscellaneous Metals Association (NOMMA), as follows:

1. Ornamental Railing: Type 1.

I. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work, unless otherwise indicated.

1. At brackets and fittings fastened to plaster or gypsum board partitions, provide fillers made from crush-resistant material, or other means to transfer wall loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.

J. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.

2.10 GLAZING PANEL FABRICATION

A. General: Fabricate to sizes and shapes required; provide for proper edge clearance and bite on glazing panels.

B. Structural Glass Balusters: Factory-bond glass to aluminum base and top-rail channels in railing manufacturer's plant using glazing cement to comply with manufacturer's written specifications, unless field glazing is standard with manufacturer.

C. Apply ceramic linework on glass to comply with GANA's "Engineering Standards Manual."

2.11 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 shipment.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.12 ALUMINUM FINISHES

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.

C. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.

1. Color: Black.

2.13 STAINLESS-STEEL FINISHES

A. Remove tool and die marks and stretch lines or blend into finish.

B. Grind and polish surfaces to produce uniform finish indicated, free of cross scratches.

1. Run grain of directionally textured finishes with long dimension of each piece.

C. Directional Satin Finish: No. 4.

D. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

2.14 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.
3. Fill vent and drain holes that will be exposed in finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.
4. Handrails: Galvanizing shall exhibit a rugosity (smoothness) not greater than 4 rug (16-20 microns of variation) when measured by a profilometer over a 1 inch straight line on the surface of the railings.

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 products:

1. Exterior Stairs (SSPC Zone 1B): SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
2. Interior Stairs (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."

C. Apply shop primer to uncoated surfaces of metal components, 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.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine plaster and gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements have been clearly marked for Installer. Locate reinforcements and mark locations if not already done.

3.2 INSTALLATION, GENERAL

A. Fit exposed connections together to form tight, hairline joints.

B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.

1. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
2. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.

C. Corrosion Protection: Coat concealed surfaces of aluminum and copper alloys that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

D. Adjust railings before anchoring to ensure matching alignment at abutting joints.

E. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.3 ANCHORING POSTS

A. Use steel pipe sleeves preset and anchored into concrete for installing posts. After posts have been inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions.

B. Form or core-drill holes not less than 5 inches deep and 3/4 inch larger than OD of post for installing posts in concrete. 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.

C. Cover anchorage joint with flange of same metal as post, attached to post with set screws.

D. Leave anchorage joint exposed; wipe off surplus anchoring material; and leave 1/8-inch buildup, sloped away from post.

E. Anchor steel posts to steel with flanges, angle or floor type as required by conditions, welded to posts and bolted to metal supporting members.

F. Anchor posts to metal surfaces with flanges, angle type, or floor type as required by conditions, connected to posts and to metal supporting members as follows:

1. For aluminum railings, attach posts as indicated using fittings designed and engineered for this purpose.
2. For stainless-steel railings, weld flanges to posts and bolt to metal-supporting surfaces.

G. Install removable railing sections, where indicated, in slip-fit metal sockets cast in concrete.

3.4 ANCHORING RAILING ENDS

A. Anchor railing ends to concrete and masonry as indicated on the drawings and anchored to wall construction with anchors and bolts.

B. Anchor railing ends to metal surfaces with flanges bolted to metal surfaces.

3.5 ATTACHING HANDRAILS TO WALLS

A. Attach handrails to walls with wall brackets. Provide brackets with 1-1/2-inch clearance from inside face of handrail and finished wall surface.

B. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.

C. Secure wall brackets to building construction as follows:

1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
2. For hollow masonry anchorage, use toggle bolts.
3. For wood stud partitions, use hanger or lag bolts set into wood backing between studs. Coordinate with carpentry work to locate backing members.
4. For steel-framed partitions, fasten brackets directly to steel framing or concealed steel reinforcements using self-tapping screws of size and type required to support structural loads.

3.6 INSTALLING GLASS PANELS

A. Glass-Supported Railings: Install assembly to comply with railing manufacturer's written instructions.

1. Attach base channel to building structure, then insert and connect factory-fabricated and -assembled glass panels.

    a. Support glass panels in base channel at quarter points with channel-shaped setting blocks that also act as shims to maintain uniform space for glazing cement. Fill remaining space in base channel with glazing cement for uniform support of glass.

2. Adjust spacing of glass panels so gaps between panels are equal before securing in position.
3. Erect glass railings under direct supervision of manufacturer's authorized technical personnel.

B. Post-Supported Glass Railings: Install assembly to comply with railing manufacturer's written instructions and with requirements in other Part 3 articles. Erect posts and other metal railing components, then set factory-cut glass panels. Do not cut, drill, or alter glass panels in field. Protect edges from damage.

3.7 CLEANING

A. Clean aluminum and stainless steel by washing thoroughly with clean water and soap, rinsing with clean water, and wiping dry.

B. Clean and polish glass.

3.8 PROTECTION

A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings 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 field to shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION

SECTION 057500

DECORATIVE FORMED METAL

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Column covers.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 055000 - METAL FABRICATIONS for non-ornamental metal fabrications.
2. Section 057300 - DECORATIVE METAL RAILINGS for ornamental metal railings.
3. Section 076100 - SHEET METAL ROOFING for items made of formed metal for roofing and for items made of formed metal for parapets and copings
4. Section 076200 - SHEET METAL FLASHING AND TRIM for items made of formed metal for flashings.

1.3 PERFORMANCE REQUIREMENTS

A. Structural Loads: Capable of withstanding the following structural loads without exceeding the allowable design working stress of materials involved, including anchors and connections, and without exhibiting permanent deformation in any components:

1. Wind Loads on Exterior Items: As indicated on Drawings.

B. Thermal Movements: Provide exterior ornamental formed-metal assemblies 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 joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

C. Corrosion Control: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated, including finishes.

B. Shop Drawings: Show fabrication and installation details for formed metal fabrications.

1. Include plans, elevations, sections, and details of formed metal fabrications and their connections. Show anchorage and accessory items.
2. Provide templates for anchors and bolts specified for installation under other Sections.
3. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer licensed in the jurisdiction where Project is located responsible for their preparation.
4. Where fabrications are to receive sprayed-on fireproofing, include statement that primer is compatible with fireproofing proposed for use.

C. Samples for Initial Selection: Manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, including mechanical finishes, and patterns available for each type of ornamental formed-metal product indicated.

D. Samples for Verification: For each type of exposed finish required, prepared on 6-inch-square samples of metal of same thickness and material indicated for the Work.

E. Welding certificates.

1.5 QUALITY ASSURANCE

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

1. Engineering Responsibility: Preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.

B. Anodic Finisher Qualifications: A firm experienced in successfully applying anodic finishes of type indicated and employing competent control personnel to conduct continuing, effective quality-control program to ensure compliance with requirements.

C. Source Limitations: Obtain each ornamental formed-metal item through one source from a single manufacturer.

D. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.2, "Structural Welding Code - Aluminum."
2. AWS D1.6, "Structural Welding Code - Stainless Steel."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver ornamental formed-metal products wrapped in protective coverings and strapped together in suitable packs or in heavy-duty cartons. Remove protective coverings before they stain or bond to finished surfaces.

B. Store products on elevated platforms in a dry location.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls, columns, beams, and other construction contiguous with ornamental formed metal by field measurements before fabrication and indicate measurements on Shop Drawings.

1.8 COORDINATION

A. Coordinate installation of anchorages for ornamental formed-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.

B. Coordinate installation of ornamental formed metal with adjacent construction to ensure that wall assemblies, flashings, trim, and joint sealants, are protected against damage from the effects of weather, age, corrosion, and other causes.

PART 2 - PRODUCTS

2.1 SHEET METAL

A. General: Provide sheet metal without pitting, seam marks, roller marks, stains, discolorations, or other imperfections where exposed to view on finished units.

B. Aluminum Sheet: Flat sheet complying with ASTM B 209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than strength and durability properties of alloy 5005-H32.

C. Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304 for interior and Type 316 for exterior, stretcher-leveled standard of flatness.

2.2 MISCELLANEOUS MATERIALS

A. Gaskets: As required to seal joints in ornamental formed metal and remain weathertight; and as recommended in writing by ornamental formed-metal manufacturer.

1. ASTM D 1056, Type 1, Class A, grade as recommended by gasket manufacturer to obtain seal for application indicated.
2. Closed cell polyurethane foam, adhesive on two sides, release paper protected.

B. Filler Metal and Electrodes: Provide type and alloy of filler metal and electrodes as recommended by producer of metal to be welded or brazed and as necessary for strength, corrosion resistance, and compatibility in fabricated items.

1. Use filler metals that will match the color of metal being joined and will not cause discoloration.

C. Fasteners: Use fasteners fabricated from same basic metal and alloy as fastened metal, unless otherwise indicated. Do not use metals that are corrosive or incompatible with materials joined.

1. Provide concealed fasteners for interconnecting ornamental formed-metal items and for attaching them to other work.
2. Provide Phillips flat-head machine screws for exposed fasteners, unless otherwise indicated.

D. Structural Anchors: For applications indicated to comply with certain design loads, provide 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.

E. Nonstructural Anchors: For applications not indicated to comply with design loads, provide anchors of type, size, and material necessary for type of load and installation indicated, as recommended by manufacturer, unless otherwise indicated. Use nonferrous-metal or hot-dip galvanized anchors for exterior installations and elsewhere as needed for corrosion resistance.

F. Sound-Deadening Materials:

1. Insulation: Unfaced, mineral-fiber blanket insulation complying with ASTM C 665, Type I, and passing ASTM E 136 test.
2. Mastic: Cold-applied asphalt emulsion complying with ASTM D 1187.

G. Backing Materials: Provided or recommended by ornamental formed-metal manufacturer.

H. Laminating Adhesive: Compatible with substrate; noncombustible after curing.

1. Contact Adhesive: VOC content of not more than 80 g/L when calculated according to 40 CFR 59, Subpart D (EPA method 24).
2. Metal-to-Metal Adhesive: VOC content of not more than 30 g/L when calculated according to 40 CFR 59, Subpart D (EPA method 24).
3. Multi-Purpose Construction Adhesive: VOC content of not more than 70 g/L when calculated according to 40 CFR 59, Subpart D (EPA method 24).
4. Special-Purpose Contact Adhesive (contact adhesive used to bond melamine-covered board, metal, unsupported vinyl, Teflon, ultra-high molecular weight polyethylene, and rubber or wood veneer, 1/16 inch or less in thickness, to any surface): 250 g/L.

I. Isolation Coating: Manufacturer's standard bituminous paint.

2.3 PAINTS AND COATINGS

A. Shop Primers: Provide primers that comply with Section 099000 - PAINTING

B. Shop Primer for Ferrous Metal: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI # 79.

C. Zinc-Rich Primer: Complying with SSPC-Paint 20 or 29 and compatible with finish paint systems indicated.

1. Provide interior, field-applied primer with a VOC content of 250 g/L or less, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. Shop Primer for Galvanized Steel: Zinc-dust, zinc-oxide primer formulated for priming zinc-coated steel and for compatibility with finish paint systems indicated; complying with SSPC-Paint 5.

E. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

1. Provide interior, field-applied paint with a VOC content of 250 g/L or less, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.4 FABRICATION, GENERAL

A. Shop Assembly: Preassemble ornamental formed-metal items in 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.

B. Coordinate dimensions and attachment methods of ornamental formed-metal items with those of adjoining construction to produce integrated assemblies with closely fitting joints and with edges and surfaces aligned, unless otherwise indicated.

C. Form metal to profiles indicated, in maximum lengths to minimize joints. Produce flat, flush surfaces without cracking or grain separation at bends. Fold back exposed edges of unsupported sheet metal to form a 1/2-inch- (12-mm-) wide hem on the concealed side, or ease edges to a radius of approximately 1/32 inch (1 mm) and support with concealed stiffeners.

D. Increase metal thickness or reinforce with concealed stiffeners, backing materials, or both, as needed to provide surface flatness equivalent to stretcher-leveled standard of flatness and sufficient strength for indicated use.

1. Support joints with concealed stiffeners as needed to hold exposed faces of adjoining sheets in flush alignment.

E. Build in straps, plates, and brackets as needed to support and anchor fabricated items to adjoining construction. Reinforce ornamental formed-metal items as needed to attach and support other construction.

F. Provide support framing, mounting and attachment clips, splice sleeves, fasteners, and accessories needed to install ornamental formed-metal items.

G. Where welding or brazing is indicated, weld or braze joints and seams continuously. Grind, fill, and dress to produce smooth, flush, exposed surfaces in which joints are not visible after finishing is completed.

1. Use welding and brazing procedures that will blend with and not cause discoloration of metal being joined.

2.5 COLUMN COVERS

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

1. ATAS International, Inc.
2. Ceilings Plus, Inc.
3. Copper Sales, Inc.
4. Fry Reglet Corporation.
5. Industrial Louvers, Inc.
6. MM Systems Corporation.
7. Pittcon Industries.

B. Snap-Together Type: Form column covers to shapes indicated from metal of type and minimum thickness indicated below. Return vertical edges and bend to form hook that will engage continuous mounting clips.

1. Aluminum Sheet: Minimum 0.040 inch
   a. Finish: Clear anodic.

2. Column covers may be fabricated from prefinished metal sheet in lieu of finishing after fabrication provided unfinished edges are concealed from view.
3. Form returns at vertical joints to provide hairline V-joints.
4. Fabricate column covers without horizontal joints.
5. Fabricate ceiling ring to match column covers.
6. Fabricate with calk stop/stiffener ring.
7. Apply manufacturer's recommended sound-deadening insulation to backs of column covers.

2.6 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for steel sheet finishes.

C. Complete mechanical finishes of flat sheet metal surfaces before fabrication where possible. After fabrication, finish all joints, bends, abrasions, and other surface blemishes to match sheet finish.

D. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

E. Apply organic and anodic finishes to formed metal after fabrication, unless otherwise indicated.

F. Finish items after assembly.

G. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.7 ALUMINUM FINISHES

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.

2.8 STAINLESS-STEEL FINISHES

A. Remove tool and die marks and stretch lines or blend into finish.

B. Grind and polish surfaces to produce uniform, polished finish indicated, free of cross scratches.

1. Run grain of directionally textured finishes with long dimension of each piece.

C. Directional Satin Finish: No. 4 finish.

D. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

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 ornamental formed metal.

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

3.2 INSTALLATION

A. Locate and place ornamental formed-metal items level and plumb and in alignment with adjacent construction.

B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where needed to protect metal surfaces and to make a weathertight connection.

C. Form tight joints with exposed connections accurately fitted together. Provide reveals and openings for sealants and joint fillers as indicated.

D. Install concealed gaskets, joint fillers, insulation, sealants, and flashings, as the Work progresses, to make exterior ornamental formed-metal items weatherproof.

E. Install concealed gaskets, joint fillers, sealants, and insulation, as the Work progresses, to make interior ornamental formed-metal items soundproof or lightproof as applicable to the type of fabrication indicated.

F. Corrosion Protection: Apply nonmelting/nonmigrating-type bituminous coating or other permanent separation materials on concealed surfaces where metals would otherwise be in direct contact with substrate materials that are incompatible or could result in corrosion or deterioration of either material or finish.

3.3 ADJUSTING

A. 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.

3.4 PROTECTION

A. Protect finishes of ornamental formed-metal items from damage during construction period. Remove temporary protective coverings at time of Substantial Completion.

END OF SECTION

SECTION 061000

ROUGH CARPENTRY

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Wood blocking, cants, and nailers.
2. Plywood backing panels.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 042000 - UNIT MASONRY for wood nailers and blocking built into masonry.
2. Section 061600 - SHEATHING for plywood and gypsum sheathing.
3. Section 064020 - INTERIOR ARCHITECTURAL WOODWORK for interior woodwork not specified in this Section.
4. Section 092110 - GYPSUM BOARD ASSEMBLIES for sheet metal backing.

1.3 SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product.

1. Indicate component materials and dimensions and include construction and application details.
2. 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.
3. 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.
4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
5. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber, plywood, and other panels; place spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of lumber grading agencies certified by the American Lumber Standards Committee Board of Review.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
3. Provide dressed lumber, S4S, unless otherwise indicated.
4. Provide dry lumber with 15 percent maximum moisture content at time of dressing for 2-inch nominal thickness or less, unless otherwise indicated.

B. Plywood Panels:

1. Plywood: Either DOC PS 1 or DOC PS 2, unless otherwise indicated.
2. Thickness: As needed to comply with requirements specified but not less than thickness indicated.
3. Factory mark panels according to indicated standard.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with the ground, Use Category UC3b for exterior construction not in contact with the ground, and Use Category UC4a for items in contact with the ground.

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.

a. Use Borate or Copper Azule treatments. Product shall not contain creosote, arsenic or pentachlorophenol.

2. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.

B. Kiln-dry material after treatment to a maximum moisture content of 19 percent for lumber and 18 percent for plywood. Do not use material that is warped or does not comply with requirements for untreated material.

C. Mark each treated item with the treatment quality mark of an inspection agency approved by the American Lumber Standards Committee Board of Review.

D. Application: Treat items indicated on Drawings, and the following:

1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete in exterior walls.

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

1. Hoover Treated Wood Products; PyroGuard.
2. Koppers Performance Chemicals; LifeWood MicroPro Treatment.
3. Sustainable Northwest Wood; Pressure Treated Wood with Copper Azule.

2.3 FIRE-RETARDANT-TREATED MATERIALS

A. General: For fire-rated exterior walls, all interior use materials, and where fire-retardant-treated materials are indicated, materials shall comply with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet (3.2 m) beyond the centerline of the burners at any time during the test.

1. Treatment shall not promote corrosion of metal fasteners.
2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.
4. Design Value Adjustment Factors: Treated lumber shall be tested according to ASTM D 5664 and design value adjustment factors shall be calculated according to ASTM D 6841.
5. Product shall not contain creosote, arsenic or pentachlorophenol.

C. Kiln-dry lumber after treatment to maximum moisture content of 19 percent. Kiln-dry plywood after treatment to maximum moisture content of 15 percent.

D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.

2.4 MISCELLANEOUS LUMBER

A. General: Provide FRTW lumber for support or attachment of other construction, including, but not limited to, the following: Rooftop equipment bases and support curbs, blocking, cants, nailers, furring and grounds.

B. For items of dimension lumber size, provide Construction, Stud, or No. 2 grade lumber with 15 percent moisture content.

2.5 PANEL PRODUCTS

A. Miscellaneous Concealed Plywood: Exposure 1 sheathing, span rating to suit framing in each location, and thickness as indicated but not less than 1/2 inch.

B. Telephone and Electrical Equipment Backing Panels: DOC PS 1, Exposure 1, C-D Plugged, fire-retardant treated, in thickness indicated or, if not indicated, not less than 1/2 inch thick.

2.6 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.

1. Where carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners of Type 304 stainless steel.

B. Nails, Wire, Brads, and Staples: ASTM F 1667.

C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

D. Wood Screws: ASME B18.6.1.

E. Screws for Fastening to Cold-Formed Metal Framing: ASTM C 954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.

F. Bolts: Steel bolts complying with ASTM A 307, Grade A with ASTM A 563 hex nuts and, where indicated, flat washers.

G. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.

1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5; except provide stainless steel complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2, where in contact with pressure-preservative treated wood or when exposed to exterior conditions.

2.7 MISCELLANEOUS MATERIALS

A. Adhesive, Including Gluing Furring and Sleepers to Concrete or Masonry: Formulation complying with ASTM D 3498 that is approved for use indicated by adhesive manufacturer.

1. Basis of Design: Henkel Corp.; OSI SF450 Heavy Duty Subfloor Construction Adhesive.
2. VOC Content: 70 g/L or less.
3. Do not use adhesives that contain urea formaldehyde.
4. Methylene chloride and perchloroethylene may not be intentionally added to adhesives.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Discard units of material with defects that impair quality of carpentry and that are too small to use with minimum number of joints or optimum joint arrangement.

B. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.

C. Apply field treatment complying with AWPA M4 to cut surfaces of preservative-treated lumber and plywood.

D. Securely attach carpentry work as indicated and according to applicable codes and the following:

1. Table 2304.10.1, "Fastening Schedule," in ICC's International Building Code (IBC).
2. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.
3. ICC-ES evaluation report for fastener.

E. Countersink fastener heads on exposed carpentry work and fill holes with wood filler.

F. Use fasteners of appropriate type and length. Predrill members when necessary to avoid splitting wood.

3.2 WOOD BLOCKING, AND NAILER INSTALLATION

A. Install as required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated.

END OF SECTION

SECTION 061063

SITE EXTERIOR ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes materials, labor, apparatus, tools, equipment, temporary construction, transportation, and services necessary for and incidental to performing the proper completion of Work as required to make complete Exterior Rough Carpentry assemblies and installations, as shown on the Contract Drawings, and as specified herein this Section.

B. Work under this Section consists of, but is not necessarily limited to, furnishing and installing the following:

1. Wood Trellis Structure(s).

C. Related Work in Separate Sections: The following Documents contain requirements that relate to Work in this Section:

1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
2. Section 055214 “Site Guard and Hand Railing”.
3. Section 062013 "Site Exterior Finish Carpentry".
4. Section 321323 "Cast-in-Place Concrete for Landscape Features".
5. Wind Report - published under separate volume.

1.2 DEFINITIONS AND APPLICABLE STANDARDS

A. Boards: Lumber of less than 2 inches nominal in thickness and 2 inches nominal or greater width.

B. Dimension Lumber: Lumber of 2 inches nominal or greater but less than 5 inches nominal in least dimension.

C. Timber: Lumber of 5 inches nominal or greater in least dimension.

D. Lumber grading agencies, and the abbreviations used to reference them, include the following:

1. ALSC: American Lumber Standard Committee
2. NLGA: National Lumber Grades Authority.
3. SPIB: The Southern Pine Inspection Bureau.
4. WWPA: Western Wood Products Association.
5. WRCLA: Western Red Cedar Lumber Association
6. FSC – Forest Stewardship Council.

E. Definitions:

1. S4S: Surfaced Four (4) Sides.
2. PTWF: Pressure-Treated Douglas fir.

1.3 SUBMITTALS

A. General: Refer to Division 01 for project submittal requirements and timelines. If provided in hardcopy submittal booklets submit each item in this Article in required copies with three (3) copies for review by Landscape Architect. Two (2) copies shall be returned (One for Client/Owner and one for Contractor) and one copy maintained by Landscape Architect. .

B. Provide two (2) sets of Material Samples (if any) for review by the Landscape Architect.

C. Submittal Booklets: Each Submittal Booklet under this Section shall be tabbed into specific sections, containing clearly identified (through yellow highlighter or other specific identification methods) and legible information on the following information indicated in this Article.

D. Electronic Submittals: Electronic Submittal shall be provided in a single bound file, PDF format preferred, unless otherwise noted in Division 01.

E. Submittals under this Article will be rejected and returned without the benefit of review by the Landscape Architect if they are difficult to read due to insufficient scale, poor image quality, or poor drafting quality; or if all of the required information is missing or not presented in the format as requested.

F. No Work shall proceed under this Section until Submittal requirements indicated herein have been reviewed accordingly by the Landscape Architect.

G. Product Data: For preservative-treated wood products and metal framing anchors.

1. For preservative-treated wood products, include chemical treatment manufacturer's written instructions for handling, storing, installing, and finishing treated material.
2. For metal framing anchors, include installation instructions.

H. Samples:

1. For all wood products shown in the drawings, not less than 12 inches long, showing the range of variation to be expected in appearance, including surface texture.
2. Provide stain / sealer on actual wood sample.

I. Scaled Shop Drawings: Provide enlarged scaled plans, elevations, sections, details, as required, for review by the Landscape Architect and Structural Engineer, indicating dimensioned fabrication and setting/layout of each type of fabricated stone pavement material and their connections and /or joints layouts. Show construction including anchorage, mortar settings and grout, and accessory items. Furnish templates for anchors and bolts installed under other Sections.

1. A full layout plan shall be provided of the Street Level and Level 27 granite pavement areas indicating stone types, finishes and sizes and locations of each unit.

2. Engineered Shop Drawings shall be provided and sealed by a currently licensed engineer for the Level 27 paving depicting required paver minimum thickness, pedestal connections to structural slab (or other), attachments and installation requirements such that they meet or exceed the wind loading requirements per the Wind Report for rooftop applications.

3. Provide calculation(s) on shop drawings or under separate cover, sealed by licensed engineer, depicting wind load(s) resistance for pedestal(s) and paver(s).

J. Material Certificates:

1. For preservative-treated wood products. Indicate type of preservative used and net amount of preservative retained. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

K. Certificates of Inspection: Issued by lumber grading agency for exposed wood products not marked with grade stamp.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store materials under cover and protected from weather and contact with damp or wet surfaces. Stack lumber flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 LUMBER, GENERAL

A. Lumber: Comply with DOC PS 20 and with applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by ALSC's Board of Review. Provide lumber graded by an agency certified by ALSC's Board of Review to inspect and grade lumber under the rules indicated.

2.2 DIMENSION LUMBER

A. Exposed Lumber: Rough sawn or sanded wood to be used for trellis structures, fencing, and trim or lattice boards. Provide material hand selected to meet grades noted. Select for finish appearance and for freedom from characteristics, on exposed surfaces and edges, that would impair finish appearance, including decay, honeycomb, knot holes, shake, splits, torn grain, and wane.

2.3 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture. Provide nails or screws, in sufficient length, to penetrate not less than 1-1/2 inches into wood substrate.

1. Use stainless steel fasteners unless otherwise indicated.
2. Use hot dip galvanized metal hardware attachments where hardware fasteners are indicated.
3. Use stainless exterior grade finishing screws with narrow diameter heads for installing fencing on all exposed faces.

B. Wood Screws: ASME B18.6.1.

C. Lag Screws: ASME B18.2.1.

D. Stainless-Steel Bolts: ASTM F 593, Alloy Group 1 or 2; with ASTM F 594, Alloy Group 1 or 2 hex nuts and, where indicated, flat washers.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine grades, substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

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

3.2 PREPARATION

A. Clean substrates of projections and substances detrimental to application.

3.3 INSTALLATION, GENERAL

A. Set exterior rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit exterior rough carpentry to other construction; scribe and cope as needed for accurate fit.

B. Framing Standard: Comply with AF&PA's "Details for Conventional Wood Frame Construction" unless otherwise indicated.

C. Secure fencing to framing with small head diameter wood screws or blind fasteners.

D. Install metal framing anchors to comply with manufacturer's written instructions.

E. Do not splice structural members between supports unless otherwise indicated.

F. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.

G. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

3.4 GENERAL REQUIREMENTS

A. All trellis work shall be true to line and grade as indicated on the Drawings.

B. Tolerance: Vertical and horizontal members shall be plumb and finished grade of fence shall match finished grade of ground plane.

C. Use narrow stainless head finish deck screws for fence faces and use stainless wire nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view. Make tight connections between members. Install fasteners in face slightly recessed without splitting wood; do not countersink nail heads unless otherwise indicated.

D. For exposed work, arrange fasteners in straight rows parallel with edges of members, with fasteners evenly spaced, and with adjacent rows staggered.

E. Workmanship:

1. Workmanship shall be first class throughout. All lumber shall be accurately cut to a close fit and shall have even bearing over the entire contact surfaces.
2. All joints shall be square and tight unless otherwise shown. No shimming will be permitted in making joints. Work shall be free of hammer marks, dents, or other disfiguration.

F. Hardware to be seated flush unless otherwise shown and surface screws to be slightly recessed

END OF SECTION

SECTION 061600

SHEATHING

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Gypsum sheathing attached to cold-formed metal framing members at exterior wall.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 042000 - UNIT MASONRY for masonry-veneer anchors and insulation in cavity wall construction.
2. Section 054000 - COLD-FORMED METAL FRAMING for metal framing at exterior wall.
3. Section 061000 - ROUGH CARPENTRY for plywood backing panels.
4. Section 072700 - AIR BARRIERS for modified bituminous sheet membrane over gypsum sheathing and membrane flashing.
5. Section 076200 - SHEET METAL FLASHING AND TRIM for flashing applied to gypsum sheathing.

1.3 DEFINITIONS

A. Gypsum Board Construction Terminology Standard: Refer to ASTM C 11 and GA-505 for definitions of terms for gypsum sheathing board construction not defined in this Section or in other referenced standards.

1.4 SUBMITTALS

A. Product Data: For each product specified.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain each gypsum sheathing product through one source from a single manufacturer.

B. Fire-Resistance-Rated Assemblies: Where gypsum sheathing boards are part of fire-resistance-rated assemblies, provide assemblies as follows:

1. Assemblies comply with requirements of fire-response-tested assemblies indicated by GA File Numbers in GA-600, "Fire Resistance Design Manual"; or by design designations in UL's "Fire Resistance Directory" or in certification listings of another testing and inspecting agency acceptable to authorities having jurisdiction.
2. Fire-resistance ratings were determined by fire-response testing assemblies according to ASTM E 119.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages, containers, or bundles, each bearing brand name and identification of manufacturer.

B. Store materials protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, or other causes. Neatly stack gypsum sheathing board flat on leveled supports off the ground, under cover, and fully protected from weather.

1.7 SEQUENCING AND SCHEDULING

A. Sequence installing sheathing with installing exterior cladding to comply with requirements indicated below:

1. Do not leave glass-mat gypsum sheathing board exposed to weather for more than 180 days.

PART 2 - PRODUCTS

2.1 SHEATHING BOARD

A. Glass-Mat Gypsum Sheathing Board: ASTM C 1177.

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

a. CertainTeed Corp.; GlasRoc.
b. Georgia-Pacific Gypsum LLC; Dens-Glass Gold.
c. National Gypsum Company; Gold Bond, e^2XP.
d. USG Corporation; Securock.

2. Type and Thickness: 5/8 inch, Type X.

2.2 FASTENERS

A. Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing board to be attached, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.

1. For steel framing from 0.033 to 0.112 inch thick, attach sheathing to comply with ASTM C 954.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install gypsum sheathing to comply with GA-253 and manufacturer's written instructions.

B. Cut boards at penetrations, edges, and other obstructions of the work; fit tightly against abutting construction, except provide a 3/8-inch setback where non-load-bearing construction abuts structural elements.

C. Coordinate sheathing installation with flashing and joint sealant installation so these materials are installed in the sequence and manner that prevent exterior moisture from passing through completed exterior wall assembly.

D. Apply fasteners so screw heads bear tightly against face of sheathing boards but do not cut into facing.

E. Do not bridge building expansion joints with sheathing; cut and space edges to match spacing of structural support elements.

F. Vertical Installation: Install 48-inch- wide gypsum sheathing boards vertically with vertical edges centered over flanges of steel studs. Abut ends and edges of each board with those of adjacent boards. Screw-attach boards at perimeter and within field of board to each steel stud:

1. Perimeter: 6 inches on center.
2. Field: 8 inches on center.

END OF SECTION

SECTION 061613

INSULATING SHEATHING

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Oriented strand board (OSB) sheathing attached to cold-formed framing members at exterior wall and roof assemblies.

B. Related Work: The following items are not included in this Section and will be performed under the designated Sections:

1. Refer to Structural Drawings for other types of sheathing.
2. Section 054000 – COLD-FORMED METAL FRAMING for metal framing.
3. Section 061000 - ROUGH CARPENTRY for wood framing and plywood backing panels.
4. Section 072100 - THERMAL INSULATION for other types of thermal building insulation.
5. Section 076200 - SHEET METAL FLASHING AND TRIM for flashing applied to sheathing.

1.3 SUBMITTALS

A. Product Data: For each product specified.

B. Evaluation Reports: For wood sheathing and seam tape, from ICC-ES.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain each sheathing product through one source from a single manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages, containers, or bundles, each bearing brand name and identification of manufacturer.

B. Store materials protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, or other causes. Neatly stack sheathing board flat on leveled supports off the ground, under cover, and fully protected from weather.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace sheathing that does not comply with requirements or that fails within specified warranty period. Failures include, but are not limited to, water leakage, delamination, or otherwise deteriorating beyond normal wear.

1. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 INSULATING SHEATHING BOARD

A. Composite Insulating Wall Sheathing: Oriented-strand-board Exposure 1 sheathing 7/16 inch thick, with factory-laminated water-resistive barrier exterior facer, and with rigid foam plastic insulating board laminated to interior face.

1. Basis-of-Design: Huber Engineered Woods LLC; ZIP System R Sheathing.
2. Span Rating and Performance Category of Sheathing Layer: Not less than 24/16; 7/16 Performance Category.
3. Thickness: 2 inch
4. Thermal Resistivity (R Value): 9.6 deg F x h x sq. ft./Btu x in. at 75 deg F.
5. Edge Profile: Square edge.
6. Exterior Facer: Medium-density, phenolic-impregnated polymer-modified sheet material meeting requirements for ASTM D779 Grade D weather-resistive barrier in accordance with ICC AC38 and AC310, with fastener spacing symbols on exterior facer for 16-inch and 24-inch on center spacing, with the following characteristics

a. Water Resistance of Coatings, ASTM D2247: Pass 14 day exposure test.
b. Moisture Vapor Transmission, ASTM E96: Not less than 12 perms.
c. Water Penetration, ASTM E331: Pass at 2.86 lbf/sq. ft.
d. Wind Driven Rain, TAS-100: Pass.
e. Accelerated Weathering, ASTM G154: Pass.

2.2 MATERIALS

A. Oriented Strand Board: DOC PS 2, made with binder containing no added urea formaldehyde.

B. Rigid Foam Plastic Insulating Board: Rigid polyisocyanurate foam core complying with ASTM C1289 Type II, Class 2, and ICC-ES AC12, with coated glass fiber facers on both sides, with the following characteristics:

1. Nominal Density: 2.0 pcf (32 kg/cu. m).
2. Compressive Strength, ASTM D1621: Not less than 20 psi (150 kPa).
3. Vapor Permeance, ASTM E96/E96M: Less than 1.0 perm.
4. Edge Configuration: Square finished.

C. Self-Adhering Seam and Flashing Tape: Pressure-sensitive, self-adhering, cold-applied, seam tape consisting of polyolefin film with acrylic adhesive, meeting ICC AC148.

1. Basis-of-Design: Huber Engineered Woods; ZIP System Tape.

2. Thickness: 0.012 inch

2.3 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

1. Provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M or of Type 304 stainless steel.
2. Nails, Brads, and Staples: ASTM F 1667, ICC AC116, and ICC AC201.
3. Wood Screws: ASTM C 1002 and ASME B18.6.1.
4. Power-Driven Fasteners: ICC-ES-1539 or NER-272.

B. Screws for Fastening OSB Sheathing to Cold-Formed Metal Framing: ASTM C 954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.

1. For roof and wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M or Type 304 stainless steel.

C. Adhesives for Field Gluing Panels to Framing: Formulation complying with APA AFG-01 or ASTM D 3498 that is approved for use with type of construction panel indicated by manufacturers of both adhesives and panels.

1. Adhesives shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install sheathing to comply with manufacturer's written instructions, requirements of applicable Evaluation Reports, and requirements of authorities having jurisdiction.

B. Cut boards at penetrations, edges, and other obstructions of the work; fit tightly against abutting construction, except provide a 3/8-inch setback where non-load-bearing construction abuts structural elements.

C. Securely attach to substrate by fastening as indicated, complying with the following, as applicable:

1. Table 2304.9.1, "Fastening Schedule," in the ICC's International Building Code.
2. ICC-ES evaluation report for fastener.

D. Coordinate sheathing installation with flashing and joint sealant installation so these materials are installed in the sequence and manner that prevent exterior moisture from passing through completed exterior wall assembly.

E. Apply fasteners so screw heads bear tightly against face of sheathing boards but do not cut into facing.

F. Do not bridge building expansion joints with sheathing; cut and space edges to match spacing of structural support elements.

G. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.2 WOOD STRUCTURAL PANEL INSTALLATION

A. General: Comply with applicable recommendations in APA Form No. E30, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.

B. Fastening Methods: Fasten panels as indicated below:

1. Wall and Roof Sheathing:

a. Screw to cold-formed metal framing.
b. Space panels 1/8 inch apart at edges and ends.

C. Apply air barrier / sheathing tape at joints between and edges of sheathing boards.

1. Seal seams, edges, fasteners, and penetrations with tape.
2. Extend into jambs of openings and seal corners with tape.

END OF SECTION

SECTION 062010

EXTERIOR FINISH CARPENTRY

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Wood decking.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 076200 - SHEET METAL FLASHING AND TRIM for sheet metal flashing used with patio decking.

1.3 DEFINITIONS

A. Boards: Lumber of less than 2 inches nominal in thickness and 2 inches nominal or greater in width.

B. Dimension Lumber: Lumber of 2 inches nominal or greater but less than 5 inches nominal in least dimension.

C. Lumber grading agencies, and the abbreviations used to reference them, include the following:

1. NeLMA: Northeastern Lumber Manufacturers' Association.
2. NLGA: National Lumber Grades Authority.
3. RIS: Redwood Inspection Service.
4. SPIB: The Southern Pine Inspection Bureau.
5. WCLIB: West Coast Lumber Inspection Bureau.
6. WWPA: Western Wood Products Association.

1.4 SUBMITTALS

A. Product Data: For metal framing anchors.

B. Samples: For plastic decking, not less than 24 inches long, showing the range of variation to be expected in appearance of decking, including surface texture.

C. Material Certificates:

1. For lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by ALSC's Board of Review.

D. Certificates of Inspection: Issued by lumber grading agency for exposed wood products not marked with grade stamp.

E. Evaluation Reports: For the following, from ICC-ES:

1. Preservative-treated wood products.
2. Expansion anchors.
3. Metal framing anchors.
4. Decking fasteners.

1.5 QUALITY ASSURANCE

A. Lumber Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.

B. Lumber Vendor Qualifications: A vendor that is certified for chain of custody by an FSC-accredited certification body.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store materials under cover and protected from weather and contact with damp or wet surfaces. Stack lumber flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

B. Handle and store plastic lumber to comply with manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 LUMBER, GENERAL

A. Comply with DOC PS 20 and with grading rules of lumber grading agencies certified by ALSC's Board of Review as applicable. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by ALSC's Board of Review.

1. Factory mark each item with grade stamp of grading agency.
2. For items that are exposed to view in the completed Work, mark grade stamp on end or back of each piece.
3. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry wood products.
4. Provide dressed lumber, S4S, unless otherwise indicated.

B. Maximum Moisture Content:

1. Boards: 15 percent.
2. Dimension Lumber: 15 percent.

2.2 WOOD DECKING

A. Hand select wood for freedom from characteristics, on exposed surfaces and edges, that would impair finish appearance, including decay, honeycomb, knot holes, shake, splits, torn grain, and wane.

B. Board Decking: 1-inch actual thickness radius-edged S4S boards, with one face free of planer skip, machine burn, and torn or chipped grain.

1. Species: Ipe.
2. Grade Characteristics:
   a. Clear one face; small pin knots and worm holes will be accepted on back face.
   b. Sound; small pin knots, worm holes, and fixed knots will be accepted.
   c. All heart one face.
   d. Straight grained and parallel cut.
   e. Free of heart centers.
   f. No decay, incipient decay, honeycomb, knot holes, shakes, splits, or wane.
   g. No discoloration.

2.3 FASTENERS

A. General: Provide fasteners of size and type indicated, acceptable to authorities having jurisdiction, and that comply with requirements specified in this article for material and manufacture. Provide nails or screws, in sufficient length, to penetrate not less than 1-1/2 inches into wood substrate.

1. Use stainless steel unless otherwise indicated.

B. Nails: ASTM F 1667.

C. Power-Driven Fasteners: ICC-ES AC70.

D. Wood Screws and Lag Screws: ASME B18.2.1, ASME B18.6.1, or ICC-ES AC233.

E. Stainless-Steel Bolts: ASTM F 593, Alloy Group 1 or 2; with ASTM F 594, Alloy Group 1 or 2 hex nuts and, where indicated, flat washers.

F. Postinstalled Anchors: Stainless-steel, [chemical] [or] [torque-controlled expansion] anchors with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing according to ASTM E 488 conducted by a qualified independent testing and inspecting agency.

1. Stainless-steel bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2.

2.4 METAL FRAMING ANCHORS

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

1. Cleveland Steel Specialty Co.
2. KC Metals Products, Inc.

3. Phoenix Metal Products, Inc.
4. R. H. Tamlyn & Sons LP.
5. Simpson Strong-Tie Co., Inc.
6. USP Structural Connectors.

B. Allowable Design Loads: Provide products with allowable design loads, as published by manufacturer, that meet or exceed those of products of manufacturers listed. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

C. Stainless-Steel Sheet: ASTM A 666, Type 316.

2.5 CONCEALED DECKING FASTENERS

A. Deck Splines: Corrosion-resistant metal or plastic splines that fit in grooves routed into the sides of decking material and are fastened to deck framing with screws. Splines provide uniform spacing of decking material.

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

a. Blue Heron Enterprises, LLC; Eb-Ty Hidden Deck-Fastener.
b. Grabber Construction Products; Deck Clip.
c. Ipe Clip Fastener Company Inc. (The); Ipe Clip.
d. KK Mfg. Co., Inc; Lumber Loc Hidden Deck Fasteners.
e. M. M. Products, Inc; Invisi-Fast Biscuit.
f. Titan Metal Werks, Inc; DeckEase Hidden Deck Fasteners.

B. Deck Clips: Black-oxide-coated, stainless-steel clips designed to be fastened to deck framing with screws, and to secure decking material with teeth that also provide uniform spacing of decking material.

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

a. Tiger Claw Inc; Tiger Claw Hidden Deck Fasteners.

C. Deck Tracks: Formed metal strips designed to be fastened to deck framing and to secure decking material from underside with screws. Made from epoxy-powder-coated, hot-dip galvanized steel or stainless steel.

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

a. Grabber Deckmaster; Deckmaster.
b. Ty-Lan Enterprises Inc; Shadoe Track.

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 the Work.

B. 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, GENERAL

A. Set work to required levels and lines, with members plumb, true to line, cut, and fitted. Fit work to other construction; scribe and cope as needed for accurate fit.

B. Framing Standard: Comply with AF&PA WCD1 unless otherwise indicated.

C. Install wood decking with crown up (bark side down).

D. Secure decking to framing.

E. Install metal framing anchors to comply with manufacturer's written instructions.

F. Do not splice structural members between supports unless otherwise indicated.

G. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.

H. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of members or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

I. Securely attach exterior rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. ICC-ES AC70 for power-driven fasteners.
2. "Fastening Schedule" in ICC's International Building Code.
3. "Fastener Schedule for Structural Members" and "Alternate Attachments" in ICC's International Residential Code for One- and Two-Family Dwellings.

J. Use common wire nails unless otherwise indicated. Select fasteners of size that do not fully penetrate members where opposite side is exposed to view. Make tight connections between members. Install fasteners without splitting wood; do not countersink nail heads unless otherwise indicated.

K. For exposed work, arrange fasteners in straight rows parallel with edges of members, with fasteners evenly spaced and with adjacent rows staggered.

END OF SECTION

SECTION 062013

SITE EXTERIOR FINISH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes materials, labor, apparatus, tools, equipment, temporary construction, transportation, and services necessary for and incidental to performing the proper completion of Work, as required to make a complete Site Finish Carpentry installation, as shown in the Contract Drawings, and as specified herein this Section.

B. Work under this Section consists of, but is not necessarily limited to, furnishing and installing the following:

1. Site carpentry and framing of wood Decking, including wooden members (posts, beams, joists, planks, blocking, etc) and similar items.
2. Wood Fencing Systems
3. Wood Railing components or systems.

C. Related Documents: The following Documents contain requirements that relate to Work in this Section:

1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
2. Section 062013 "Site Exterior Rough Carpentry".
3. Section 055013 “Site Metal Fabrication”
4. Section 321323 "Cast-in-Place Concrete for Landscape Features".

1.2 DEFINITIONS AND APPLICABLE STANDARDS

A. References:

1. ASTM – American Society for Testing and Materials.
2. ANSI – American National Standards Institute.
3. UBC – Uniform Building Code.
4. NFPA – National Forest Products Association, National Design Specifications.
5. NEPA – National Fire Protection Association.
6. ALSC – USDA American Lumber Standards Committee.
7. WCLI – West Coast Lumber Inspection Bureau, Standard Grading and Dressing Rules.
8. WWPA – Western Wood Products Association, Grading Rules for Western Lumber.
9. FSC – Forest Stewardship Council.

B. Applicable Standards:

1. Unless noted otherwise latest edition, issue or revision applies.
2. PS (Product Standards) as referred herein by specification number.
3. West Coast Lumber Inspection Bureau Standard Grading and Dressing Rules.
4. Federal Specifications as referred to herein by number.

C. Definitions:

1. S4S: Surfaced Four (4) Sides and smooth.
2. PTWF: Pressure-Treated Douglas fir.

1.3 SUBMITTALS

A. General: Refer to Division 01 for project submittal requirements and timelines. If provided in hardcopy submittal booklets submit each item in this Article in required copies with three (3) copies for review by Landscape Architect. Two (2) copies shall be returned (One for Client/Owner and one for Contractor) and one copy maintained by Landscape Architect. .

B. Provide two (2) sets of Material Samples (if any) for review by the Landscape Architect.

C. Submittal Booklets: Each Submittal Booklet under this Section shall be tabbed into specific sections, containing clearly identified (through yellow highlighter or other specific identification methods) and legible information on the following information indicated in this Article.

D. Electronic Submittals: Electronic Submittal shall be provided in a single bound file, PDF format preferred, unless otherwise noted in Division 01.

E. Submittals under this Article will be rejected and returned without the benefit of review by the Landscape Architect if they are difficult to read due to insufficient scale, poor image quality, or poor drafting quality; or if all of the required information is missing or not presented in the format as requested.

F. No Work shall proceed under this Section until Submittal requirements indicated herein have been reviewed accordingly by the Landscape Architect.

G. Product Data: Manufacturer's current catalogue cuts and specifications for the following items:

1. Wood Fastener System
2. Wood Adhesives.
3. Pedestal systems, if any.

H. Shop Drawings:

1. Enlarged plans, elevations and sections and details for trellis, pavilions and decks showing supports, openings, framing, supports, connections and hardware with miscellaneous metal fabrication details.
2. Materials List: Indicate type of member, location, grade, specie, size, length and quantity on the drawings.

I. Samples: two (2) of each specified wood in dimensions and finish provided, 12 inch length. Apply sealer or stain for acceptance.

J. Submittals Coordination:

1. Shop drawings and layout drawings to coordinate cutting, notching and boring holes for piping, wiring and other items attached to or concealed in the carpentry work.

1.4 MOCK-UP

A. Mock-up to be constructed according to specifications and design details.

1. Decking: Provide minimum 4' square fabrication of each item to match design details, include edge angles, curtain rod and fastening system, fasteners, rope and rope hardware, critical connections and wood jointing in the mockup.
2. Final Mock-Up is to include approved sealer application for final approval prior to installation

1.5 QUALITY ASSURANCE.AND CONTROL

A. Installer Qualifications: Engage an experienced Installer with experience in successfully demonstrating the fabrication, installation, and completion of Site Finish Carpentry Work similar in material, design, and extent to that indicated for this Project, with a record of successful performance, and with sufficient production capacity to produce required units without causing delay in the Work.

B. Permits, Fees, Bonds, and Inspections: Contractor shall arrange and pay for permits, fees, bonds, and inspections necessary to perform and complete Work under this Section.

C. Single-Source Responsibility: Obtain each color, type, and variety of Site Carpentry lumber, joint materials, and setting materials from a single source with resources to provide products and materials of consistent quality in appearance and physical properties without delaying the Work.

D. Pre-installation Conference:

1. Before installing Work as indicated herein this Section, conduct a Pre-installation Conference at the Project Site with the Landscape Architect to review requirements and design objectives, including a review of textures, colors, finishes, layouts, and other design intents of the Work. Conference shall be held prior to erecting the Field-Constructed Mock-up Samples.
2. Notify participants in writing at least five (5) working days prior to Conference.

1.6 DELIVERY, STORAGE AND HANDLING.

A. Provide new, unused materials indicated under this Section. Store and secure properly to prevent theft and damage.

B. Deliver manufactured materials in original, unopened packages or containers with manufacturer's labels intact and legible.

C. Store materials off ground and under cover, away from damp surfaces and inclement weather. Protect materials during storage and construction against soilage or contamination from earth and other materials.

1. Wrap lumber materials in plastic or use other packaging materials that will prevent rust marks from steel strapping used in shipping.
2. Deliver and unload materials at the Project Site in such a manner that no damage occurs to the products or materials.
3. Store lumber and timber in neat stacks at the site. Stack so that it may be readily inspected.
4. Pile structural timber neatly on skids above ground with spacers to allow free air circulation.
5. Protect from termites, decay, rain and excessive sun.

D. Deliver and install materials so as to not delay Work, and install only after preparation for installation have been completed.

E. Handling:

1. Handle lumber and timber in a manner that will avoid injury or breakage.
2. Handle treated timber with rope slings. Do not use cant hooks, peaveys, or other sharp instruments in handling treated timber. Undue injury in handling will be cause for rejection.

1.7 COORDINATION, SCHEDULING, AND OBSERVATIONS

A. Notify the Contractors performing Work related to installation of Work under this Section in ample time so as to allow sufficient time for them to perform their portion of Work and that progress of Work is not delayed. Verify conditions at the Project Site for Work that affects installation under this Section. Coordinate items of other trades to be furnished and set in place.

B. Field Measurements: Contractor shall take field measurements as required. Report major discrepancies between the Contract Drawings and field dimensions to the Landscape Architect prior to commencing Work.

C. Utilities: Determine location of above grade and underground utilities and perform Work in a manner which will avoid damage to utilities.

D. Grades and Levels: Establish and maintain required levels and grade elevations. Review installation procedures and coordinate Work herein this Section with other Work affected.

E. Excavation of Foundations: When conditions detrimental to adequate installation operations are encountered, such as rubble fill, adverse drainage conditions, or obstructions, cease operations and notify Landscape Architect for further direction.

F. Perform installation operations only when weather is suitable in accordance with locally accepted practices.

G. Sequence and Scheduling:

1. Verify and obtain location and size of rough openings, bracing and blocking required to accommodate the work of other sections into the carpentry work.
2. Layout: Furnish layouts for foundation bolts and framing anchors in concrete.
3. Adjustments: Determine foundation adjustments required in framing to obtain required levels and alignments.

H. Construction Site Observations: Landscape Architect may observe installation of Site Carpentry Work at Project Site for compliance with requirements for type, size, and quality. Landscape Architect retains right to observe Site Carpentry Work for defects and to reject unsatisfactory or defective material at any time during progress of Work. Contractor shall remove rejected Work immediately from Project site. Contractor shall request, in writing, at least one (1) week in advance of the time when mandatory site observation(s) by the Landscape Architect are required.

PART 2 - PRODUCTS

2.1 LUMBER

A. General:

1. Use only lumber conforming to grades and dress sizes permitted within the applicable grading rules.
2. Lumber shall be new, uniformly sized unless otherwise noted on the Contract Drawings.
3. Mark each piece of lumber for use in structural framing with the grade and trade mark of a lumber grading organization.
4. Lumber shall be certified by the Forest Stewardship Council (FSC).

B. Structural / Framing Lumber:

1. Select grade Pressure Treated Douglas Fir (PTWF).

    a. Use preservatives conforming to UBC

C. Appearance Grade, Select Lumber:

1. Decking: Provide appearance grade, select clear #1 free of heart, re-sawn (per approved texture) lumber for all exposed wood. Lumber members shall be straight and true, with no bends, curves, excessive gouges, chips, or cracks.

    a. Type: Refer to Drawings

2.2 ACCESSORIES

A. Builders Rough Hardware: As needed, all new materials, of standard manufacture as designated on the Contract Documents or specified herein, or subject to prior acceptance by the Landscape Architect.

1. Nails: Common wire nails conforming to Federal Specification FF-N105B and according to the nailing schedule. Use galvanized nails for all exterior exposed nailing.
2. Bolts, Lag Screws, Wood Screws, Washers: Carbon steel conforming to Federal Specifications FF-B-561C, FF-B-575C, FF-B-0584D and/or FF-S-111C. Items exposed to the weather shall be hot-dipped galvanized, all other items shall be unfinished unless otherwise shown on the Contract Drawings.
3. Decorative Hardware (Washers, Brackets, etc.): Malleable Iron, sized to fit.

B. Brackets, Hangers and Framing Clips (where non-custom manufactured products are indicated):

1. Deck Structure: Steel, Galvanized Finish.
2. Products & Manufacturers: Subject to compliance with requirements, provide products by one (1) of the following:

    a. Simpson Strong Tie Co., ph. (415) 562-7775.
    b. Teco Products, ph. (301) 654-8288.
    c. Or equal, as approved by the Landscape Architect.

C. Finishing Hardware for Deck Planks:

1. Blind Decking System:

a. Products & Manufacturers: Subject to compliance with requirements, provide products by one (1) of the following:

1) *EBE004 Hidden Deck Fastener System*, EB-TY, ph. (800)438-3289.

a) Deck Holes Plugs: #IPLUG01, EB-TY.
b) Stainless Steel Tim Head Screws: SWAN Secure, #7 x 2 ¼", EB-TY.
c) Adhesives for Deck Boards: Exterior grade Liquid Nails or equivalent construction adhesive as recommended by EB-TY.
d) Glue for plugs: Exterior grade water resistant wood glue or as recommended by EB-TY.

2) Or equal, as approved by the Landscape Architect.

2. Deck Screws: Trim head, square drive, countersink shank, color to match lumber in length to securely anchor Deck Planks to structural lumber.

a. Provide stainless steel screws.
b. All screws are to be recessed and plugged with matching wood

D. Cast-in-Place Concrete Footings or Slabs: Refer to Section 321323 – Cast-in-Place Concrete for Landscape Features.

E. Steel or Other Structural Members: Conform to applicable UBC and ASTM standards, as acceptable to Landscape Architect.

1. Trellis Structure Decorative Hangars: Steel, Galvanized Finish, primed and painted per Section 099113 – Exterior Painting and Staining. Size per Structural Engineer.

F. Premixed Preservative Material for Jobsite Treatment: Not Used.

G. Moisture Content: All lumber after treatment shall be either air or kiln dried so that material at time of shipment does not exceed 18% moisture content.

2.3 DECK PEDESTALS

A. General: Provide adjustable height, leveling deck pedestals to support stone pavers as detailed. System shall be adhered to structural concrete slab system and adjustable to height of 24".

B. Material: High Density Polypropylene conforming to ASTM standards D-746, D 1525-91, and D1706.

C. Performance:

1. Minimum support capacity of 1000 pounds per pedestal.
2. Wind load tolerances as required per requirements set forth in Wind Report.

D. Manufacturers

1. Bison Screwjack Company (Preferred System)
2. Buzon
3. Tile Tech
4. AWS
5. Hanover Elevator
6. Carlisle Syntec
7. Westile Screwjack
8. Or approved equal by Landscape Architect.

2.4 FINISHING

A. Finishing for Wood Decking: Per Drawings, apply Penetrating Wood Sealer to all finished surfaces. Penetrating Wood Sealer shall be an oil-based Sealer, specifically formulated for dense exterior hardwoods, providing 99% ultraviolet protection via transoxide pigments. Sealer formula shall include a high-grade mildecide for mold and mildew protection. Sealer shall be a one-coat application, providing a natural transparent tone to wood once applied.

PART 3 - EXECUTION

3.1 EXAMINATION: Field verify the location and elevations of all existing trees prior to commencing construction. Notify the owner’s representative of all conditions differing from those shown on the drawings.

3.2 PREPARATION

A. Concrete Footings: Install per Structural and design drawings. See Division 3, Section "Site Concrete" for footing specifications.

3.3 INSTALLATION

A. Cutting and Fitting:

1. Cutting: Accurately cut and frame all lumber to a close fit, with even bearing over all contact surfaces.
2. Fitting: Form all joints square and tight unless otherwise shown. Do not use shims when making joints.

B. Nails, Screws and Bolts:

1. Nails: Seat flush. Countersink all finishing nails to 1/16 in. below finish surface.
2. Screws:

a. Drill holes for screws and lag screws same diameter as inner shank (bolt size minus depth of thread).
b. Use size of drill to fit manufacturers dowel for first row of deck per manufacturer’s requirements.
c. Unless noted otherwise, countersink screws until heads are flush with finish surface.

3. Bolts:

   a. Pre-drill holes for countersunk bolts with a bit 1/16 in. larger than the accompanying washer, and to a depth, which allows bolt, and washer head to be secured flush with finish surface. Counter sink depth 1" as required for wood plug success.
   b. Where bolts are not countersunk, bore hole to accept bolt only. Tighten bolt and washers flush to finish surface without compressing wood.

C. Washers:

1. Cut Washers: Fit all bolts 5/8 in. in diameter or less with cut washers.
2. Cast Washers: Fit all bolts and lag screws over 5/8 in. in diameter with cast or malleable iron washers, unless otherwise shown on the Drawings.

D. Blind Fastening System for Decking: Install according to manufacturers recommendations using EB-TY joiner system with stainless fasteners. Allow for shrinkage and swelling during construction and spacing of product.

3.4 FINISHING

A. Edge Treatment: Edges of seat decks, benches, handrails, planter caps and other exposed or leading corners are to be eased (1/8" radius).

B. Surfaces: All bench and seat deck tops and handrails are to be sanded smooth before application of finish coats.

3.5 ADJUSTING: Turn up and make tight all nuts, bolts, and lag screws at time of installation and again at the completion of the work, to insure that shrinkage has been overcome and fastenings are tight.

3.6 FIELD QUALITY CONTROL

A. Workmanship: Workmanship shall be first class throughout, and free of hammer marks, dents or other disfiguration. Unless otherwise specified, lumber shall not show saw marks.

END OF SECTION

SECTION 064020

INTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Interior standing and running trim.
2. Interior frames and jambs.
3. Wood railings.
4. Wood casework.
5. Plastic-laminate casework.
6. Wood countertops.
7. Plastic-laminate countertops.
8. Solid-surfacing-material countertops.
9. Upholstered seating.
10. Closet and utility shelving.
11. Shop finishing of interior woodwork.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 061000 - ROUGH CARPENTRY for wood furring, blocking, shims, and hanging strips required for installing woodwork and concealed within other construction before woodwork installation.
2. Section 064200 - PANELING for wood paneling.
3. Section 099000 – PAINTING AND COATING for field finishing work of this Section.

1.3 SUBMITTALS

A. Product Data: For each type of product specified, including casework hardware and accessories, and finishing materials and processes.

1. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements.
2. For fabric and padding, documentation indicating that the materials contain no chemical flame retardants.

B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.

1. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.

    a. Provide schedule of blocking required to support the Work of this Section.

2. Show locations and sizes of cutouts and holes for plumbing fixtures, electrical components and other items installed in architectural woodwork.
3. Show veneer leaves with dimensions, grain direction, exposed face, and identification numbers indicating the flitch and sequence within the flitch for each leaf.

C. Samples for Verification:

1. Lumber with or for transparent finish, not less than 5 inches wide by 12 inches long for each species and cut, finished on 1 side and 1 edge.
2. Veneer leaves representative of and selected from flitches to be used for transparent-finished woodwork.

    a. Submit step-type range sample sets of factory finished plywood and factory finished solid wood in size illustrating wood grain and specified finish, including edge banding detail and any veneer or solid edge glue joints.
    b. Submit one leaf for every 1000 gross square foot of veneer required.

3. Lumber and panel products with shop-applied opaque finish, 5 inches wide by 12 inches long for lumber and 8 by 10 inches for panels, for each finish system and color, with 1/2 of exposed surface finished.
4. Plastic laminates, 8 by 10 inches for each type, color, pattern, and surface finish, with 1 sample applied to core material, and specified edge material applied to 1 edge.
5. Solid-surfacing materials, 6 inches square.
6. Fabric: Full width and one pattern repeat.

D. Qualification Data: For Installer and fabricator.

1.4 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

B. Source Limitations: Engage a qualified woodworking firm to assume undivided responsibility for production of interior architectural woodwork with blueprint-matched wood veneers and components.

C. Quality Standard: Unless otherwise indicated, comply with AWI/AWMAC/WI's "Architectural Woodwork Standards," latest edition, including errata, for grades of interior architectural woodwork indicated for construction, finishes, installation, and other requirements.

D. Fire-Test-Response Characteristics: Where fire-retardant materials or products are indicated, provide materials and products with specified fire-test-response characteristics as determined by testing identical products per test method indicated by UL, ITS, or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify with appropriate markings of applicable testing and inspecting agency in the form of separable paper label or,

where required by authorities having jurisdiction, imprint on surfaces of materials that will be concealed from view after installation.

1. Fire-Test-Response Characteristics of Upholstery Fabric and Padding: Comply with California Technical Bulletin 117-2013 Update, with no chemical flame retardants.

E. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

F. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver woodwork until painting and similar operations that could damage woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Project Conditions" Article.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

1. The HVAC systems as specified elsewhere may not provide for humidity controls. The expected ranges of relative humidity are expected to be as high as 55% to a low of uncontrolled during the heating system. Comply with AWS Section 2, Care and Storage.

B. Field Measurements: Where woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed, and indicate measurements on Shop Drawings.
2. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating woodwork without field measurements. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.7 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that interior architectural woodwork can be supported and installed as indicated.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Provide materials that comply with requirements of AWI/AWMAC/WI's "Architectural Woodwork Standards" for each type of woodwork and quality grade specified, unless otherwise indicated.

B. Wood Veneers and Lumber: Provide AWI Custom Grade materials and workmanship, unless otherwise indicated. For species not listed in the AWS comply with the following:

1. Provide AWI Lumber Grade 1 and AWI Grade A Veneer, book-matched, minimum 6 inch face veneer width. Kiln dry to 6-8 percent moisture content. Components shall be free of defects and sapwood. Match adjacent pieces for color and grain pattern.
2. Single-Source Requirement for Wood Veneers and Solids: Intent is to provide wood which matches as closely as possible throughout the project. Provide wood veneers and solids from the same distributor, and from the same flitches and solids sources to the greatest extent possible.

C. Wood Species and Cut for Transparent Finish: As selected by the Architect.

1. Architect’s control samples for transparent finish, veneer grain and figure characteristics are available for review at the office of the Architect.
2. Veneer Matching Requirements:

    a. Matching Between Adjacent Veneer Leaves: Book match and architectural end match.
    b. Matching Within Individual Panel Faces: Balance and Center Match.
    c. Method of Matching Panels: Blueprint-matched panels and components.

D. Wood Species for Opaque Finish: Any closed-grain hardwood.

E. Composite Wood Products: Comply with the following:

1. Medium-Density Fiberboard (MDF): ANSI A208.2, Grade MD.
2. Particleboard: ANSI A208.1, Grade M-2-Exterior Glue.
3. Softwood Plywood: DOC PS 1, Medium Density Overlay (MDO).
4. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1.

    a. Resin impregnated paper backs are not permitted. Backs shall be of compatible hardwood species and cut. Contact adhesive is not permitted.

F. High-Pressure Decorative Plastic Laminate: NEMA LD 3, grades as indicated or, if not indicated, as required by woodwork quality standard.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering high-pressure decorative laminates that may be incorporated into the Work include, but are not limited to, the following:

    a. Abet Laminati, Inc.
    b. Arborite; a division of Wilsonart.
    c. Formica Corporation.

d. Lamin-Art; a division of Wilsonart.
e. Nevamar, Panolam, and Pionite; divisions of Panolam Surface Systems.
f. Wilsonart LLC.

G. Solid-Surfacing Material: Homogeneous solid sheets of filled plastic resin complying with ISFA-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 Surfaces; Aristech Surfaces.
b. E. I. du Pont de Nemours and Company; Corian.
c. Formica Corporation.
d. LG Hausys; Hi-Macs.
e. Wilsonart LLC.

H. Solid-Surfacing Material, Quartz-Agglomerate Type: Solid sheets consisting of quartz aggregates bound together with a matrix of filled plastic resin complying with ISFA-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. CaesarStone.
b. Cosentino USA; Silestone.
c. Dal-Tile; ONE Quartz Surfaces.
d. E. I. du Pont de Nemours and Company; Zodiaq.
e. LG Hausys; Viatera Quartz Surface.

I. Tempered Float Glass for Casework: ASTM C 1048, Kind FT, Condition A, Type I, Class 1 (clear), Quality-Q3, with exposed edges seamed before tempering, 1/4 inch (6 mm) thick, unless otherwise indicated.

J. Cushions:

1. Fabric: Provide as indicated on the Finish Schedule.
2. Upholstery Padding: Flexible, cellular, molded or slab polyurethane foam, with no added chemical flame retardants.

2.2 FIRE-RETARDANT-TREATED MATERIALS

A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this Article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified.

1. Do not use treated materials that do not comply with requirements of referenced woodworking standard or that are warped, discolored, or otherwise defective.
2. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants to distinguish treated materials from untreated materials.

3. Identify fire-retardant-treated materials with appropriate classification marking of UL, U.S. Testing, Timber Products Inspection, or another testing and inspecting agency acceptable to authorities having jurisdiction.

B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Comply with performance requirements of AWPA C20 (lumber) and AWPA C27 (plywood). Use the following treatment type:

1. Exterior Type: Organic-resin-based formulation thermally set in wood by kiln drying.
2. Mill lumber before treatment and implement special procedures during treatment and drying processes that prevent lumber from warping and developing discolorations from drying sticks or other causes, marring, and other defects affecting appearance of treated woodwork.
3. Kiln-dry materials before and after treatment to levels required for untreated materials.

C. Fire-Retardant Particleboard: Panels complying with the following requirements, made from softwood particles and fire-retardant chemicals mixed together at time of panel manufacture to achieve flame-spread index of 25 or less and smoke-developed index of 25 or less per ASTM E 84.

1. Fire-Retardant Fiberboard and Particleboard: Provide five ply construction with crossbands to prevent any ammonia fuming from the core to the face veneers.

2.3 CASEWORK HARDWARE AND ACCESSORIES

A. General: Provide casework hardware and accessory materials associated with architectural casework, except for items specified in Section 087100 - DOOR HARDWARE.

B. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602,100 degrees of opening, self-closing.

C. Back-Mounted Pulls: BHMA A156.9, B02011.

D. Catches: Push-in magnetic catches, BHMA A156.9, B03131.

E. Adjustable Shelf Standards and Supports: BHMA A156.9, B04071; with shelf rests, B04081 or BHMA A156.9, B04102; with shelf brackets, B04112.

F. Drawer Slides: BHMA A156.9, B05091; side mounted and extending under bottom edge of drawer; full-extension type; epoxy-coated-steel with steel ball-bearings; of the following grades:

1. Box Drawer Slides: Grade 1.
2. File Drawer Slides: Grade 1HD-100.
3. Pencil Drawer Slides: Grade 2.
4. Keyboard Slides: Grade 1.
5. Trash Bin Slides: Grade 1HD-100.

G. Aluminum Slides for Sliding Glass Doors: BHMA A156.9, B07063.

H. Door Locks: BHMA A156.11, E07121.

I. Drawer Locks: BHMA A156.11, E07041.

J. Grommets for Cable Passage through Countertops: Molded-plastic grommets and matching plastic caps with slot for wire passage.

K. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.

1. Satin Stainless Steel: BHMA 630.
2. Satin Aluminum, Clear Anodized: BHMA 628.

L. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

2.4 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Fire-retardant-treated softwood lumber, kiln dried to less than 15 percent moisture content.

B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

C. Handrail Brackets: Cast from malleable iron with wall flange drilled [for exposed anchor and with support arm for screwing to underside of rail. Sized to provide 1-1/2-inch clearance between handrail and wall.

D. Installation Adhesives and Wood Glues: Formulations approved for use indicated by adhesive manufacturer.

1. Low-Emitting Materials: Provide adhesives in compliance with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
2. VOC Limits: Use installation adhesives that comply with the following limits for VOC content:

    a. Wood Glues: 30 g/L.
    b. Contact Adhesives: Not permitted on the Project without Architect’s prior approval.

3. Do not use adhesives that contain urea formaldehyde.
4. Methylene chloride and perchloroethylene may not be intentionally added to adhesives.

2.5 FABRICATION, GENERAL

A. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.

B. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.

C. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:

1. Corners of Casework and Edges of Solid-Wood (Lumber) Members and Rails: 1/16 inch.

D. Complete fabrication, including assembly, finishing, and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

E. 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. Sand edges of cutouts to remove splinters and burrs.

1. Seal edges of openings in countertops with a coat of varnish.

F. Install glass to comply with applicable requirements in Section 088000 - GLAZING and in GANA's "Glazing Manual." For glass in wood frames, secure glass with removable stops.

2.6 INTERIOR STANDING AND RUNNING TRIM FOR TRANSPARENT FINISH

A. Grade: Custom.

B. Wood Species and Cut: As specified hereinabove.

1. Provide split species on trim that faces areas with different wood species, matching each face of woodwork to species and cut of finish wood surfaces in areas finished.

C. For trim items wider than available lumber, use veneered construction. Do not glue for width.

D. For rails wider or thicker than available lumber, use veneered construction. Do not glue for width or thickness.

E. Backout or groove backs of flat trim members and kerf backs of other wide, flat members, except for members with ends exposed in finished work.

F. Assemble casings in plant except where limitations of access to place of installation require field assembly.

2.7 INTERIOR STANDING AND RUNNING TRIM FOR OPAQUE FINISH

A. Grade: Custom.

B. Wood Species: Any closed-grain hardwood.

C. Backout or groove backs of flat trim members and kerf backs of other wide, flat members, except for members with ends exposed in finished work.

D. Assemble casings in plant except where limitations of access to place of installation require field assembly.

2.8 INTERIOR FRAMES AND JAMBS FOR TRANSPARENT FINISH

A. Grade: Custom.

B. Wood Species and Cut: As specified hereinabove

C. For frames or jambs wider than available lumber, use veneered construction. Do not glue for width.

D. Fire-Rated Interior Frames and Jambs Where Indicated: Products fabricated from fire-retardant particleboard or fire-retardant medium-density fiberboard with veneered, exposed surfaces and 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. Fire Rating: 20 minutes.

2.9 INTERIOR FRAMES AND JAMBS FOR OPAQUE FINISH

A. Grade: Custom.

B. Wood Species: Any closed-grain hardwood.

2.10 RAILINGS

A. Grade: Custom.

B. Wood Species and Cut for Transparent Finish: As specified hereinabove.

2.11 WOOD CASEWORK FOR TRANSPARENT FINISH

A. Grade: Custom.

B. AWI Type of Casework Construction: Flush overlay.

C. Wood Species and Cut for Exposed Surfaces: As specified hereinabove.

1. Grain Direction: Vertically for drawer fronts, doors, and fixed panels.
2. Matching of Veneer Leaves: Book match.
3. Vertical Matching of Veneer Leaves: End match.
4. Veneer Matching within Panel Face: Running match.
5. Veneer Matching within Room: Provide casework veneers in each room or other space from a single flitch with doors, drawer fronts, and other surfaces matched in a sequenced set with continuous match where veneers are interrupted perpendicular to the grain.

D. Semiexposed Surfaces: Provide surface materials indicated below:

1. Surfaces Other Than Drawer Bodies: Compatible species to that indicated for exposed surfaces, stained to match.
2. Drawer Sides and Backs: Solid-hardwood lumber, stained to match species indicated for exposed surfaces.
3. Drawer Bottoms: Hardwood plywood.

E. Upholstery: Fabricate fabric-covered cushions with molded padding beneath fabric and with fabric covering free of welts, creases, stretch lines, and wrinkles. For each upholstered component, install pile and pattern run in a consistent direction.

2.12 WOOD CASEWORK FOR OPAQUE FINISH

A. Grade: Custom.

B. AWI Type of Casework Construction: Flush overlay.

C. Species for Exposed Lumber Surfaces: Any closed-grain hardwood.

D. Panel Product for Exposed Surfaces: Medium-density overlay.

E. Semiexposed Surfaces: Provide surface materials indicated below:

1. Surfaces Other Than Drawer Bodies: Match materials indicated for exposed surfaces.
2. Drawer Sides and Backs: Solid-hardwood lumber.
3. Drawer Bottoms: Hardwood plywood.

2.13 PLASTIC-LAMINATE CASEWORK

A. Grade: Custom.

B. AWI Type of Casework Construction: Flush overlay.

C. Laminate Cladding for Exposed Surfaces: High-pressure decorative laminate complying with the following requirements:

1. Horizontal Surfaces Other Than Tops: Grade HGS.
2. Postformed Surfaces: Grade HGP.
3. Vertical Surfaces: Grade HGS.
4. Edges: Grade HGS.

D. Materials for Semiexposed Surfaces:

1. Surfaces Other Than Drawer Bodies: High-pressure decorative laminate, Grade VGS.

a. Edges of Plastic-Laminate Shelves: PVC tape, 0.018-inch minimum thickness, matching laminate in color, pattern, and finish.
b. For semiexposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, Grade VGS.

2. Drawer Sides and Backs: Solid-hardwood lumber.
3. Drawer Bottoms: Hardwood plywood.

E. Concealed Backs of Panels with Exposed Plastic Laminate Surfaces: High-pressure decorative laminate, Grade BKL.

F. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:

1. As selected by Architect from laminate manufacturer's full range.

2.14 WOOD COUNTERTOPS

A. Grade: Custom.

B. Type of Top: Solid wood for transparent finish, edge glued, with crown direction reversed in adjacent boards, to produce widths indicated. Select boards for similarity of color and grain and arrange boards for optimum match between adjacent boards. Species and cut as follows:

1. Wood Species and Cut: As specified hereinabove.

C. Type of Top: Panel product for transparent finish (wood veneer laminated over core) as follows:

1. Wood Species and Cut: As specified hereinabove
2. Matching of Adjacent Veneer Leaves: Book match.
3. Matching of Adjacent Veneer Leaves: End match.
4. Veneer Matching within Panel Face: Running match.
5. Edge Treatment: Solid wood matching face for species and cut.
6. Core Material: Exterior-grade plywood.

2.15 PLASTIC-LAMINATE COUNTERTOPS

A. Grade: Custom.

B. High-Pressure Decorative Laminate Grade: HGS.

C. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:

1. As selected by Architect from manufacturer's full range.

D. Edge Treatment: As indicated.

E. Core Material: Exterior-grade plywood.

F. Backer Sheet: Provide plastic-laminate backer sheet, Grade BKL, on underside of countertop substrate.

2.16 SOLID-SURFACING-MATERIAL COUNTERTOPS

A. Grade: Custom.

B. Colors, Patterns, and Finishes: Provide materials and products that result in colors of solid-surfacing material complying with the following requirements:

1. As selected by Architect from manufacturer's full range.

C. Fabricate tops in one piece, unless otherwise indicated. Comply with solid-surfacing-material manufacturer's written recommendations for adhesives, sealers, fabrication, and finishing.

1. Fabricate tops with shop-applied edges of materials and configuration indicated.

2. Fabricate tops with loose backsplashes for field application.

D. Drill holes in countertops for plumbing fittings and soap dispensers in shop.

2.17 CLOSET AND UTILITY SHELVING

A. Grade: Custom.

B. Shelf Material: 1-inch plastic laminate-faced panel product with solid-lumber edge.

C. Cleats: 3/4-inch solid lumber.

D. Standards for Adjustable Shelf Brackets: BHMA A156.9, B04102; powder-coat-finished steel.

E. Adjustable Shelf Brackets: BHMA A156.9, B04112; powder-coat-finished steel.

F. Clothes Rods: 1-5/16-inch-diameter, chrome-plated-steel tubes.

1. Rod Flanges: Chrome-plated steel.

2.18 SHOP FINISHING

A. General: Comply with AWI/AWMAC/WI's "Architectural Woodwork Standards" for factory finishing.

1. Finish architectural woodwork at fabrication shop as specified in this Section. Defer only final touchup, cleaning, and polishing until after installation.

B. 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 woodwork. Apply two coats to back of paneling and to end-grain surfaces. Concealed surfaces of plastic-laminate-clad woodwork do not require backpriming when surfaced with plastic laminate, backing paper, or thermoset decorative panels.

C. Shop Priming: Shop apply the prime coat including backpriming, if any, for opaque-finished items specified to be field finished. Refer to Section 099000 - PAINTING AND COATING for material and application requirements.

D. Transparent Finish: 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: Same as item to be finished.
2. AWS Finish System 5: Conversion varnish.
3. Washcoat for Closed-Grain Woods: Apply washcoat sealer to woodwork made from closed-grain wood before staining and finishing
4. Staining: Match approved sample for color.
5. Open Finish for Open-Grain Woods: Do not apply filler to open-grain woods.
6. Sheen: Satin, 30-50 gloss units.

7. Effect: Partially filled pore.

E. Opaque Finish: Comply with requirements indicated below for grade, finish system, color, effect, and sheen, with sheen measured on 60-degree gloss meter per ASTM D 523.

1. Grade: Same as item to be finished.
2. AWS Finish System 5: Conversion varnish.
3. Color: As selected by Architect from manufacturer's full range.
4. Sheen: Satin, 30-50 gloss units.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installation, condition woodwork to average prevailing humidity conditions in installation areas.

B. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

3.2 INSTALLATION

A. Grade: Install woodwork to comply with requirements for the same grade specified in Part 2 for fabrication of type of woodwork involved.

B. Assemble woodwork and complete fabrication at Project site to comply with requirements for fabrication in Part 2, to extent that it was not completed in the shop.

C. Install woodwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of 1/8 inch in 96 inches.

D. Scribe and cut woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

E. Fire-Retardant-Treated Wood: Handle, store, and install fire-retardant-treated wood to comply with chemical treatment manufacturer's written instructions, including those for adhesives used to install woodwork.

F. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.

G. Standing and Running Trim: Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to greatest extent possible. Do not use pieces less than 60 inches long, except where shorter single-length pieces are necessary. Scarf running joints and stagger in adjacent and related members.

1. Fill gaps, if any, between top of base and wall with plastic wood filler, sand smooth, and finish same as wood base if finished.
2. Install wall railings on indicated metal brackets securely fastened to wall framing.

3. Install standing and running trim with no more variation from a straight line than 1/8 inch in 96 inches.

H. Railings:

1. General: Install rails with no more than 1/8 inch in 96-inch variation from a straight line.
2. Stair Rails: Glue and dowel or pin balusters to treads and railings, and railings to newel posts.
3. Wall Rails: Support rails on indicated metal brackets securely fastened to wall framing.

I. Casework: Install without distortion so 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 installation of hardware and accessory items as indicated.

1. Install casework with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
2. Maintain veneer sequence matching of casework with transparent finish.
3. Attach casework to walls with mechanical fasteners. Do not use adhesives, so that casework may be removed and salvaged in the future.

J. Countertops: Anchor securely by screwing through corner blocks of base casework or other supports into underside of countertop.

1. Align adjacent 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.
2. Install countertops with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
3. Secure backsplashes to tops with concealed metal brackets at 16 inches and to walls with adhesive.
4. Calk space between backsplash and wall with sealant specified in Section 079200 - JOINT SEALANTS.

K. Touch up finishing work specified in this Section after installation of woodwork. Fill nail holes with matching filler where exposed.

3.3 ADJUSTING AND CLEANING

A. Repair damaged and defective woodwork, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

B. Clean, lubricate, and adjust hardware.

C. Clean woodwork on exposed and semiexposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION

SECTION 066400

FRP PANELING

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Glass-fiber reinforced plastic (FRP) wall paneling and trim accessories.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 061000 - ROUGH CARPENTRY for wood furring for installing plastic paneling.

1.3 SUBMITTALS

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

B. Samples for Verification: For plastic paneling and trim accessories, in manufacturer's standard sizes.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain plastic paneling and trim accessories from single manufacturer.

B. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 450 or less.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install plastic paneling until spaces are enclosed and weathertight and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. 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. Crane Composites.
2. Marlite.
3. Nudo Products, Inc.

B. Basis-of-Design:

2.2 PLASTIC SHEET PANELING

A. General: Gelcoat-finished, glass-fiber reinforced plastic (FRP) panels complying with ASTM D 5319.

1. Nominal Thickness: Not less than 0.075 inch.
2. Surface Finish: Molded pebble texture.
3. Color: As selected by Architect from manufacturer's full range.

2.3 ACCESSORIES

A. Trim Accessories: Manufacturer's standard one-piece vinyl extrusions designed to retain and cover edges of panels. Provide division bars, inside corners, outside corners, and caps as needed to conceal edges.

1. Color: Match panels.

B. Exposed Fasteners: Nylon drive rivets recommended by panel manufacturer.

C. Concealed Mounting Splines: Continuous, H-shaped aluminum extrusions designed to fit into grooves routed in edges of factory-laminated panels and to be fastened to substrate.

D. Adhesive: As recommended by plastic paneling manufacturer for substrate indicated.

1. Low-Emitting Materials: Provide adhesives in compliance with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
2. VOC Content: 50 g/L or less.
3. Do not use adhesives that contain urea formaldehyde.
4. Methylene chloride and perchloroethylene may not be intentionally added to adhesives.

E. Sealant: Single-component, mildew-resistant, neutral-curing silicone sealant recommended by plastic paneling manufacturer and complying with requirements in Section 079200 - JOINT SEALANTS.

1. Low-Emitting Materials: Provide adhesives in compliance with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation

of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2. VOC Content, Architectural Sealants: 250 g/L or less.
3. Methylene chloride and perchloroethylene may not be intentionally added to sealants.

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 the Work.

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

3.2 PREPARATION

A. Remove wallpaper, vinyl wall covering, loose or soluble paint, and other materials that might interfere with adhesive bond.

B. Prepare substrate by sanding high spots and filling low spots as needed to provide flat, even surface for panel installation.

C. Clean substrates of substances that could impair bond of adhesive, including oil, grease, dirt, and dust.

D. Condition panels by unpacking and placing in installation space before installation according to manufacturer's written recommendations.

E. Lay out paneling before installing. Locate panel joints to provide equal panels at ends of walls not less than half the width of full panels and so that trimmed panels at corners are not less than 12 inches wide.

1. Mark plumb lines on substrate at panel joint locations for accurate installation.
2. Locate trim accessories to allow clearance at panel edges according to manufacturer's written instructions.

3.3 INSTALLATION

A. Install plastic paneling according to manufacturer's written instructions.

B. Install panels in a full spread of adhesive.

C. Install trim accessories with adhesive.

D. Fill grooves in trim accessories with sealant before installing panels and bed inside corner trim in a bead of sealant.

E. Maintain uniform space between panels and wall fixtures. Fill space with sealant.

F. Remove excess sealant and smears as paneling is installed. Clean with solvent recommended by sealant manufacturer and then wipe with clean dry cloths until no residue remains.

END OF SECTION

SECTION 070150

MODIFICATIONS TO EXISTING ROOFING

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Modify existing roofing systems as required to accommodate new construction or equipment removal.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 061000 - ROUGH CARPENTRY for wood nailers, curbs, and blocking.
2. Section 073113 - ASPHALT SHINGLES for new roof system.
3. Section 073126 - SLATE SHINGLES for new roof system.
4. Section 075400 - THERMOPLASTIC MEMBRANE ROOFING for new roof system.
5. Section 076200 - SHEET METAL FLASHING AND TRIM for metal roof penetration flashings, flashings, and counterflashings.
6. Section 079200 - JOINT SEALANTS for sealants.
7. Division 22 - PLUMBING for roof drains.
8. Division 23 - HEATING, VENTILATING, AND AIR CONDITIONING for roof curbs for HVAC equipment.

1.3 DEFINITIONS

A. Roofing Terminology: Refer to ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definition of terms related to roofing work in this Section.

1.4 PERFORMANCE REQUIREMENTS

A. General: Provide installed roofing membrane and base flashings that remain watertight; do not permit the passage of water; and resist specified uplift pressures, thermally induced movement, and exposure to weather without failure.

B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by roofing manufacturer based on testing and field experience.

C. Roofing System Design: Roofing system shall be designed to withstand Code required loads and wind speeds.

D. Flashings: Provide base flashings, perimeter flashings, detail flashings and component materials that comply with requirements and recommendations in FMG 1-49 Loss Prevention Data Sheet for Perimeter Flashings; FMG 1-29 Loss Prevention Data Sheet for Above Deck Roof Components; NRCA Roofing and Waterproofing Manual (Fourth Edition) for Construction Details and SMACNA Architectural Sheet Metal Manual (Fifth Edition) for Construction Details, as applicable.

E. Certification: Upon completion of work of this Section, submit certification by existing roof manufacturer acknowledging that all work performed is acceptable and that the entire roof remains under warranty.

1.5 SUBMITTALS

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

B. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other Work.

1. Base flashings and membrane terminations.
2. Tapered insulation, including slopes.
3. Insulation attachment patterns.
4. Setting Drawings showing layout, sizes, sections, profiles, and joint details of concrete pavers with paver support assemblies.

C. Samples: For the following products:

1. Concrete paver, full sized, in each color and texture required.
2. Paver pedestal assembly.

D. Installer Certificates: Signed by roofing system manufacturer certifying that Installer is approved, authorized, or licensed by manufacturer to install roofing system.

E. Qualification Data: For Installer and manufacturer.

F. Maintenance Data: For roofing system to include in maintenance manuals.

G. Inspection Report: Copy of roofing system manufacturer's inspection report of completed roofing installation.

1.6 QUALITY ASSURANCE

A. Source Limitations: Obtain components for roofing system from or approved by roofing system manufacturer.

B. Preinstallation Conference: Conduct conference at Project site. Comply with requirements in Division 01. Review methods and procedures related to roofing system including, but not limited to, the following:

1. Meet with the Architect, Owner, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, and installers whose work interfaces with or affects roofing including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
5. Review structural loading limitations of roof deck during and after roofing.
6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.
7. Review governing regulations and requirements for insurance and certificates if applicable.
8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storing and mixing with other components.

B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.

1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.

C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

D. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

1.8 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

1.9 WARRANTY

A. Roofing Contractor's Warranty: The roofing subcontractor shall supply Owner with a minimum two-year workmanship warranty for each roof. In the event any work related to the roofing, flashing, or metalwork is found to be defective within two years of substantial completion, the roofing contractor shall remove and replace such at no additional cost to the Owner. A copy of the roofing signed warranty shall be sent to the roofing system's manufacturer.

1. The duration of the Roofing Contractor's two-year warranty shall run concurrent with the roofing system's manufacturer's existing warranty.

B. Roofing Systems Manufacturer's Warranty: Maintain existing warranties. Coordinate with Owner.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Compatibility: Provide products recommended by manufacturers to be fully compatible with indicated substrates. Provide separation materials as required to eliminate contact between incompatible materials.

1. Furnish specific product acceptable to manufacturer of roofing membrane which will not compromise the roofing manufacturer's warranty.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with the following requirements and other conditions affecting performance of roofing system:

1. Verify that roof openings and penetrations are in place and set and braced and that roof drains are securely clamped in place.
2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
3. Verify that surface plane flatness and fastening of steel roof deck comply with requirements in Section 053100 - STEEL DECKING.
4. Verify that existing wood roof deck is sound and securely attached to structure.
5. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrate of dust, debris, moisture, 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.

C. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

D. Coordinate installing membrane roofing system components so underlayment, vapor retarder, insulation, and cover boards are not exposed to precipitation or left exposed at the end of the workday.

3.3 INSTALLATION

A. General: Install roofing system and components in compliance with the following Sections:

1. Section 073113 - ASPHALT SHINGLES.
2. Section 073126 - SLATE SHINGLES.
3. Section 075400 - THERMOPLASTIC MEMBRANE ROOFING.

B. Comply with field quality control requirements for each Section.

END OF SECTION

SECTION 071300

SELF-ADHERING SHEET WATERPROOFING

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Rubberized-asphalt sheet waterproofing.
2. HDPE sheet waterproofing.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 072100 - THERMAL INSULATION for insulation at foundations and under slabs.
2. Section 079200 - JOINT SEALANTS for joint-sealant materials and installation.
3. Section 079500 - EXPANSION CONTROL for expansion-joint systems.

1.3 PERFORMANCE REQUIREMENTS

A. Provide waterproofing that prevents the passage of water.

1.4 SUBMITTALS

A. Product Data: For each type of product.

1. Include manufacturer's written instructions for evaluating, preparing, and treating substrate, technical data, and tested physical and performance properties of waterproofing.

B. Shop Drawings: Show locations and extent of waterproofing. Include details for substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, and other termination conditions.

C. Samples: For the following products:

1. 12-by-12-inch square of waterproofing and flashing sheet.
2. 4-by-4-inch square of drainage panel.

D. Installer Certificates: Signed by manufacturers certifying that installers comply with requirements.

E. Sample Warranty: Copy of special waterproofing manufacturer's and Installer's warranty stating obligations, remedies, limitations, and exclusions before starting waterproofing.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who is acceptable to waterproofing manufacturer to install manufacturer's products.

B. Source Limitations: Obtain waterproofing materials, protection course, and molded-sheet drainage panels through one source from a single manufacturer.

C. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01. 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.

1.6 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.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended by waterproofing manufacturer. Do not apply waterproofing to a damp or wet substrate.

1. Do not apply waterproofing in snow, rain, fog, or mist.

B. Maintain adequate ventilation during preparation and application of waterproofing materials.

1.8 WARRANTY

A. Special Manufacturer's Warranty: Written warranty, signed by waterproofing manufacturer agreeing to replace waterproofing material that does not comply with requirements or that does not remain watertight during specified warranty period.

1. Warranty does not include failure of waterproofing due to failure of substrate not prepared and treated according to requirements or formation of new joints and cracks in substrate exceeding 1/16 inch in width.
2. Warranty Period: Five years after date of Substantial Completion.

3. Warranty includes removing and reinstalling protection board, drainage panels, insulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Rubberized-Asphalt Sheet Waterproofing - Post-Applied:

a. American Hydrotech, Inc.; VM 60.
b. Carlisle Corporation, Carlisle Coatings & Waterproofing Div.; MiraDRI 860/861.
c. Cetco; Envirosheet.
d. GCP Applied Technologies (formerly W.R. Grace); Bituthene 3000.
e. Henry Company; WP 200
f. W. R. Meadows, Inc.; Mel-Rol.

2. HDPE Sheet Waterproofing:

a. GCP Applied Technologies (formerly W.R. Grace); Preprufe 160R Plus for vertical surfaces and Preprufe 300R Plus for horizontal surfaces.
b. MiraPLY-H for horizontal and MiraPLY-V for vertical by Carlisle Coatings and Waterproofing.
c. PRECON for horizontal and vertical by W.R. Meadows.

3. Composite HDPE/Bentonite Sheet Waterproofing – Post-Applied:

a. Tremco Inc.; Peraseal Membrane for vertical surfaces.

4. Composite HDPE/Bentonite Sheet Waterproofing – Pre-Applied:

a. Tremco Inc.; Peraseal LG Membrane for blindside conditions on retained earth or below slab and Peraseal GM for blindside conditions with hydrostatic water.

2.2 RUBBERIZED-ASPHALT SHEET WATERPROOFING

A. Rubberized-Asphalt Sheet: 60-mil-thick, self-adhering sheet consisting of 56 mils of rubberized asphalt laminated to a 4-mil-thick, polyethylene film with release liner on adhesive side.

1. Physical Properties: As follows, measured per standard test methods referenced:

a. Tensile Strength: 325 psi minimum; ASTM D 412, Die C, modified.
b. Ultimate Elongation: 300 percent minimum; ASTM D 412, Die C, modified.
c. Low-Temperature Flexibility: Pass at minus 20 deg F ASTM D 1970.
d. Crack Cycling: Unaffected after 100 cycles of 1/8-inch (movement; ASTM C 836.
e. Puncture Resistance: 50 lbf minimum; ASTM E 154.
f. Hydrostatic-Head Resistance: 200 feet (minimum; ASTM D 5385.
g. Water Absorption: 0.15 percent weight-gain maximum after 48-hour immersion at 70 deg F; ASTM D 570.
h. Vapor Permeance: 0.05 perms; ASTM E 96, Water Method.

2.3 HDPE SHEET WATERPROOFING

A. HDPE Sheet for Vertical Applications: 32-mil-thick, uniform, flexible sheets consisting of 16-mil-thick, HDPE sheet coated with a pressure-sensitive rubber adhesive, a protective adhesive coating; release sheet not required.

B. HDPE Sheet for Horizontal Applications: 46-mil-thick, uniform, flexible sheets consisting of 30-mil-thick, HDPE sheet coated with a pressure-sensitive rubber adhesive, a protective adhesive coating, a detackifying surface treatment, an uncoated self-adhering side lap strip, and a release liner.

C. Physical Properties: As follows, measured per standard test methods referenced:

1. Tensile Strength, Film: 4000 psi minimum; ASTM D 412.
2. Lateral Water Migration Resistance: Pass at 231 ft. of hydrostatic head pressure; ASTM D 5385, modified.
3. Low-Temperature Flexibility: Pass at minus 10 deg F; ASTM D 1970.
4. Peel Adhesion to Concrete: 5 lbf/in.; ASTM D 903, modified.
5. Lap Adhesion: 2.5 lbf/in.; ASTM D 1876, modified.
6. Hydrostatic-Head Resistance: 231 feet; ASTM D 5385, modified.
7. Vapor Permeance: 0.01 perms; ASTM E 96, Water Method.

2.4 COMPOSITE HDPE/BENTONITE SHEET WATERPROOFING

A. HDPE/Bentonite Sheet for Vertical Applications: Dual-waterproofing, resealable, composite sheet membrane system composed of high-density polyethylene with a sodium-bentonite face

B. Physical Properties: As follows, measured per standard test methods referenced:

1. Puncture Resistance: 169 lbs.; ASTM E154.
2. Tensile Strength: 4,000 psi; ASTM D412.
3. Water Vapor Permeance: 0.03 perms; ASTM E96
4. Percent Elongation: 700 percent; ASTM D638, Type 4 Dumbbell.
5. Resistance to Hydrostatic Head: 150 feet: ASTM D751
6. Warranted Crack-Bridging Capability: 1/8 inch.

2.5 AUXILIARY MATERIALS

A. General: Furnish auxiliary materials recommended by waterproofing manufacturer for intended use and compatible with sheet waterproofing.

1. Furnish liquid-type auxiliary materials that comply with VOC limits of authorities having jurisdiction.

B. Primer: Liquid primer recommended for substrate by manufacturer of sheet waterproofing material.

C. Surface Conditioner: Liquid, waterborne surface conditioner recommended for substrate by manufacturer of sheet waterproofing material.

D. Sheet Strips: Self-adhering, rubberized-asphalt composite sheet strips of same material and thickness as sheet waterproofing.

E. Liquid Membrane: Elastomeric, two-component liquid, cold fluid applied, trowel grade or low viscosity.

F. Substrate Patching Membrane: Low-viscosity, two-component, asphalt-modified coating.

G. Mastic, Adhesives, and Tape: Liquid mastic and adhesives, and adhesive tapes recommended by waterproofing manufacturer.

1. Detail Tape: Two-sided, pressure-sensitive, self-adhering reinforced tape, 4-1/2 inches wide, with a tack-free protective adhesive coating on one side and release film on self-adhering side.

H. Metal Termination Bars: Aluminum bars, approximately 1 by 1/8 inch thick, predrilled at 9-inch centers.

I. Protection Course: Fan-folded, extruded-polystyrene board insulation, unfaced, nominal thickness 3/8 inch.

2.6 MOLDED-SHEET DRAINAGE PANELS

A. Nonwoven-Geotextile-Faced, Molded-Sheet Drainage Panel: Manufactured composite subsurface drainage panels consisting of a nonwoven, needle-punched geotextile facing with an apparent opening size not exceeding No. 70 (0.21-mm) sieve laminated to 1 side with a polymeric film bonded to the other side of a 3-dimensional (studded), nonbiodegradable, molded-plastic-sheet drainage core, with a vertical flow rate of 9 to 15 gpm per ft. (112 to 188 L/min. per m).

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

a. American Hydrotech, Inc.; Hydrodrain 420.
b. Carlisle Coatings & Waterproofing Inc.; CCW MiraDRAIN 6200 series.
c. GCP Applied Technologies (formerly W.R. Grace); Hydroduct 220 vertical, 660 horizontal.
d. Henry Company; DB 220 vertical, DB 650 horizontal.
e. Sika Sarnafil Inc.; Drainage Panel 900 series.
f. Tremco Inc. TREMDrain 1000 or TREMDrain 2000.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance.

1. Verify that concrete has cured and aged for minimum time period recommended by waterproofing manufacturer.
2. Verify that concrete is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.

3. Verify that compacted subgrade and substrates are dry, smooth, and sound; ready to receive HDPE sheet.
4. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE 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. Bridge and cover isolation joints, expansion joints and discontinuous deck-to-wall and deck-to-deck joints with overlapping sheet strips.

1. Invert and loosely lay first sheet strip over center of joint. Firmly adhere second sheet strip to first and overlap to substrate.

G. Corners: Prepare, prime, and treat inside and outside corners according to ASTM D 6135.

1. Install membrane strips centered over vertical inside corners. Install 3/4-inch fillets of liquid membrane on horizontal inside corners and as follows:

a. At footing-to-wall intersections, extend liquid membrane each direction from corner or install membrane strip centered over corner.
b. At plaza deck-to-wall intersections, extend liquid membrane or sheet strips onto deck waterproofing and to finished height of sheet flashing.

H. 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 RUBBERIZED-ASPHALT SHEET APPLICATION

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.

1. 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 .

D. Horizontal Application: Apply sheets from low point to high point of decks to ensure that side laps shed water.

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 as applicable.

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.

3.4 HDPE SHEET APPLICATION

A. Install HDPE sheets according to waterproofing manufacturer's written instructions.

B. Vertical Applications: Install sheet membrane with HDPE face against substrate. Accurately align sheets and maintain uniform 3-inch-minimum lap widths and end laps. Overlap and seal seams and stagger and tape end laps to ensure watertight installation. Mechanically fasten to substrate.

1. Securely fasten top termination of membrane with continuous metal termination bar anchored into substrate and cover with detailing tape.

C. Horizontal Applications: Install sheet membrane with HDPE face against substrate. Accurately align sheets and maintain uniform 3-inch-minimum lap widths and end laps. Overlap and seal seams. Overlap, stagger, and seal end laps with detail tape to ensure watertight installation.

D. Corners: Seal lapped terminations and cut edges of sheet waterproofing at inside and outside corners with detail tape.

E. Seal penetrations through sheet waterproofing to provide watertight seal with detail tape patches or wraps and a liquid-membrane troweling.

F. Install sheet waterproofing and auxiliary materials to produce a continuous watertight tie into adjacent waterproofing.

G. Repair tears, voids, and lapped seams in waterproofing not complying with requirements. Tape perimeter of damaged or nonconforming area extending 6 inches beyond repaired areas in all directions. Apply a patch of sheet membrane and firmly secure with detail tape.

H. Correct deficiencies in or remove waterproofing that does not comply with requirements, repair substrates, reapply waterproofing, and repair sheet flashings.

3.5 COMPOSITE HDPE/BENTONITE INSTALLATION

A. Install composite HDPE/bentonite sheets according to waterproofing manufacturer's written instructions.

B. Below Slab Installation:

1. Bentonite-Side Up:

a. Install membrane sheets bentonite-side up with edges overlapped 3" minimum over stable, smoothed and compacted subgrade or mud slab; position membrane to stagger end laps 12"; securely fasten seams with staples every 8"on center.
b. Extend membrane upward 6" minimum within the formwork at bottom edges of mat slabs and wrapped footings to provide for proper tie-in to vertical membrane; install membrane in double layer continuous along bottom edges of slabs and wrapped footings extending 6" from edge in both directions.
c. Install membrane to wrap footings where shown on Drawings; carry membrane across top surfaces of unwrapped footings or mud slab to interior vertical faces of walls and columns and terminate as manufacturer recommends.
d. Waterproof penetrations in accord with manufacturers recommendations.
e. Verify membrane is protected from damage caused by rebar and support chairs.
f. Protect exposed bentonite from moisture with temporary plastic sheets; remove plastic sheets before final covering.

2. Bentonite-Side Down:

a. Install polyethylene base sheets with edges lapped 5" over stable, smoothed and compacted subgrade or mud slab; trim base sheet away from penetrations and terminations.
b. Install membrane bentonite-side down over polyethylene base sheets with edges lapped 3" minimum; position membrane sheets to stagger end laps 12"; tape seams with reinforced seam tape closely following membrane placement and immediately secure by roll-pressing with hand-held metal seam roller.
c. Extend membrane upward 6" minimum within the formwork at bottom edges of mat slabs and wrapped footings; install a second layer of membrane, with the bentonite-side up, under the field membrane and extending upward within the formwork at bottom edges of mat slabs and wrapped footings to provide for proper tie-in to vertical membrane; membrane double layer continuous along bottom edges of slabs and wrapped footings shall extend 6" from edge in both directions.
d. Install membrane to wrap footings where shown on Drawings; carry membrane across top surfaces of unwrapped footings or mud slab to interior vertical faces of walls and columns and terminate as manufacturer recommends.
e. Waterproof penetrations in accord with manufacturer's recommendations.
f. Verify membrane is protected from damage caused by rebar and support chairs.

3. Backfilled Wall Installation:

a. Install membrane sheets in vertical or horizontal lifts with HDPE-side facing applicator to prepared surfaces conforming to manufacturer's requirements.

1) Vertical installation: Securely fasten membrane 12" on center along top edge with sheet extending out onto footing surfaces 6" minimum, overlapping below-slab membrane 6"; install subsequent membrane sheets to overlap previous sheets 1-1/2" minimum; securely fasten membrane 24" on center through both sheets at overlaps; securely fasten 18" on center to tops of footing surfaces and horizontal shelves; apply seam tape to seam overlaps.
2) Horizontal installation: Start membrane at lowest portion of wall; securely fasten membrane 24" on center along top edge with sheet extending out onto footing surfaces 6" minimum, overlapping under slab membrane 6"; install subsequent membrane sheets to overlap previous sheets minimum 1-1/2" in shingle fashion with staggered end laps; securely fasten membrane 24" on center through both sheets at overlaps; securely fasten 18" on center to tops of footing surfaces and horizontal shelves; apply seam tape to seam overlaps.

b. Waterproof penetrations in accord with manufacturer's recommendations.

4. Blindside Wall Installation:

a. Ensure that vertical surfaces to receive waterproofing system conform to manufacturer's requirements as applicable to the earth retaining system employed prior to commencing installation; contact manufacturer for requirements of project conditions not provided for in installation manuals.
b. Install waterproofing membrane starter-strip to vertical surfaces of earth retaining system with bentonite-side facing applicator prior to placement of concrete footings or foundation mat slab.
c. Prepare all vertical inside corners that occur along the earth retaining system by fastening a minimum 12" wide strip of membrane pressed tight into corner with bentonite-side facing applicator; securely fasten along vertical edges 24" on center.
d. Install membrane sheets oriented vertically with bentonite-side facing applicator; overlap membrane sheets 3" minimum for poured-in-place walls and 4" minimum for shotcrete/gunite walls; securely fasten membrane through both sheets at overlap areas with nails every 24" on center and staples every 3" on center.
e. Verify which penetrations must be accessed after concrete placement for completion of waterproofing detail treatment and ensure that sufficient access to membrane is provided within a formed boxout; verify which penetrations will not be accessed after concrete placement for completion of waterproofing detail treatment and ensure that final detailing procedures are completed prior to erection of concrete formwork or shotcreting/guniting; waterproof penetrations in accord with manufacturer's current procedures; contact manufacturer for procedures at project conditions not provided for in installation manuals.
f. Protect membrane system from excessive rain.
g. Inspect and repair damages to membrane system immediately prior to erection of concrete formwork or shotcreting/guniting; ensure that concrete directly contacts membrane.
h. Complete waterproofing details and terminations at gradeline coordinating with other trades.

5. Deck Installation:

a. Install membrane with bentonite-side down against deck surfaces with edges overlapped minimum 1-1/2" in shingle fashion with staggered end laps; start installation at lowest point; tape seams with reinforced waterproofing seam tape closely following membrane placement and immediately secure by roll-pressing with hand-held metal seam roller.
b. Waterproof penetrations, horizontal-to-vertical junctures and vertical terminations with liquid-applied elastomeric flashing carried out onto deck surfaces 12"; overlap cured elastomeric flashing 6" with membrane sheet and seal leading edge with reinforced waterproofing seam tape.
c. Conduct flood-test of membrane installed to elevated horizontal surfaces by damming perimeter, stopping drains and covering with 2" of water for 24 hours; if leakage occurs, make repairs and repeat flood-test; when area is proven watertight, drain water and remove dams; obtain written authorization by manufacturer's representative prior to conducting flood-test.
d. Ensure membrane is protected from damage caused by construction trades.

3.6 MOLDED-SHEET DRAINAGE-PANEL INSTALLATION

A. Place and secure molded-sheet drainage panels, with geotextile facing away from wall or deck substrate, according to manufacturer's written instructions. Use adhesives or other methods that do not penetrate waterproofing. Lap edges and ends of geotextile to maintain continuity. Protect installed molded-sheet drainage panels during subsequent construction.

1. For vertical applications, install board insulation before installing drainage panels.

3.7 FIELD QUALITY CONTROL

A. Flood Testing: Flood test each deck area for leaks, according to recommendations in ASTM D 5957, after completing waterproofing but before overlying construction is placed. Install temporary containment assemblies, plug or dam drains, and flood with potable water.

1. Flood to an average depth of 2-1/2 inches with a minimum depth of 1 inch and not exceeding a depth of 4 inches. Maintain 2 inches of clearance from top of sheet flashings.
2. Flood each area for 24 hours.
3. After flood testing, repair leaks, repeat flood tests, and make further repairs until waterproofing installation is watertight.
4. Engage an independent testing agency to observe flood testing and examine underside of decks and terminations for evidence of leaks during flood testing.

3.8 PROTECTION AND CLEANING

A. Do not permit foot or vehicular traffic on unprotected membrane.

B. Protect waterproofing from damage and wear during remainder of construction period.

C. Protect installed insulation from damage due to ultraviolet light, harmful weather exposures, physical abuse, and other causes. Provide temporary coverings where insulation will be subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

D. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION

SECTION 071400

FLUID-APPLIED WATERPROOFING

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Rubberized-asphalt waterproofing membrane, reinforced.
2. Molded-sheet drainage panels.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 071300 - SELF-ADHERING SHEET WATERPROOFING for foundation and underslab waterproofing.
2. Section 072100 - THERMAL INSULATION for insulation at foundations and under slabs.
3. Section 079200 - JOINT SEALANTS for joint-sealant materials and installation.
4. Section 079500 - EXPANSION CONTROL for expansion-joint systems.

1.3 SUBMITTALS

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

1. Include manufacturer's written instructions for evaluating, preparing, and treating substrate, technical data, and tested physical and performance properties of waterproofing.

B. Shop Drawings: Show locations and extent of waterproofing. Include details for substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, tie-ins to adjoining waterproofing, and other termination conditions.

C. Samples: For the following products:

1. 12-by-12-inch square of waterproofing and flashing sheet.
2. 4-by-4-inch square of drainage panel.

D. Installer Certificates: Signed by manufacturers certifying that installers comply with requirements.

E. Sample Warranty: Copy of special waterproofing manufacturer's and Installer's warranty stating obligations, remedies, limitations, and exclusions before starting waterproofing.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who is acceptable to waterproofing manufacturer to install manufacturer's products.

B. Source Limitations: Obtain waterproofing materials, flashing, protection course, and molded-sheet drainage panels through one source from a single manufacturer.

C. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01. 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.

1.5 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 containers in a clean, dry, protected location and within the temperature range required by waterproofing manufacturer.

C. Remove and replace liquid materials that cannot be applied within their stated shelf life.

D. Protect stored materials from direct sunlight.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended by waterproofing manufacturer. Do not apply waterproofing to a damp or wet substrate, or when temperature is below 0 deg F.

1. Do not apply waterproofing in snow, rain, fog, or mist.

B. Maintain adequate ventilation during application and curing of waterproofing materials.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace waterproofing and sheet flashings that do not comply with requirements or that fail to remain watertight within specified warranty period.

1. Warranty insulation will retain 80 percent of original published thermal value.
2. Warranty includes removing and reinstalling protection board, drainage panels, insulatio.
3. Warranty Period: Five years from date of Substantial Completion.

B. Special 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, drainage panels, insulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Hot Fluid-Applied, Rubberized-Asphalt Waterproofing Membrane:

a. American Hydrotech, Inc.; Monolithic Membrane 6125.
b. Carlisle Coatings & Waterproofing Inc.; CCW-500R.
c. Henry Company; 790-11.
d. Tremco Incorporated; Tremproof 150.

2.2 WATERPROOFING MEMBRANE

A. Hot Fluid-Applied, Rubberized-Asphalt Waterproofing Membrane: Single component; 100 percent solids; hot fluid-applied, rubberized asphalt.

B. Physical Properties:

PROPERTY	TEST METHOD	TYPICAL RESULTS
Flash Point	ASTM D-92, CGSB-37.50-M89	500°F*
Low Temperature Crack Bridging Capability	CGSB-37.50-M89	No cracking, adhesion loss, or splitting
Water Vapor Permeability	ASTM E 96, Procedure E, CGSB-37.50-M89	1.6ng/Pa(s)M², (0.018 perm)
Water Resistance (5 days/50 °C)	CGSB-37.50-M89	No delamination, blistering, emulsification, or deterioration
Water Absorption	CGSB-37.50-M89	0.22g weight gain
Toughness	CGSB-37.50-M89	13.0 Joules
Ratio of Toughness to Peak Load	CGSB-37.50-M89	0.069
Viscosity	CGSB-37.50-M89	7.0 seconds
Heat Stability	CGSB-37.50-M89	No change in viscosity, penetration, flow or low temperature flexibility
Low Temperature Flexibility (- 25 °C)	CGSB-37.50-M89	No delamination, flexibility adhesion loss, or cracking
Penetration	ASTM D 1191, CGSB-37.50-M89	75.0 mm at 77°F, 121.7mm at 122 °F
Flow	ASTM D 1191, GSB-37.50-M89	0.0mm @ 140°F
Softening Point	ASTM D 36	180°F
Elongation	ASTM D 1191	1000% minimum
Resiliency	ASTM D 3407	40% minimum
Bond to Concrete @ 0 °F, (18 °C)	ASTM D 3408	Pass
Hydrostatic Pressure Resistance	ASTM D-08.22, Draft 2	100 psi (=231 foot head of water)

PROPERTY	TEST METHOD	TYPICAL RESULTS
Acid Resistance	ASTM D 896 Procedure 7.1(N-8)	Pass 50% Nitric Acid, 50% Sulfuric Acid
Salt Water Resistance (20% sodium carbonate and calcium chloride)	ASTM D-896 similar	No delamination, blistering, emulsification, or deterioration

*45°F more than the application temperature recommended by the manufacturer.

2.3 FLASHING SHEET MATERIALS

A. Granulated Cap Flashings: SBS modified bitumen membrane composed of a polyethylene lower surface and a ceramic granule top surface, reinforced with a non-woven polyester reinforcement, designed specifically for hot mop applications, and having the following physical properties in accordance with ASTM D6164 Type 1, Grade G:

1. Thickness: 0.140 inches (140 mils).
2. Tensile strength at 0 degrees F: 113 lbf/inch (md), 100 lbf/inch (xd).
3. Elongation at 0 degrees F: 40 percent (md & xd).
4. Low temperature flexibility: -15 degrees F.

B. Elastomeric Flashing Sheet: 60-mil-minimum, uncured sheet neoprene as follows:

1. Tensile Strength: 1400 psi minimum; ASTM D 412, Die C.
2. Elongation: 300 percent minimum; ASTM D 412.
3. Tear Resistance: 125 psi minimum; ASTM D 624, Die C.
4. Brittleness: Does not break at minus 30 deg F; ASTM D 2137.

2.4 AUXILIARY MATERIALS

A. Primer: ASTM D 41, asphaltic primer.

B. Elastomeric Sheet: 60-mil-minimum, uncured sheet neoprene as follows:

1. Tensile Strength: 1400 psi minimum; ASTM D 412, Die C.
2. Elongation: 300 percent minimum; ASTM D 412.
3. Tear Resistance: 125 psi minimum; ASTM D 624, Die C.
4. Brittleness: Does not break at minus 30 deg F; ASTM D 2137.

C. Elastomeric Sheet Adhesive: Quick setting, pressure sensitive, contact adhesive with good tack retention.

D. Metal Termination Bars: Manufacturer's standard, predrilled stainless-steel or aluminum termination bars; approximately 1 by 1/8 inch thick; with anchors.

E. Sealants and Accessories: Manufacturer's recommended sealants and accessories.

F. Reinforcing Fabric: Manufacturer's recommended, spun-bonded polyester fabric.

G. Protection Course: 80 mil SBS modified bitumen with the following properties:

1. Fiber glass reinforcement of 100 g/M2 meeting ASTM D6163.

2. Type 1, Grade S.
3. Upper and lower surface having a sanded surface.

2.5 MOLDED-SHEET DRAINAGE PANELS

A. Nonwoven-Geotextile-Faced, Molded-Sheet Drainage Panel: Manufactured composite subsurface drainage panels consisting of a nonwoven, needle-punched geotextile facing with an apparent opening size not exceeding No. 70 (0.21-mm) sieve laminated to 1 side with a polymeric film bonded to the other side of a 3-dimensional (studded), nonbiodegradable, molded-plastic-sheet drainage core, with a vertical flow rate of 9 to 15 gpm per ft. (112 to 188 L/min. per m).

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

a. American Hydrotech, Inc.; Hydrodrain 420.
b. Carlisle Coatings & Waterproofing Inc.; CCW MiraDRAIN 6200 series.
c. GCP Applied Technologies (formerly W.R. Grace); Hydroduct 220 vertical, 660 horizontal.
d. Henry Company; DB 220 vertical, DB 650 horizontal.
e. Sika Sarnafil Inc.; Drainage Panel 900 series.
f. Tremco Inc. TREMDrain 1000 or TREMDrain 2000.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. Verify that concrete has cured and aged for minimum time period recommended by waterproofing manufacturer.
2. Verify that substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.

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

3.2 PREPARATION

A. Clean and prepare substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrate for waterproofing application.

B. Mask off adjoining surfaces not receiving waterproofing to prevent spillage and overspray affecting other construction.

C. Close off deck drains and other deck penetrations to prevent spillage and migration of waterproofing fluids.

D. Remove grease, oil, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.

E. Remove fins, ridges, and other projections and fill honeycomb, aggregate pockets, and other voids.

3.3 JOINTS, CRACKS, AND TERMINATIONS

A. Prepare and treat substrates to receive waterproofing membrane, including joints and cracks, deck drains, corners, and penetrations according to manufacturer's written instructions.

1. Rout and fill joints and cracks in substrate. Before filling, remove dust and dirt according to ASTM D 4258.
2. Adhere strip of elastomeric sheet to substrate in a layer of hot rubberized asphalt. Extend elastomeric sheet a minimum of 6 inches on each side of moving joints and cracks or joints and cracks exceeding 1/8 inch thick, and beyond deck drains and penetrations. Apply second layer of hot fluid-applied, rubberized asphalt over elastomeric sheet.
3. Embed strip of reinforcing fabric into a layer of hot rubberized asphalt. Extend reinforcing fabric a minimum of 6 inches on each side of nonmoving joints and cracks not exceeding 1/8 inch thick, and beyond roof drains and penetrations.

    a. Apply second layer of hot fluid-applied, rubberized asphalt over reinforcing fabric.

3.4 FLASHING INSTALLATION

A. Install flashing sheets at terminations of waterproofing membrane according to manufacturer's written instructions.

B. Prime substrate with asphalt primer.

C. Install flashing sheet and adhere to deck and wall substrates in a layer of hot rubberized asphalt.

D. Extend flashing sheet up walls or parapets a minimum of 8 inches (200 mm) above plaza deck pavers and 6 inches (150 mm) onto deck to be waterproofed.

E. Install termination bars and mechanically fasten to top of elastomeric flashing sheet at terminations and perimeter of roofing.

3.5 MEMBRANE APPLICATION

A. Apply primer, at manufacturer's recommended rate, over prepared substrate and allow to dry.

B. Heat and apply rubberized asphalt according to manufacturer's written instructions.

1. Heat rubberized asphalt in an oil- or air-jacketed melter with mechanical agitator specifically designed for heating rubberized asphalt.

C. Start application with manufacturer's authorized representative present.

D. Reinforced Membrane: Apply hot rubberized asphalt to substrates and adjoining surfaces indicated. Spread to a thickness of 90 mils (2.3 mm); embed reinforcing fabric, overlapping sheets 2 inches (50 mm); spread another 125-mil- (3.2-mm-) thick layer to provide a uniform, reinforced, seamless membrane 215 mils (5.5 mm) thick.

E. Protection Course: Protection course shall be rolled onto hot applied rubberized asphalt while still warm and tacky. Lap protection course 2 inches on side and 6 inches on end laps. Starting at the low points or drains, install the protection course in full continuous sheets in a shingle pattern. Stager all end laps.

F. Apply waterproofing over prepared joints and up wall terminations and vertical surfaces to heights indicated or required by manufacturer.

3.6 MOLDED-SHEET DRAINAGE PANEL INSTALLATION

A. Place and secure molded-sheet drainage panels, with geotextile facing away from wall or deck substrate according to manufacturer's written instructions. Use methods that do not penetrate waterproofing. Lap edges and ends of geotextile to maintain continuity. Protect installed molded-sheet drainage panels during subsequent construction.

3.7 FIELD QUALITY CONTROL

A. Flood Testing: Flood test each deck area for leaks, according to recommendations in ASTM D 5957, after completing waterproofing but before overlying construction is placed. Install temporary containment assemblies, plug or dam drains, and flood with potable water.

1. Flood to an average depth of 2-1/2 inches with a minimum depth of 1 inch and not exceeding a depth of 4 inches. Maintain 2 inches of clearance from top of sheet flashings.
2. Flood each area for 24 hours.
3. After flood testing, repair leaks, repeat flood tests, and make further repairs until waterproofing installation is watertight.

B. Engage an independent testing agency to observe flood testing and examine underside of decks and terminations for evidence of leaks during flood testing.

3.8 CLEANING AND PROTECTION

A. Protect waterproofing from damage and wear during remainder of construction period.

B. Protect installed insulation drainage panels from damage due to UV light, harmful weather exposures, physical abuse, and other causes. Provide temporary coverings where insulation will be subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

C. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION

SECTION 071610

CRYSTALLINE WATERPROOFING

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Crystalline waterproofing for the following applications.

a. Elevator pits.
b. Sump pits.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 033000 - CAST-IN-PLACE CONCRETE for concrete substrate and finishing concrete walls and slabs to receive waterproofing.
2. Section 042000 - UNIT MASONRY for preparing concrete unit masonry walls to receive waterproofing.
3. Section 079200 - JOINT SEALANTS for elastomeric and preformed sealants in concrete and masonry walls and floors.

1.3 SUBMITTALS

A. Product Data: Include construction details, and material descriptions and installation instructions for crystalline waterproofing.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

B. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

1.5 PROJECT CONDITIONS

A. Weather Limitations: Proceed with application only when existing and forecasted weather conditions permit crystalline waterproofing to be performed according to manufacturer's written instructions and warranty requirements.

B. Proceed with waterproofing work only after pipe sleeves, vents, curbs, inserts, drains, and other projections through the substrate to be waterproofed have been completed. Proceed only after concrete and masonry substrate defects, including honeycombs, voids, and cracks, have been repaired to provide a sound substrate free of forming materials, including reveal inserts.

C. Ambient Conditions: Proceed with waterproofing work only if temperature is maintained at 40 deg F or above during work and cure period, and space is well ventilated and kept free of water.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of crystalline waterproofing that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Failure to maintain watertight conditions within specified warranty period.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Crystalline Waterproofing:

a. Anti-Hydro International, Inc.; Hydro Cap.
b. Conproco Corp.; Super Seal.
c. Tamms Industries, Inc.; Hey'Di K-11.
d. ThoRoc, Div. of ChemRex; Tegraproof.
e. Vandex International Ltd.; Vandex Super.
f. Xypex Chemical Corporation; Xypex.

2.2 MATERIALS

A. Crystalline Waterproofing: A prepackaged, proprietary blend of Portland cement, specially treated sand, and active chemicals that, when mixed with water and applied, penetrates by capillary action into concrete or masonry and reacts chemically with free lime in the presence of water to develop crystalline growth within concrete or masonry capillaries to produce an impervious, dense, waterproof concrete or masonry with properties meeting or exceeding the following criteria:

1. Permeability: 0 for water at 33 feet when tested according to CE CRD-C 48.
2. Compressive Strength: Minimum 3000 psi when tested according to ASTM C 109/C 109M.

B. Patching Compound: Cementitious waterproofing and repair mortar for filling and patching tie holes, honeycombs, reveals, and other imperfections; with properties meeting or exceeding the following criteria:

1. Compressive Strength: 7600 psi at 28 days when tested according to ASTM C 109/C 109M.
2. Flexural Strength: 710 psi at 28 days when tested according to ASTM C 348.
3. Shrinkage: Minus 0.093 percent at 28 days and plus 0.073 percent at 90 days when tested according to ASTM C 596.

C. Plugging Compound: Cementitious compound with hydrophobic properties; resistant to water and moisture but vapor permeable for all standard applications (vertical, overhead and horizontal surfaces not exposed to vehicular traffic); with properties meeting or exceeding the following criteria:

1. Permeability: 30 feet when tested according to CE CRD-C 48.
2. Compressive Strength: 6000 psi at 28 days when tested according to ASTM C 109/C 109M.
3. Flexural Strength: 1000 psi at 28 days when tested according to ASTM C 348.
4. Bond Strength: 300 psi at 14 days when tested according to ASTM C 321.

D. Water: Potable.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Conditions: Examine substrates, with Applicator present, where waterproofing is to be applied.

1. Proceed with application only after unsatisfactory conditions have been corrected.
2. Notify Architect in writing of active leaks or structural defects that would affect system performance.

3.2 PREPARATION

A. Protect other work from damage from cleaning, preparation, and application of crystalline waterproofing. Provide temporary enclosure to confine spraying operation and to ensure adequate ambient temperatures and ventilation conditions for application.

B. Stop active water leaks according to waterproofing manufacturer's written instructions.

C. Repair damaged or unsatisfactory concrete or masonry according to manufacturer's written instructions.

D. Surface Preparation: Comply with waterproofing manufacturer's written instructions to remove efflorescence, chalk, dust, dirt, mortar spatter, grease, oils, curing compounds, and form-release agents to ensure that waterproofing bonds to concrete or masonry surfaces.

1. Clean masonry surfaces according to ASTM D 4261.

a. Lightweight Concrete Masonry: Etch with 10 percent muriatic (hydrochloric) acid solution or abrade surface by wire brushing. Remove acid residue until pH readings of water after rinse are not more than 1.0 pH lower or 2.0 pH higher than pH of water before rinse.
b. Medium- and Normal-Weight Concrete Masonry: Sandblast or bushhammer to a depth of 1/16 inch.

2. Clean concrete surfaces according to ASTM D 4258.

a. Scratch- and Float-Finished Concrete: Etch with 10 percent muriatic (hydrochloric) acid solution according to ASTM D 4260.
b. Prepare smooth-formed and trowel-finished concrete by mechanical abrading or abrasive-blast cleaning according to ASTM D 4259.

3. Concrete Joints: Clean reveals according to waterproofing manufacturer's written instructions.

3.3 APPLICATION

A. General: Comply with waterproofing manufacturer's written instructions for application.

1. Dampen surface with water and maintain damp condition until applying waterproofing.
2. Apply waterproofing to negative-side surfaces.
3. Number of Coats: Two coats.
4. Dampen surface between coats.

B. Final Coat Finish: Smooth

C. Moist-cure waterproofing for three days immediately after application has set, followed by two days of air drying as recommended in writing by manufacturer.

D. Waterproofing Treatment Extensions: Extend waterproofing treatment as follows:

1. Onto columns integral with treated walls.
2. Onto every substrate in areas indicated for treatment, including pipe trenches, pits, and sumps.

3.4 PROTECTION

A. Protect applied crystalline waterproofing from rapid drying, severe weather exposure, and water accumulation. Maintain completed Work in moist condition for not less than three days by procedures recommended in writing by waterproofing manufacturer. Protect waterproofing from temperatures below 36 deg F.

3.5 FIELD QUALITY CONTROL

A. Inspection: Engage manufacturer's representative to inspect completed application and to provide a written report that application complies with manufacturer's written instructions.

END OF SECTION

SECTION 072100

THERMAL INSULATION

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Rigid insulation under slabs-on-grade and at perimeter foundation walls.
2. Rigid insulation at cavity walls.
3. Glass-fiber blanket insulation.
4. Mineral-wool blanket and board insulation.
5. Spray polyurethane foam insulation.
6. Spray-applied cellulose insulation.
7. Vapor retarders.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 033000 - CAST-IN-PLACE CONCRETE for underslab vapor barrier.
2. Section 072700 - AIR BARRIERS for air and vapor barrier membrane.
3. Section 075400 - THERMOPLASTIC MEMBRANE ROOFING for roofing insulation.
4. Section 092110 - GYPSUM BOARD ASSEMBLIES for acoustic insulation in gypsum board assemblies.
5. Division 22 - PLUMBING for plumbing insulation.
6. Division 23 - HEATING, VENTILATING, AND AIR CONDITIONING for mechanical insulation.

1.3 SUBMITTALS

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

B. Cavity Wall Insulation Certification: Submit manufacturer’s certification that cavity wall insulation, as designed in the assemblies indicated on the Drawings, has been tested to meet the requirements of NFPA 285 and passed.

C. Qualification Data: For Installer of spray-applied products and Testing Agency.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of building insulation through one source from a single manufacturer.

B. Installer Qualifications: A qualified installer who has been trained by and is acceptable to spray polyurethane foam insulation manufacturer to install manufacturer's products.

C. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

D. Fire Test Performance for Insulation in Cavity Wall: Passes NFPA 285, Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components.

E. Testing Agency Qualifications: An independent agency qualified as a “Certified Infrared Thermographer” per ASNT SNT-TC-1A guidelines, Level I certification minimum.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store in a dry and secure location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

B. Protect plastic and spray polyurethane foam insulation as follows:

1. Do not expose to sunlight, except to extent necessary for period of installation and concealment.
2. Protect against ignition at all times. Do not deliver materials to Project site before installation time.
3. Complete installation and concealment of materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 FOUNDATION WALL AND UNDER SLAB INSULATION

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. DiversiFoam Products.
2. Dow Chemical Company.
3. Owens Corning.

B. Extruded-Polystyrene (XPS) Board Insulation: ASTM C 578, square edged of type, density, and compressive strength indicated below:

1. For vertical applications, Type IV, 1.6-lb/cu. ft. minimum density and 25-psi minimum compressive strength.

2. For horizontal applications, pedestrian traffic, Type VII, 2.2-lb/cu. ft. minimum density and 60-psi minimum compressive strength.
3. For horizontal applications, vehicular traffic, Type V, 3-lb/cu. ft. minimum density and 100-psi minimum compressive strength.
4. MRc3, Recycled Content: 20 percent min.

C. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates indicated without damaging insulation and substrates.

2.2 CAVITY WALL INSULATION (NOT FOR USE BEHIND METAL WALL PANEL)

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. DiversiFoam Products.
2. Dow Chemical Company.
3. Owens Corning.

B. Extruded-Polystyrene (XPS) Board Insulation: ASTM C 578, Type X, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, and ASTM D 1621 compressive strength of 15 pounds per square inch minimum.

C. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates indicated without damaging insulation and substrates.

2.3 CAVITY WALL INSULATION, POLYISOCYANURATE BOARD

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

1. Atlas Roofing Corp.
2. Dow Chemical Company.
3. Rmax Inc.

B. Foil-Faced, Polyisocyanurate Board Insulation: ASTM C 1289, Type I, Class 1 or 2, with maximum flame-spread and smoke-developed indexes of 25 and 450, respectively, per ASTM E 84; 25-psi minimum compressive strength.

1. Fire Resistance: NFPA 286, for interior walls.
2. Thermal Resistance: ASTM C 518, R-Value 6.5 per inch.
3. Blowing Agent: Free from CFCs, HCFCs, or HFCs.

C. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates indicated without damaging insulation and substrates.

D. Joint Tape: Provide manufacturer’s recommended foil tape, as approved by the Architect.

2.4 CAVITY WALL INSULATION, MINERAL-WOOL BOARD

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. Isolatek International.

2. Owens Corning; Thermafiber.
3. Rockwool (formerly Roxul).

B. Unfaced, Mineral-Wool Board Insulation: ASTM C 612, Type IVB; with maximum flame-spread and smoke-developed indexes of 15 and zero, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.

1. Nominal density of 4 lb/cu. ft. Types IA and IB, thermal resistivity of 4 deg F x h x sq. ft./Btu x in. at 75 deg F minimum.
2. Fiber Color: Natural, except darkened where visible through joints in cladding.
3. NFPA 285 Assembly Fire Propagation Characteristics Testing Results: Passing.

C. Attachment to Substrate, Masonry Veneers: Manufacturer's recommended mechanical attachment clip or disk.

D. Attachment to Substrate, Panel Veneers: Manufacturer's recommended adhesively attached, spindle-type insulation anchors.

2.5 BLANKET INSULATION, GLASS FIBER BLANKET

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. CertainTeed Corporation.
2. Johns Manville.
3. Knauf Insulation.
4. Owens Corning.

B. Glass-Fiber Blanket, Unfaced: ASTM C 665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics. GreenGuard certified as formaldehyde free and low chemical emissions.

C. Glass-Fiber Blanket, Polypropylene-Scrim-Kraft Faced: ASTM C 665, Type II (nonreflective faced), Class A (faced surface with a flame-spread index of 25 or less); Category 1 (membrane is a vapor barrier). GreenGuard certified as formaldehyde free and low chemical emissions.

D. Glass-Fiber Blanket, Kraft Faced: ASTM C 665, Type II (nonreflective faced), Class C (faced surface not rated for flame propagation); Category 1 (membrane is a vapor barrier). GreenGuard certified as formaldehyde free and low chemical emissions.

E. Glass-Fiber Blanket, Foil Faced: ASTM C 665, Type III (reflective faced), Class B (faced surface with a flame-propagation resistance of 0.12 W/sq. cm); Category 1 (membrane is a vapor barrier), faced with foil scrim, foil-scrim kraft, or foil-scrim polyethylene. GreenGuard certified as formaldehyde free and low chemical emissions.

2.6 BLANKET INSULATION, MINERAL-WOOL BLANKET

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. Owens Corning; Thermafiber UltraBatt FF.

2. Isolatek International.
3. Rockwool (formerly Roxul).

B. Mineral-Wool Blanket, Unfaced: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.

C. Mineral-Wool Blanket, Reinforced-Foil Faced: ASTM C 665, Type III (reflective faced), Class A (faced surface with a flame-spread index of 25 or less per ASTM E 84); Category 1 (membrane is a vapor barrier), faced with foil scrim, foil-scrim kraft, or foil-scrim polyethylene. GreenGuard certified as formaldehyde free and low chemical emissions.

2.7 CLOSED-CELL SPRAY POLYURETHANE FOAM INSULATION

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

1. Accella Polyurethane Systems; Ecobay CC/CC Polar.
2. BASF Corporation; WALLTITE.
3. Corbond Corporation, a division of Johns Manville; Corbond III.
4. Demilec (USA) LLC; Heatlok.
5. Dow Chemical Company; STYROFOAM Spray Polyurethane Foam (CM Series).
6. Henry Company; PERMAX.
7. NCFI, a Division of Barnhardt Mfg. Co.; InsulStar.

B. Closed-Cell Polyurethane Foam Insulation: ASTM C 1029, Type I and II.

1. Minimum density of 1.5 lb/cu. ft., thermal resistivity of 6.2 deg F x h x sq. ft./Btu x in. at 75 deg F.
2. Fire Resistance: ASTM E 84, Flame Spread 75 max., and Smoke Developed 450 max.

2.8 OPEN-CELL SPRAY POLYURETHANE FOAM INSULATION

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

1. Accella Polyurethane Systems; Bayseal OC.
2. BASF Corporation; ENERTITE.
3. Corbond Corporation, a division of Johns Manville; Corbond ocSPF.
4. Demilec (USA) LLC; Sealection 500.
5. Henry Company; PERMAX 0.5 lb. Open Cell.
6. Icynene Inc.; Icynene Classic LD-C-50.
7. NCFI, a Division of Barnhardt Mfg. Co.; Sealite.

B. Open-Cell Polyurethane Foam Insulation:

1. Minimum density of 0.4 lb/cu. ft., thermal resistivity of 3.6 deg F x h x sq. ft./Btu x in. at 75 deg F.
2. Fire Resistance: ASTM E 84, Flame Spread 75 max., and Smoke Developed 450 max.

2.9 SPRAYED-FOAM INSULATION, AT GAPS AND VOIDS

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

1. Dow Chemical; GreatStuff Pro.
2. ICP Adhesives and Sealants (formerly Fomo Products): Handi-Foam products.

B. Sprayed-Foam Insulation: Water-cure closed cell polyurethane containing no urea-formaldehyde and no CFCs.

1. Minimum density of 0.4 lb/cu. ft., thermal resistivity of 4.0 deg F x h x sq. ft./Btu x in. at 75 deg F.
2. Fire Resistance: UL 723, Flame Spread 25 max., and Smoke Developed 50 max.

2.10 THERMAL AND IGNITION BARRIERS

A. Thermal Barrier for Foam Plastic Insulation at Occupied Spaces: Provide thermal barrier recommended by foam plastic manufacturer and tested with the specific product. Product shall have an active building code evaluation report that lists report number and effective dates of product acceptance.

B. Ignition Barrier for Foam Plastic Insulation at Attic and Crawl Spaces, including Areas not Separated from Occupied Spaces by a Thermal Barrier: Provide ignition barrier recommended by foam plastic manufacturer and tested with the specific product. Product shall have an active building code evaluation report that lists report number and effective dates of product acceptance.

2.11 SPRAY-APPLIED CELLULOSIC INSULATION

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. National Fiber; Cel-Pak.
2. Nu-Wool Cellulose Insulation.
3. US Greenfiber.

B. Spray-Applied Cellulosic Insulation: ASTM C 739 cellulose materials intended for dry dense pack installation, as follows:

1. Minimum density of 3.5 lb/cu. ft., thermal resistivity of 3.6 deg F x h x sq. ft./Btu x in. at 75 deg F.
2. Accessories: Non-woven, vapor-permeable netting, metal staples, and tape, as recommended by manufacturer for a complete assembly.

2.12 VAPOR RETARDERS

A. Polyethylene Vapor Retarders: ASTM D 4397, 6 mils thick, with maximum permeance rating of 0.06 perm.

B. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.

2.13 AUXILIARY INSULATING MATERIALS

A. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates indicated without damaging insulation and substrates.

1. Do not use adhesives that contain urea formaldehyde.
2. Methylene chloride and perchloroethylene may not be intentionally added to adhesives.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements of Sections in which substrates and related work are specified and for other conditions affecting performance.

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

3.2 PREPARATION

A. Clean substrates of substances harmful to insulation or vapor retarders, including removing projections capable of puncturing vapor retarders or of interfering with insulation attachment.

3.3 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and application indicated.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed at any time to ice, rain, and snow.

C. Extend insulation in thickness indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. Spray Polyurethane Foam: Comply with recommendations of the American Chemistry Council, “Health and Safety Product Stewardship Workbook for High-Pressure Application of Spray Polyurethane Foam (SPF).”

1. Spray Polyurethane Foam: Spray insulation no greater than 1-1/2 inch thickness per layer. Allow each layer to fully cure before spraying additional thickness.
2. Contain and fully ventilate the area being sprayed with negative air machines, venting directly to the exterior. Do not operate permanent building HVAC system during installation. Continue ventilation during curing process.
3. Install spray polyurethane foam insulation with uniform full thickness and with density which will not displace adjacent materials.
4. Do not apply insulation until installation of pipes, ducts, conduits, wiring, and electrical outlets in walls is completed and windows, electrical boxes, and other items not indicated to receive insulation are masked. After insulation is applied, make flush with face of studs by using method recommended by insulation manufacturer.

E. Miscellaneous Voids: Install spray polyurethane foam insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation.

1. Cure insulation with continuous natural or mechanical ventilation.
2. Remove and dispose of over-spray.

3.4 INSTALLATION OF BELOW-GRADE INSULATION

A. On vertical surfaces, set rigid insulation units in adhesive applied according to manufacturer's written instructions. Use adhesive recommended by insulation manufacturer.

1. If not otherwise indicated, extend insulation a minimum of 48 inches below exterior grade line.

B. On horizontal surfaces, loosely lay rigid insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.

3.5 INSTALLATION OF CAVITY-WALL INSULATION

A. On units of foam-plastic board insulation, install pads of adhesive spaced approximately 24 inches o.c. both ways on inside face, and as recommended by manufacturer. Fit courses of insulation between wall ties (if applicable) and other obstructions, with edges butted tightly in both directions. Press units firmly against inside substrates indicated. Fill gaps with compatible insulating material.

B. Install mineral wool board cavity insulation per manufacturer’s instructions. Fit insulation with edges butted tightly in both directions. Do not compress insulation. Maintain cavity width of dimension indicated between insulation and cladding material.

1. Masonry Veneers: Secure with clips installed over masonry anchors. Provide at least 6 clips per mineral wool board.
2. Panel Veneers: Secure with adhesively attached, spindle-type insulation anchors. Space anchors according to insulation manufacturer's written instructions.

3.6 INSTALLATION OF INSULATION FOR FRAMED CONSTRUCTION

A. Glass-Fiber or Mineral-Wool Blanket Insulation: Install in cavities formed by framing members according to the following requirements:

1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
3. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.

B. Spray-Applied Insulation: Apply spray-applied insulation according to manufacturer's written instructions. Do not apply insulation until installation of pipes, ducts, conduits, wiring, and electrical outlets in walls is completed and windows, electrical boxes, and other items not indicated to receive insulation are masked. After insulation is applied, make flush with face of studs by using method recommended by insulation manufacturer.

3.7 INSTALLATION OF VAPOR RETARDERS

A. Place vapor retarders on side of construction indicated on Drawings. Extend vapor retarders to extremities of areas to protect from vapor transmission. Secure vapor retarders in place with adhesives or other anchorage system as indicated. Extend vapor retarders to cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation.

B. Seal vertical joints in vapor retarders over framing by lapping no fewer than two studs.

1. Attach vapor retarders to framing at top, end, and bottom edges; at perimeter of wall openings; and at lap joints.
2. Seal overlapping joints in vapor retarders with vapor-retarder tape according to vapor-retarder manufacturer's written instructions. Seal butt joints with vapor-retarder tape. Locate all joints over framing members or other solid substrates.

C. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with vapor-retarder tape to create an airtight seal between penetrating objects and vapor retarders.

D. Repair tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarders.

3.8 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections indicated below and prepare test reports.

B. Infrared Camera Survey: Perform an infrared camera scan of walls, floors, and ceilings to determine where insulation and air barrier are not continuous, after insulation has been installed, but prior to plaster patching or new gypsum board installation.

1. Provide complete digital report with images of test results with recommendations for repairs.

C. Repair or replace work where test results and inspections indicate that it does not comply with specified requirements.

D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.9 PROTECTION

A. Protect installed insulation and vapor retarders from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION

SECTION 072419

EXTERIOR INSULATION AND FINISH SYSTEM (EIFS)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Water-drainage, polymer-based exterior insulation and finish system (EIFS) including, but not limited to, the following components:

a. Water-resistive, water-vapor-impermeable air barrier applied over sheathing.
b. Flexible flashing.
c. Adhesive; vertically “channeled” to permit water drainage.
d. Rigid insulation.
e. Reinforcing mesh.
f. Finish coat.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 061600 - SHEATHING for sheathing substrate.
2. Section 076200 - SHEET METAL FLASHING AND TRIM for metal flashing.
3. Section 079200 - JOINT SEALANTS for sealing joints in EIFS with elastomeric joint sealants.

1.3 COORDINATION

A. Coordinate installation of EIFS with related Work specified in other Sections to ensure that wall assemblies, including sheathing, flashing, trim, joint sealants, windows, and doors, are protected against damage from the effects of weather, age, corrosion, moisture, and other causes. Do not allow water to penetrate behind flashing and barrier coating of EIFS.

1.4 SYSTEM DESCRIPTION

A. Class PB EIFS: A non-load-bearing, exterior wall cladding system that consists of an insulation board attached adhesively, mechanically, or both to the substrate; an integrally reinforced base coat; and a textured protective finish coat.

B. Water-Drainage EIFS: EIFS with a means that allows water entering into an EIFS assembly to drain to the exterior.

1.5 PERFORMANCE REQUIREMENTS

A. EIFS Performance: Comply with the following:

1. Bond Integrity: Free from bond failure within EIFS components or between system and supporting wall construction, resulting from exposure to fire, wind loads, weather, or other in-service conditions.
2. Weathertightness: Resistant to water penetration from exterior into EIFS and assemblies behind it or through them into interior of building that results in deterioration of thermal-insulating effectiveness or other degradation of EIFS and assemblies behind it, including substrates, supporting wall construction, and interior finish.

B. Class PB EIFS: Provide EIFS having physical properties and structural performance that comply with the following:

1. Abrasion Resistance: Sample consisting of 1-inch- thick EIFS mounted on 1/2-inch- thick gypsum board; cured for a minimum of 28 days; and showing no cracking, checking, or loss of film integrity after exposure to 528 quarts of sand when tested per ASTM D 968, Method A.
2. Absorption-Freeze Resistance: No visible deleterious effects and negligible weight loss after 60 cycles per ASTM E 2485.
3. Accelerated Weathering: Five samples per ASTM E 2568 showing no cracking, checking, crazing, erosion, rusting, blistering, peeling, delamination, or other characteristics that might affect performance as a wall cladding after testing for 2000 hours when viewed under 5 times magnification per ASTM G 153, ASTM G 154 or ASTM G 155.
4. Mildew Resistance of Finish Coat: Sample applied to 2-by-2-inch clean glass substrate, cured for 28 days, and showing no growth when tested per ASTM D 3273 and evaluated according to ASTM D 3274.
5. Salt-Spray Resistance: No deleterious affects when tested according to ASTM E 2568.
6. Tensile Adhesion: No failure in the EIFS, adhesive, base coat, or finish coat when tested per ASTM E 2134.
7. Water Penetration: Sample consisting of 1-inch- thick EIFS mounted on 1/2-inch- thick gypsum board, cured for 28 days, and showing no water penetration into the plane of the base coat to expanded-polystyrene board interface of the test specimen after 15 minutes at 6.24 lbf/sq. ft. of air pressure difference or 20 percent of positive design wind pressure, whichever is greater, across the specimen during a test period when tested per International Building Code.
8. Water Resistance: Three samples, each consisting of 1-inch- thick EIFS mounted on 1/2-inch- thick gypsum board; cured for 28 days; and showing no cracking, checking, crazing, erosion, rusting, blistering, peeling, or delamination after testing for 14 days per ASTM D 2247.
9. Impact Resistance: Sample consisting of 1-inch- thick EIFS when constructed, conditioned, and tested per ASTM E 2486; and meeting or exceeding the following:

    a. Standard Impact Resistance: 25 to 49 inch-lb.
    b. Medium Impact Resistance: 50 to 89 inch-lb.
    c. High Impact Resistance: 90 to 150 inch-lb.
    d. Ultra-High Impact Resistance: More than 150 inch-lb.

10. Structural Performance Testing: EIFS assembly and components shall be tested per ASTM E 330.

1.6 SUBMITTALS

A. Product Data: For each type and component of EIFS indicated.

B. Shop Drawings: For EIFS. Include plans, elevations, sections, details of components, details of penetration and termination, flashing details, joint locations and configurations, fastening and anchorage details including mechanical fasteners, and connections and attachments to other work.

C. Samples for Initial Selection: For each type of finish-coat color and texture indicated.

1. Include similar Samples of joint sealants and exposed accessories involving color selection.

D. Samples for Verification: 24-inch- square panels for each type of finish-coat color and texture indicated, prepared using same tools and techniques intended for actual work including custom trim, each profile, an aesthetic reveal, a typical control joint filled with sealant of color selected.

1. Include sealants and exposed accessory Samples to verify color selected.

E. Qualification Data: For Installer and testing agency.

F. Manufacturer Certificates: Signed by manufacturers certifying that EIFS comply with requirements.

G. Material or Product Certificates: For each insulation and joint sealant, from manufacturer.

H. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each insulation, reinforcing mesh, and coating.

I. Field quality-control reports.

J. Maintenance Data: For EIFS to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An installer who is certified in writing by EIFS manufacturer as qualified to install manufacturer's system using trained workers. Installer shall possess a current manufacturer’s certificate of education and be experienced and competent in installation of plaster-like materials.

1. Fabricator/Erector Qualifications: Certified in writing by EIFS manufacturer as qualified to fabricate and erect manufacturer's prefabricated panel system using skilled and trained workers.

B. Source Limitations: Obtain EIFS from single source from single EIFS manufacturer and from sources approved by EIFS manufacturer as compatible with system components.

C. Regulatory Requirements: Insulation Board must be produced and labeled under a third party quality program as required by applicable building codes.

D. Fire-Test-Response Characteristics: Provide EIFS and system components with the following fire-test-response characteristics as determined by testing identical EIFS and system components per test method indicated below by IBC. Identify products with appropriate markings of applicable code.

1. Fire-Resistance Characteristics: Provide materials and construction tested for fire resistance per ASTM E 119.
2. Intermediate-Scale Multistory Fire Test: Tested mockup, representative of completed multistory wall assembly of which EIFS is a part, complies with NFPA 285 for test method and required fire-test-response characteristics of exterior non-load-bearing wall panel assemblies containing foam-plastic insulation.
3. Radiant Heat Exposure: No ignition of EIFS when tested according to NFPA 268.
4. Surface-Burning Characteristics: Provide insulation board, adhesives, base coats, and finish coats with flame-spread index of 25 or less and smoke-developed index of 450 or less, per ASTM E 84.

E. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution and set quality standards for fabrication and installation.

1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

F. Preinstallation Conference: Conduct conference at Project site.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original, unopened packages with manufacturers' labels intact and clearly identifying products.

B. Store materials in a cool location, inside and under cover and at a temperature above 40°F (4°C) and below 110°F (43°C); keep them dry and protected from weather, direct sunlight, surface contamination, aging, corrosion, damaging temperatures, construction traffic, and other causes, and in accordance with manufacturer’s instructions.

1. Stack insulation board flat and off the ground.
2. Protect plastic insulation against ignition at all times. Do not deliver plastic insulating materials to Project site before installation time.
3. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

1.9 PROJECT CONDITIONS

A. Weather Limitations: Maintain ambient temperatures above 40 deg F for a minimum of 24 hours before, during, and after adhesives or coatings are applied. Do not apply EIFS adhesives or coatings during rainfall. Proceed with installation only when existing and forecasted weather conditions and ambient outdoor air, humidity, and substrate temperatures permit EIFS to be applied, dried, and cured according to manufacturers' written instructions and warranty requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Dryvit Systems Inc.
2. Parex USA, Inc.
3. Senergy, BASF Wall Systems
4. Sto Corp.
5. Greenmaker Industries.

B. Basis of Design: Sto Corp; StoTherm Essence E100G NExT.

2.2 MATERIALS

A. Compatibility: Provide water-resistive coating, adhesive, fasteners, board insulation, reinforcing meshes, base- and finish-coat systems, sealants, and accessories that are compatible with one another and with substrates and approved for use by EIFS manufacturer for Project.

B. Water-Resistive Coatings: EIFS manufacturer's standard formulation and accessories for use as water/weather-resistive barriers, compatible with substrate, and complying with physical and performance criteria of ICC-ES AC209.

1. Sheathing Joint Compound and Tape: Type recommended by EIFS manufacturer for sealing joints between and penetrations through sheathing.

C. Primer/Sealer: EIFS manufacturer's standard substrate conditioner designed to seal substrates from moisture penetration and to improve the bond between substrate of type indicated and adhesive used for application of insulation.

D. Flexible-Membrane Flashing: Cold-applied, fully self-adhering, self-healing, rubberized-asphalt and polyethylene-film composite sheet or tape and primer; EIFS manufacturer's standard or product recommended in writing by EIFS manufacturer.

E. Insulation Adhesive: EIFS manufacturer's standard formulation designed for indicated use; compatible with substrate.

F. Molded, Rigid Cellular Polystyrene Board Insulation: Comply with ASTM C 578, Type I; EIFS manufacturer's requirements; and EIMA's "EIMA Guideline Specification for Expanded Polystyrene (EPS) Insulation Board" for most stringent requirements for material performance and qualities of insulation, including dimensions and permissible variations, and the following:

1. Thickness: As indicated on Drawings.
2. Aging: Before cutting and shipping, age insulation in block form by air drying for not less than six weeks or by another method approved by EIMA that produces equivalent results.
3. Flame-Spread and Smoke-Developed Indexes: 25 and 450 or less, respectively, per ASTM E 84.
4. Dimensions: Provide insulation boards not more than 24 by 48 inches and in thickness indicated, but not more than allowed in the EIFS manufacturer’s current ICC Evaluation Service Report.

5. Board Insulation Closure Blocks: EIFS manufacturer's standard density, size, and configuration.
6. Foam Shapes: Provide with profiles and dimensions indicated on Drawings.

G. Reinforcing Mesh: Balanced, alkali-resistant, open-weave, glass-fiber mesh treated for compatibility with other EIFS materials, made from continuous multiend strands with retained mesh tensile strength of not less than 120 lbf/in. per ASTM E 2098; complying with ASTM D 578 and the following:

1. Standard-Impact Reinforcing Mesh: Not less than 4.5 oz./sq. yd.
2. Intermediate-Impact Reinforcing Mesh: Not less than 12.0 oz./sq. yd.
3. High-Impact Reinforcing Mesh: Not less than 15 oz./sq. yd.
4. Detail Reinforcing Mesh: Not less than 4.2 oz./sq. yd.
5. Corner Reinforcing Mesh: Not less than 9.0 oz./sq. yd.

H. Base-Coat Materials: EIFS manufacturer's standard mixture complying with the following:

1. Factory-blended dry formulation of portland cement, dry polymer admixture, and inert fillers to which only water is added at Project site.

I. Waterproof Adhesive/Base-Coat Materials: EIFS manufacturer's standard waterproof formulation and complying with the following:

1. Job-combined formulation of manufacturer's standard polymer-emulsion adhesive and manufacturer's standard dry mix containing portland cement.
2. Project Locations: Provide for base coat over foundations, parapets, splash areas trim and other projecting features.

J. Primer: EIFS manufacturer's standard factory-mixed, elastomeric-polymer primer for preparing base-coat surface for application of finish coat.

K. Finish-Coat Materials: EIFS manufacturer's standard acrylic-based coating with enhanced mildew resistance, complying with the following:

1. Factory-mixed formulation of polymer-emulsion binder, colorfast mineral pigments, sound stone particles, and fillers.
2. Colors: As selected by Architect from manufacturer's full range.

L. Water: Potable.

M. Trim Accessories: Type as designated or required to suit conditions indicated and to comply with EIFS manufacturer's written instructions; manufactured from UV-stabilized PVC; and complying with ASTM D 1784, manufacturer's standard Cell Class for use intended, and ASTM C 1063.

1. Weep Screed/Track: Prefabricated, one-piece type for attachment behind insulation with perforated face leg extended to form a drip and weep holes in track bottom, of depth required to suit thickness of coating and insulation, with face leg perforated for bonding to coating and back leg; designed to drain incidental moisture that gets into wall construction to the exterior at terminations of EIFS with drainage.
2. Expansion Joint: Prefabricated, one-piece V profile; designed to relieve stress of movement.

3. Window Sill Flashing: Prefabricated type for both flashing and sloping sill over framing beneath windows; with end and back dams; designed to direct water to exterior.
4. Parapet Cap Flashing: Type for both flashing and covering parapet top with design complying with ASTM C 1397.

2.3 ELASTOMERIC SEALANTS

A. Refer to Section 079200 - JOINT SEALANTS for sealing joints in EIFS with elastomeric joint sealants.

2.4 MIXING

A. General: Comply with EIFS manufacturer's requirements for combining and mixing materials. Do not introduce admixtures, water, or other materials except as recommended by EIFS manufacturer. Mix materials in clean containers. Use materials within time period specified by EIFS manufacturer or discard.

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 EIFS.

B. Examine roof edges, wall framing, flashings, openings, substrates, and junctures at other construction for suitable conditions where EIFS will be installed.

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

1. Begin coating application only after surfaces are dry.
2. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Protect contiguous work from moisture deterioration and soiling caused by application of EIFS. Provide temporary covering and other protection needed to prevent spattering of exterior finish coats on other work.

B. Protect EIFS, substrates, and wall construction behind them from inclement weather during installation. Prevent penetration of moisture behind EIFS and deterioration of substrates.

C. Prepare and clean substrates to comply with EIFS manufacturer's written instructions to obtain optimum bond between substrate and adhesive for insulation.

1. Concrete Substrates: Provide clean, dry, neutral-pH substrate for insulation installation. Verify suitability of substrate by performing bond and moisture tests recommended by EIFS manufacturer.

3.3 EIFS INSTALLATION, GENERAL

A. Comply with EIFS manufacturer's written instructions for installation of EIFS as applicable to each type of substrate indicated.

3.4 SUBSTRATE PROTECTION APPLICATION

A. Primer/Sealer: Apply over gypsum sheathing CMU, or concrete substrates to protect substrates from degradation and where required by EIFS manufacturer for improving adhesion of insulation to substrate.

B. Water-Resistive Coatings: Apply over substrates to protect substrates from degradation and to provide water-/weather-resistive barrier and air barrier.

1. Tape and seal joints, exposed edges, terminations, and inside and outside corners of sheathing unless otherwise indicated by EIFS manufacturer's written instructions.

C. Flexible-Membrane Flashing: Install over weather-resistive barrier, applied and lapped to shed water; seal at openings, penetrations, terminations, and where indicated by EIFS manufacturer's written instructions to protect wall assembly from degradation. Prime substrates, if required, and install flashing to comply with EIFS manufacturer's written instructions and details.

3.5 TRIM INSTALLATION

A. Trim: Apply trim accessories at perimeter of EIFS, at expansion joints, and elsewhere as indicated, according to EIFS manufacturer's written instructions. Coordinate with installation of insulation.

1. Weep Screed/Track: Use at bottom termination edges, at window and door heads, and at floor line expansion joints of water-drainage EIFS unless otherwise indicated.
2. Windowsill Flashing: Use at windows unless otherwise indicated.
3. Expansion Joint: Use where indicated on Drawings.
4. Parapet Cap Flashing: Where indicated on Drawings.
5. Other Trim: Use where indicated on Drawings.

3.6 INSULATION INSTALLATION

A. Board Insulation: Adhesively attach insulation to substrate in compliance with ASTM C 1397, EIFS manufacturer's written instructions, and the following:

1. Apply adhesive to in vertical “channels” in accordance with EIFS manufacturer's written instructions to permit drainage to base flashing. Apply adhesive channels in thickness as recommended by the manufacturer for application.
2. Press and slide insulation into place to provide uniform contact with all adhesive channels while maintaining space between channels to permit drainage.
3. Allow adhered insulation to remain undisturbed for period recommended by EIFS manufacturer, but not less than 24 hours, before beginning rasping and sanding insulation, or applying base coat and reinforcing mesh.
4. Apply insulation over dry substrates in courses with long edges of boards oriented horizontally.

5. Begin first course of insulation from screed/track and work upward. Work from perimeter casing beads toward interior of panels if possible.
6. Stagger vertical joints of insulation boards in successive courses to produce running bond pattern. Locate joints so no piece of insulation is less than 12 inches wide or 6 inches high. Offset joints not less than 6 inches from corners of window and door openings and not less than 4 inches from aesthetic reveals.

    a. Adhesive Attachment: Offset joints of insulation not less than 6 inches from horizontal and 4 inches from vertical joints in sheathing.

7. Interlock ends at internal and external corners.
8. Abut insulation tightly at joints within and between each course to produce flush, continuously even surfaces without gaps or raised edges between boards. If gaps greater than 1/16 inch occur, fill with insulation cut to fit gaps exactly; insert insulation without using adhesive or other material.
9. Cut insulation to fit openings, corners, and projections precisely and to produce edges and shapes complying with details indicated.
10. Rasp or sand flush entire surface of insulation to remove irregularities projecting more than 1/32 inch (0.8 mm) from surface of insulation and to remove yellowed areas due to sun exposure; do not create depressions deeper than 1/16 inch (1.6 mm). Prevent airborne dispersal and immediately collect insulation raspings or sandings.Cut aesthetic reveals in outside face of insulation with high-speed router and bit configured to produce grooves, rabbets, and other features that comply with profiles and locations indicated. Do not reduce insulation thickness at aesthetic reveals to less than 3/4 inch.
11. Install foam build-outs and attach to sheathing.
12. Interrupt insulation for expansion joints where indicated.
13. Form joints for sealant application by leaving gaps between adjoining insulation edges and between insulation edges and dissimilar adjoining surfaces. Make gaps wide enough to produce joint widths indicated after encapsulating joint substrates with base coat and reinforcing mesh.
14. After installing insulation and before applying reinforcing mesh, fully wrap board edges with strip reinforcing mesh. Cover edges of board and extend encapsulating mesh not less than 2-1/2 inches over front and back face unless otherwise indicated on Drawings.
15. Treat exposed edges of insulation as follows:

    a. Except for edges forming substrates of sealant joints, encapsulate with base coat, reinforcing mesh, and finish coat.
    b. Encapsulate edges forming substrates of sealant joints within EIFS or between EIFS and other work with base coat and reinforcing mesh.
    c. At edges trimmed by accessories, extend base coat, reinforcing mesh, and finish coat over face leg of accessories.

16. Coordinate installation of flashing and insulation to produce wall assembly that does not allow water to penetrate behind flashing and EIFS protective-coating lamina.

B. Expansion Joints: Install at locations indicated, where required by EIFS manufacturer, and as follows:

1. At expansion joints in substrates behind EIFS.
2. Where EIFS adjoin dissimilar substrates, materials, and construction, including other EIFS.
3. At floor lines in multilevel wood-framed construction.

4. Where wall height or building shape changes.
5. Where EIFS manufacturer requires joints in long continuous elevations.

3.7 BASE-COAT INSTALLATION

A. Waterproof Adhesive/Base Coat: Apply over sloped surfaces, window sills, parapets, and where indicated on Drawings to protect substrates from degradation.

B. Base Coat: Apply to exposed surfaces of insulation and foam shapes in minimum thickness recommended in writing by EIFS manufacturer, but not less than 1/16-inch dry-coat thickness.

C. Reinforcing Mesh: Embed type indicated in wet base coat to produce wrinkle-free installation with mesh continuous at corners and overlapped not less than 2-1/2 inches or otherwise treated at joints to comply with ASTM C 1397 and EIFS manufacturer's written instructions. Do not lap reinforcing mesh within 8 inches of corners. Completely embed mesh, applying additional base-coat material if necessary, so reinforcing-mesh color and pattern are not visible.

D. Double-Layer Reinforcing Mesh Application: Where indicated, apply second base coat and second layer of intermediate-impact reinforcing mesh, overlapped not less than 2-1/2 inches or otherwise treated at joints to comply with ASTM C 1397 and EIFS manufacturer's written instructions in same manner as first application. Do not apply until first base coat has cured.

E. Additional Reinforcing Mesh: Apply strip reinforcing mesh around openings extending 4 inches beyond perimeter. Apply additional 9-by-12-inch strip reinforcing mesh diagonally at corners of openings (re-entrant corners). Apply 8-inch- wide strip reinforcing mesh at both inside and outside corners unless base layer of mesh is lapped not less than 4 inches on each side of corners.

1. At aesthetic reveals, apply strip reinforcing mesh not less than 8 inches wide.
2. Embed strip reinforcing mesh in base coat before applying first layer of reinforcing mesh.

F. Foam Shapes: Fully embed reinforcing mesh in base coat.

G. Double Base-Coat Application: Where indicated, apply second base coat in same manner and thickness as first application except without reinforcing mesh. Do not apply until first base coat has cured.

3.8 FINISH-COAT INSTALLATION

A. Primer: Apply over dry base coat according to EIFS manufacturer's written instructions.

B. Finish Coat: Apply over dry primed base coat, maintaining a wet edge at all times for uniform appearance, in thickness required by EIFS manufacturer to produce a uniform finish of color and texture matching approved sample and free of cold joints, shadow lines, and texture variations.

1. Texture: As indicated by manufacturer's designations on approved Shop Drawings.

3.9 INSTALLATION OF JOINT SEALANTS

A. Refer to Section 079200 - JOINT SEALANTS for sealing joints in EIFS with elastomeric joint sealants.

3.10 FIELD QUALITY CONTROL

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

B. EIFS Tests and Inspections: According to ASTM E 2273 “Standard Test Method for Determining the Drainage Efficiency of Exterior Insulation and Finish Systems (EIFS) Clad Wall Assemblies.”

C. Remove and replace EIFS where test results indicate that EIFS do not comply with specified requirements.

D. Prepare test and inspection reports.

3.11 CLEANING AND PROTECTION

A. Remove temporary covering and protection of other work. Promptly remove coating materials from window and door frames and other surfaces outside areas indicated to receive EIFS coatings.

END OF SECTION

SECTION 072600

VAPOR RETARDER

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Vapor retarders under slabs-on-grade.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 033000 - CAST-IN-PLACE CONCRETE.

1.3 SUBMITTALS

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

1.4 DELIVERY, STORAGE, AND HANDLING

A. Protect materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

PART 2 - PRODUCTS

2.1 VAPOR BARRIER

A. Basis-of-Design: Stego Wrap Vapor Barrier by Stego Industries LLC, or Viper VaporCheck II 15 mil by ISI Building Products. Vapor Barrier shall have the following qualities:

1. Permeance of less than 0.01 perms per ASTM F 1249 or ASTM E 96.
2. ASTM E 1745 Class A.
3. Thickness: 15 mils.

B. Accessories:

1. Seam Tape: Permeance less than 0.3 perms per ASTM F 1249 or ASTM E 96.
2. Vapor Proofing Mastic:Permeance less than 0.3 perms per ASTM F 1249 or ASTM E 96.

3. Pipe Boots: Construct pipe boots from vapor barrier material, pressure sensitive tape and/or mastic per manufacturer's instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements of Sections in which substrates and related work are specified and for other conditions affecting performance.

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

3.2 PREPARATION

A. Clean substrates of substances harmful to vapor retarders, including removing projections capable of puncturing vapor retarders.

3.3 INSTALLATION, GENERAL

A. Comply with manufacturer's written instructions.

3.4 PROTECTION

A. Protect installed vapor retarders from damage due to harmful weather exposures, physical abuse, and other causes.

END OF SECTION

SECTION 072700

AIR BARRIERS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS, which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Self-adhering, vapor-retarding, modified bituminous sheet air barrier.
2. Self-adhering, vapor-permeable, modified bituminous sheet air barrier.
3. Fluid-applied, vapor-retarding membrane air barrier.
4. Fluid-applied, vapor-permeable membrane air barrier
5. Transition strips to adjacent and penetrating materials.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 042000 - UNIT MASONRY for substrate for air and vapor barrier system.
2. Section 061600 - SHEATHING for sheathing substrate for air and vapor barrier system.
3. Section 075400 - THERMOPLASTIC MEMBRANE ROOFING for roof air and vapor barrier.
4. Section 079200 - JOINT SEALANTS for joint sealant requirements.

1.3 DEFINITIONS

A. Air Barrier Assembly: The collection of air barrier materials and auxiliary materials applied to an opaque wall or soffit, including joints and junctions to abutting construction, to control air movement through the wall.

1.4 PERFORMANCE REQUIREMENTS

A. General: Air barrier shall be capable of performing as a continuous vapor-retarding air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.

B. Air Barrier Assembly Air Leakage: Not to exceed 0.03 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft., ASTM E 2357.

C. Fire Test Performance: Passes NFPA 285, Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components.

1.5 PRECONSTRUCTION TESTING

A. Mockup Testing: Air barrier assemblies shall comply with performance requirements indicated, as evidenced by reports based on mockup testing by a qualified testing agency.

1. The Owner may engage a qualified testing agency.
2. Quantitative Air Leakage Testing: Testing of the mockup for air leakage will be conducted not to exceed the test pressure differential, positive and negative, indicated in "Performance Requirements" Article for air barrier assembly air leakage when tested according to ASTM E 783.
3. Notify Architect and the Owner a minimum of seven days in advance of the dates and times when mockup testing will take place.

1.6 SUBMITTALS

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

1. Include manufacturer's written instructions for evaluating, preparing, and treating substrate; technical data; and tested physical and performance properties of air barrier.

B. Shop Drawings: Show locations and extent of air barrier. Include details for substrate joints and cracks, counterflashing strip, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.

1. Include details of interfaces with other materials that form part of air barrier.
2. Include details of mockups.

C. Product Certificates: For air barriers, certifying compatibility of air barrier and accessory materials with Project materials that connect to or that come in contact with air barrier; signed by product manufacturer.

D. Air Barrier Certification: Submit manufacturer’s certification that air barrier, as designed in the assemblies indicated on the Drawings, has been tested to meet the requirements of NFPA 285 and passed.

E. Qualification Data: For Applicator.

F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for air barriers.

1.7 QUALITY ASSURANCE

A. Applicator Qualifications: A firm experienced in applying air barrier materials similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.

B. Mockups: Before beginning installation of air barrier, build mockups of exterior wall assembly 150 sq. ft., incorporating backup wall construction, external cladding, window, door frame and

sill, insulation, and flashing to demonstrate surface preparation, crack and joint treatment, and sealing of gaps, terminations, and penetrations of air barrier membrane.

1. Coordinate construction of mockup to permit inspection by Owner's testing agency of air barrier before external insulation and cladding is installed.
2. Include junction with roofing membrane, building corner condition, and foundation wall intersection.
3. If the Architect determines mockups do not comply with requirements, reconstruct mockups and apply air barrier until mockups are approved.
4. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

C. Preinstallation Conference: Conduct conference at Project site.

1. Include installers of other construction connecting to air barrier, such as roofing, waterproofing, architectural precast concrete, masonry, joint sealants, windows, glazed curtain walls, and door frames.
2. Review air barrier requirements including surface preparation, substrate condition and pretreatment, minimum substrate curing period, forecasted weather conditions, special details and sheet flashings, mockups, installation procedures, sequence of installation, testing and inspecting procedures, and protection and repairs.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store liquid materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by air barrier manufacturer.

B. Remove and replace liquid materials that cannot be applied within their stated shelf life.

C. Store rolls according to manufacturer's written instructions.

D. Protect stored materials from direct sunlight.

1.9 PROJECT CONDITIONS

A. Environmental Limitations: Apply air barrier within the range of ambient and substrate temperatures recommended by air barrier manufacturer. Protect substrates from environmental conditions that affect performance of air barrier. Do not apply air barrier to a damp or wet substrate or during snow, rain, fog, or mist.

PART 2 - PRODUCTS

2.1 SELF-ADHERING SHEET MEMBRANE AIR BARRIERS, FIRE-RATED TYPES

A. Self-Adhering, Vapor-Retarding Aluminum-Faced Sheet: Rubberized asphalt laminated to cross-laminated polyethylene film with aluminum facing on one side, with release liner on adhesive side, and formulated for application with primer that complies with VOC limits of authorities having jurisdiction.

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

a. Carlisle Coatings & Waterproofing; CCW 705FR-A.
b. GCP Applied Technologies (formerly W.R. Grace); Perm-A-Barrier Aluminum Wall Membranes.
c. Henry Co.; Metal Clad Membrane.

2. Thickness: 40 mils minimum.
3. Physical and Performance Properties:

a. Vapor Permeance: Not more than 0.1 perm, ASTM E 96, Water Method.
b. Air Permeance: Not to exceed 0.004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. pressure difference; ASTM E 2178.
c. Fastener Sealability: No water leaking through fastener penetration after 24 hours; ASTM D 1970.
d. Fire Test Performance: Passes NFPA 285, Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components.

B. Self-Adhering, Vapor-Permeable Sheet:

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

a. Carlisle Fire Resist 705 VP.
b. GCP Applied Technologies (formerly W.R. Grace); Perm-A-Barrier VPS.
c. Henry Co.; Blueskin VP 160.

2. Thickness: 40 mils minimum.
3. Physical and Performance Properties:

a. Fire Test Performance: Passes NFPA 285, Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components.

2.2 SELF-ADHERING SHEET MEMBRANE AIR BARRIERS

A. Self-Adhering, Vapor-Retarding Modified Bituminous Sheet: Rubberized asphalt laminated to cross-laminated polyethylene film with release liner on adhesive side and formulated for application with primer that complies with VOC limits of authorities having jurisdiction.

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

a. Carlisle Coatings & Waterproofing; CCW-705.
b. GCP Applied Technologies (formerly W.R. Grace); Perm-A-Barrier.
c. Henry Co.; Blueskin SA.
d. Rubber Polymer Corporation; Rub-R-Wall SA.
e. Tremco, Inc.; ExoAir 110.
f. W.R. Meadows; SealTight Air-Shield.

2. Thickness: 40 mils minimum.
3. Physical and Performance Properties:

a. Membrane Air Permeance: Not to exceed 0.004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. pressure difference; ASTM E 2178.
b. Tensile Strength: 250 psi minimum; ASTM D 412, Die C, modified.
c. Ultimate Elongation: 200 percent minimum; ASTM D 412, Die C, modified.
d. Low-Temperature Flexibility: Pass at minus 20 deg F, ASTM D 1970.
e. Crack Cycling: Unaffected after 100 cycles of 1/8-inch movement; ASTM C 836.
f. Puncture Resistance: 40 lbf minimum; ASTM E 154.
g. Water Absorption: 0.15 percent weight-gain maximum after 48-hour immersion at 70 deg F; ASTM D 570.
h. Vapor Permeance: 0.05 perms, ASTM E 96, Water Method.

B. Self-Adhering, Vapor-Permeable Sheet:

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

a. GCP Applied Technologies (formerly W.R. Grace); Perm-A-Barrier VPS.
b. Henry Co.; Blueskin VP 160.

2. Thickness: 23 mils minimum.
3. Physical and Performance Properties:

a. Membrane Air Permeance: Not to exceed 0.004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. pressure difference; ASTM E 2178.
b. Membrane Vapor Permeance: Not less than 10 perms; ASTM E 96.

2.3 FLUID-APPLIED MEMBRANE AIR BARRIERS, FIRE-RATED TYPES

A. Fluid-Applied, Vapor-Retarding Membrane Air Barrier: Elastomeric, modified bituminous, or synthetic polymer membrane.

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

a. Carlisle Coatings & Waterproofing; Fire Resist Barritech NP.
b. GCP Applied Technologies (formerly W.R. Grace); Perm-A-Barrier NPL 10.
c. Henry Co.; Air Bloc 16MR or 17MR.
d. Henry Co.; Air Bloc 32MR.
e. Tremco; ExoAir 130.
f. W.R. Meadows; Air-Shield LSR.

2. Physical and Performance Properties:

a. Vapor Permeance: Not more than 0.1 perm, ASTM E 96, Water Method.
b. Air Permeance: Not to exceed 0.004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. pressure difference; ASTM E 2178.
c. Fastener Sealability: No water leaking through fastener penetration after 24 hours; ASTM D 1970.
d. Fire Test Performance: Passes NFPA 285, Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components.

B. Fluid-Applied, Vapor-Permeable Membrane Air Barrier: Elastomeric, modified bituminous, or synthetic polymer membrane.

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

a. Carlisle Coatings & Waterproofing; Barritech VP.
b. GCP Applied Technologies (formerly W.R. Grace); Perm-A-Barrier VPL.
c. Henry Co.; Air Bloc 17MR.
d. Tremco; ExoAir 230.
e. W.R. Meadows; Air-Shield LMP.

2. Physical and Performance Properties:

a. Membrane Air Permeance: Not to exceed 0.004 cfm/ sq. ft. of surface area at 1.57-lbf/sq. ft. pressure difference; ASTM E 2178.
b. Membrane Vapor Permeance: Not less than 10 perms; ASTM E 96.
c. Fire Test Performance: Passes NFPA 285, Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components.

2.4 FLUID-APPLIED MEMBRANE AIR BARRIERS

A. Fluid-Applied, Vapor-Retarding Membrane Air Barrier: Elastomeric, modified bituminous, or synthetic polymer membrane.

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

a. Elastomeric Modified Bituminous Membrane:

1) Carlisle Coatings & Waterproofing; Barriseal.
2) Henry Co.; Air Bloc 06.
3) Tremco Incorporated; ExoAir 120.
4) W.R. Meadows; Air-Shield LM.

b. Synthetic Polymer Membrane:

1) GCP Applied Technologies (formerly W.R. Grace); Perm-A-Barrier Liquid.
2) Henry Co.; Air Bloc 21, 21S, 21FR, or 32MR.
3) Rubber Polymer Corporation; Rub-R-Wall Airtight.

2. Physical and Performance Properties:

a. Membrane Air Permeance: Not to exceed 0.004 cfm x sq. ft. of surface area at 1.57-lbf/sq. ft. pressure difference; ASTM E 2178.
b. Membrane Vapor Permeance: Not to exceed 0.1 perm; ASTM E 96.

B. Fluid-Applied, Vapor-Permeable Membrane Air Barrier: Elastomeric, modified bituminous or synthetic polymer membrane.

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

    a. Carlisle Coatings & Waterproofing; Barritech VP.
    b. GCP Applied Technologies (formerly W.R. Grace); Perm-A-Barrier VP.
    c. Henry Co.; Air Bloc 07, 31MR, or 33MR.

2. Physical and Performance Properties:

    a. Membrane Air Permeance: Not to exceed 0.004 cfm/ sq. ft. of surface area at 1.57-lbf/sq. ft. pressure difference; ASTM E 2178.
    b. Membrane Vapor Permeance: Not less than 10 perms; ASTM E 96.

2.5 AUXILIARY MATERIALS

A. General: Auxiliary materials recommended by air barrier manufacturer for intended use and compatible with air barrier. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.

B. Primer: Liquid waterborne or solvent-borne primer recommended for substrate by manufacturer of air barrier material.

C. Counterflashing Strip: Modified bituminous 40-mil-thick, self-adhering sheet consisting of 32 mils of rubberized asphalt laminated to an 8-mil-thick, crosslaminated polyethylene film with release liner backing.

D. Butyl Strip at Termination with EPDM or TPO Roofing Membrane: Vapor-retarding, 30- to 40-mil-thick, self-adhering; polyethylene-film-reinforced top surface laminated to layer of butyl adhesive, with release liner backing.

E. Modified Bituminous Strip To Cover Cracks and Joints and Terminate Air Barrier to Compatible Roofing Membrane: Vapor-retarding, 40-mil-thick, smooth-surfaced, self-adhering; consisting of 36 mils of rubberized asphalt laminated to a 4-mil- polyethylene film with release liner backing.

F. Termination Mastic: Cold fluid-applied elastomeric liquid; trowel grade.

G. Substrate Patching Membrane: Manufacturer's standard trowel-grade substrate filler.

H. Adhesive and Tape: Air barrier manufacturer's standard adhesive and pressure-sensitive adhesive tape.

I. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304, 0.0187 inch thick, and Series 300 stainless-steel fasteners.

J. Sprayed Polyurethane Foam Sealant to Fill Gaps at Penetrations and Openings: one- or two-component, foamed-in-place, polyurethane foam sealant, 1.5 to 2.0 lb/cu. ft. density; flame spread index of 25 or less according to ASTM E 162; with primer and noncorrosive substrate cleaner recommended by foam sealant manufacturer.

K. Modified Bituminous Transition Strip to Seal Air Barrier Terminations with Glazing Systems: Vapor-retarding, 40-mil-thick, smooth-surfaced, self-adhering; consisting of 36 mils of

rubberized asphalt laminated to a 4-mil-thick polyethylene or aluminum film with release liner backing.

L. Preformed Silicone-Sealant Extrusion to Seal Air Barrier Terminations with Glazing Systems: Manufacturer's standard system consisting of cured low-modulus silicone extrusion, sized to fit opening widths, with a single-component, neutral-curing, Class 100/50 (low-modulus) silicone sealant for bonding extrusions to substrates.

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

a. Dow Corning Corporation; 123 Silicone Seal.
b. Elbex Corp: Transition Silicone Sheeting.
c. GE Silicone; UltraSpan US1100.
d. Tremco; approved equal.

M. Joint Sealant: ASTM C 920, single-component, neutral-curing silicone; Class 100/50 (low-modulus), Grade NS, Use NT related to exposure, and, as applicable to joint substrates indicated, Use O. Comply with Section 079200 - JOINT SEALANTS.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance.

1. Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.
2. Verify that concrete has cured and aged for minimum time period recommended by air barrier manufacturer.
3. Verify that concrete is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
4. Verify that masonry joints are flush and completely filled with mortar.
5. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

A. Clean, prepare, and treat substrate according to manufacturer's written instructions. Provide clean, dust-free, and dry substrate for air barrier application.

B. Mask off adjoining surfaces not covered by air barrier 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 in concrete with substrate-patching membrane.

E. Remove excess mortar from masonry ties, shelf angles, and other obstructions.

F. Prepare, fill, prime, and treat joints and cracks in substrates. Remove dust and dirt from joints and cracks according to ASTM D 4258.

1. Install modified bituminous strips and center over treated construction and contraction joints and cracks exceeding a width of 1/16 inch.

G. Bridge and cover isolation joints expansion joints and discontinuous deck-to-wall and deck-to-deck joints with overlapping modified bituminous strips.

H. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.

I. Cover gaps in substrate plane and form a smooth transition from one substrate plane to another with stainless-steel sheet mechanically fastened to structural framing to provide continuous support for air barrier.

3.3 JOINT TREATMENT IN PREPARATION FOR INSTALLATION OF FLUID-APPLIED MEMBRANE

A. Concrete and Masonry: Prepare, treat, rout, and fill joints and cracks in substrate according to ASTM C 1193 and air barrier manufacturer's written instructions. Remove dust and dirt from joints and cracks complying with ASTM D 4258 before coating surfaces.

1. Prime substrate and apply a single thickness of preparation coat strip extending a minimum of 3 inches along each side of joints and cracks. Apply a double thickness of air barrier membrane and embed a joint reinforcing strip in preparation coat.

B. Gypsum Sheathing: Fill joints greater than 1/4 inch with sealant according to ASTM C 1193 and with air barrier manufacturer's written instructions. Apply first layer of fluid air barrier membrane at joints. Tape joints with joint reinforcing strip after first layer is dry. Apply a second layer of fluid air barrier membrane over joint reinforcing strip.

3.4 TRANSITION STRIP INSTALLATION

A. Install strips, transition strips, and auxiliary materials according to air barrier manufacturer's written instructions to form a seal with adjacent construction and maintain a continuous air barrier.

1. Coordinate the installation of air barrier with installation of roofing membrane and base flashing to ensure continuity of air barrier with roofing membrane.
2. Install butyl or modified bituminous strip on roofing membrane or base flashing so that a minimum of 3 inches of coverage is achieved over both substrates.

B. Apply primer to substrates at required rate and allow to dry. Limit priming to areas that will be covered by air barrier sheet in same day. Reprime areas exposed for more than 24 hours.

1. Prime glass-fiber-surfaced gypsum sheathing with number of prime coats needed to achieve required bond, with adequate drying time between coats.

C. Connect and seal exterior wall air barrier membrane continuously to roofing membrane air barrier, concrete below-grade structures, floor-to floor construction, exterior glazing and window

systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.

D. At end of each working day, seal top edge of strips and transition strips to substrate with termination mastic.

E. Apply joint sealants forming part of air barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

F. Wall Openings: Prime concealed perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply transition strip so that a minimum of 3 inches of coverage is achieved over both substrates. Maintain 3 inches of full contact over firm bearing to perimeter frames with not less than 1 inch of full contact.

1. Transition Strip: Roll firmly to enhance adhesion.
2. Elastomeric Flashing Sheet: Apply adhesive to wall, frame, and flashing sheet. Install flashing sheet and termination bars, fastened at 6 inches o.c. Apply lap sealant over exposed edges and on cavity side of flashing sheet.
3. Preformed Silicone-Sealant Extrusion: Set in full bed of silicone sealant applied to walls, frame, and membrane.

G. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, and doors, and miscellaneous penetrations of air barrier membrane with foam sealant.

H. Seal strips and transition strips around masonry reinforcing or ties and penetrations with termination mastic.

I. Seal top of through-wall flashings to air barrier with an additional 6-inch-wide, modified bituminous strip.

J. Seal exposed edges of strips at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.

K. Repair punctures, voids, and deficient lapped seams in strips and transition strips. Slit and flatten fishmouths and blisters. Patch with transition strips extending 6 inches beyond repaired areas in strip direction.

3.5 INSTALLATION OF SELF-ADHERING SHEET MEMBRANE

A. Install modified bituminous sheets according to air barrier manufacturer's written instructions and according to recommendations in ASTM D 6135.

1. When ambient and substrate temperatures range between 25 and 40 deg F, install self-adhering, modified bituminous air barrier sheets produced for low-temperature application. Do not use low-temperature sheets if ambient or substrate temperature is higher than 60 deg F.

B. Corners: Prepare, prime, and treat inside and outside corners according to ASTM D 6135.

1. Install modified bituminous strips centered over vertical inside corners. Install 3/4-inch fillets of termination mastic on horizontal inside corners.

C. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations with termination mastic and according to ASTM D 6135.

D. Apply primer to substrates at required rate and allow to dry. Limit priming to areas that will be covered by air barrier sheet in same day. Reprime areas exposed for more than 24 hours.

1. Prime glass-fiber-surfaced gypsum sheathing with number of prime coats needed to achieve required bond, with adequate drying time between coats.

E. Apply and firmly adhere modified bituminous sheets horizontally or vertically over area to receive air barrier sheets. Accurately align sheets and maintain a uniform 2-1/2-inch-minimum lap widths and end laps. Overlap and seal seams and stagger end laps to ensure airtight installation.

1. Apply sheets in a shingled manner to shed water without interception by any exposed sheet edges.
2. Roll sheets firmly to enhance adhesion to substrate.
3. Apply termination mastic on any horizontal, field-cut or non-factory edges.

F. Apply continuous modified bituminous sheets over modified bituminous strips bridging substrate cracks, construction, and contraction joints.

G. Seal top of non-metallic through-wall flashings to air barrier sheet with an additional 6-inch- wide strip.

H. Seal exposed edges of metallic sheets at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.

I. Install air barrier sheets and auxiliary materials to form a seal with adjacent construction and to maintain a continuous air barrier.

1. Coordinate the installation of air barrier with installation of roofing membrane and base flashing to ensure continuity of air barrier with roofing membrane.
2. Install compatible strip on roofing membrane or base flashing so that a minimum of 3 inches of coverage is achieved over both substrates.

J. Connect and seal exterior wall air barrier membrane continuously to roofing membrane air barrier, concrete below-grade structures, floor-to floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings using accessory materials.

K. Wall Openings: Prime concealed perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply membrane specified below so that a minimum of 3 inches of coverage is achieved over both substrates. Maintain 3 inches of full contact over firm bearing to perimeter frames with not less than 1 inch of full contact.

1. Modified Bituminous Transition Strip: Roll firmly to enhance adhesion.
2. Elastomeric Flashing Sheet: Apply adhesive to wall, frame, and flashing sheet. Install flashing sheet and termination bars, fastened at 6 inches o.c. Apply lap sealant over exposed edges and on cavity side of flashing sheet.
3. Preformed Silicone-Sealant Extrusion: Set in full bed of silicone sealant applied to walls, frame, and membrane.

L. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, doors, and miscellaneous penetrations of air barrier membrane with foam sealant.

M. At end or each working day, seal top edge of membrane to substrate with termination mastic.

N. Apply joint sealants forming part of air barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

O. Repair punctures, voids, and deficient lapped seams in air barrier. Slit and flatten fishmouths and blisters. Patch with air barrier sheet extending 6 inches beyond repaired areas in all directions.

P. Do not cover air barrier until it has been tested and inspected by Owner’s testing agency.

Q. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air barrier components.

3.6 INSTALLATION OF FLUID-APPLIED MEMBRANE AIR BARRIER

A. Apply air barrier membrane to form a seal with strips and transition strips and to achieve a continuous air barrier according to air barrier manufacturer's written instructions.

B. Apply air barrier membrane within manufacturer's recommended application temperature ranges.

C. Apply primer to substrates at required rate and allow to dry. Limit priming to areas that will be covered by air barrier sheet in same day. Reprime areas exposed for more than 24 hours.

1. Prime glass-fiber-surfaced gypsum sheathing with number of prime coats needed to achieve required bond, with adequate drying time between coats.

D. Apply a continuous unbroken air barrier to substrates according to the following minimum thickness. Apply membrane in full contact around protrusions such as masonry ties.

1. Vapor-Retarding Membrane Air Barrier: 60-mil dry film thickness.
2. Vapor-Permeable Membrane Air Barrier: 120-mil wet film thickness.

E. Apply strip and transition strip a minimum of 1 inch onto cured air membrane or strip and transition strip over cured air membrane overlapping 3 inches onto each surface according to air barrier manufacturer's written instructions.

F. Do not cover air barrier until it has been tested and inspected by Owner's testing agency.

G. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air barrier components.

3.7 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections and prepare test reports.

B. Inspections: Air barrier materials and installation are subject to inspection for compliance with requirements. Inspections may include the following:

1. Continuity of air barrier system has been achieved throughout the building envelope with no gaps or holes.
2. Continuous structural support of air barrier system has been provided.
3. Masonry and concrete surfaces are smooth, clean, and free of cavities, protrusions, and mortar droppings.
4. Site conditions for application temperature and dryness of substrates have been maintained.
5. Maximum exposure time of materials to UV deterioration has not been exceeded.
6. Surfaces have been primed.
7. Laps in sheet materials have complied with the minimum requirements and have been shingled in the correct direction (or mastic applied on exposed edges), with no fishmouths.
8. Termination mastic has been applied on cut edges.
9. Air barrier has been firmly adhered to substrate.
10. Compatible materials have been used.
11. Transitions at changes in direction and structural support at gaps have been provided.
12. Connections between assemblies (membrane and sealants) have complied with requirements for cleanliness, preparation, and priming of surfaces, structural support, integrity, and continuity of seal.
13. All penetrations have been sealed.

C. Tests:

1. Qualitative Testing: Air barrier assemblies will be tested for evidence of air leakage according to ASTM E 1186.
2. Quantitative Air Leakage Testing: Testing not to exceed the test pressure differential, positive and negative, indicated in "Performance Requirements" Article for air barrier assembly air leakage according to ASTM E 783.

D. Remove and replace deficient air barrier components and retest as specified above.

3.8 CLEANING AND PROTECTION

A. Protect air barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.

1. Protect air barrier from exposure to UV light and harmful weather exposure as required by manufacturer. Remove and replace air barrier exposed to these conditions for more than 30 days.
2. Protect air barrier from contact with creosote, uncured coal-tar products, TPO, EPDM, flexible PVC membranes, and sealants not approved by air barrier manufacturer.

B. Clean spills, stains, and soiling from adjacent construction that would be exposed in the completed work using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION

SECTION 073113

ASPHALT SHINGLES

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS, which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Asphalt shingles.
2. Underlayment.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 061000 - ROUGH CARPENTRY for wood nailers and cants.
2. Section 076200 - SHEET METAL FLASHING AND TRIM.

1.3 DEFINITION

A. Roofing Terminology: See ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definitions of terms related to roofing work in this Section.

1.4 SUBMITTALS

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

B. Samples for Verification: For the following products, of sizes indicated, to verify color selected:

1. Asphalt Shingle: Full size.
2. Ridge and Hip Cap Shingles: Full size.
3. Ridge Vent: 12-inch-long Sample.
4. Exposed Valley Lining: 12 inches square.
5. Self-Adhering Underlayment: 12 inches square.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for asphalt shingles.

D. Maintenance Data: For each type of asphalt shingle to include in maintenance manuals.

E. Warranties: Sample of special warranties.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain ridge and hip cap shingles ridge vents from single source from single manufacturer.

B. Fire-Resistance Characteristics: Where indicated, provide asphalt shingles and related roofing materials identical to those of assemblies tested for fire resistance per test method below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing agency.

1. Exterior Fire-Test Exposure: Class A; ASTM E 108 or UL 790, for application and roof slopes indicated.

C. Energy Performance: Provide steep slope roofing system with Solar Reflectance Index (SRI) not less than 29 when calculated according to ASTM E 1980 based on testing identical products by a qualified testing agency.

D. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockups for asphalt shingles including related roofing materials.

a. Size: 48 inches long by 48 inches wide.

2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

E. Preinstallation Conference: Conduct conference at Project site. Comply with requirements in Division 01. Review methods and procedures related to roofing system including, but not limited to, the following:

1. Meet with the Owner, Architect, Owner’s insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, and installers whose work interfaces with or affects roofing including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
5. Review structural loading limitations of roof deck during and after roofing.
6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.
7. Review governing regulations and requirements for insurance and certificates if applicable.
8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.

1.6 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.

1.7 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing to be performed according to manufacturer's written instructions and warranty requirements.

1.8 WARRANTY

A. Special Warranty: Standard form in which manufacturer agrees to repair or replace asphalt shingles that fail in materials within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Manufacturing defects.
b. Structural failures including failure of asphalt shingles to self-seal after a reasonable time.

2. Material Warranty Period: 30 years from date of Substantial Completion, prorated, with first three years nonprorated.
3. Algae-Discoloration Warranty Period: Asphalt shingles will not discolor five years from date of Substantial Completion.

B. Special Project Warranty: Roofing Installer's Warranty, signed by roofing Installer, covering Work of this Section, in which roofing Installer agrees to repair or replace components of roofing that fail in materials or workmanship within the following warranty period:

1. Warranty Period: Two years from date of Substantial Completion.

1.9 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Asphalt Shingles: 25 sq. ft of each type, in unbroken bundles.

PART 2 - PRODUCTS

2.1 GLASS-FIBER-REINFORCED ASPHALT SHINGLES

A. Environmental Product Declarations (EPD): Industry-wide EPDs for asphalt shingles are available from the Asphalt Roofing Manufacturers Association (ARMA).

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

1. Atlas Roofing Corporation.
2. CertainTeed Corporation.
3. GAF Materials Corporation.
4. IKO.
5. Owens Corning.

C. Laminated-Strip Asphalt Shingles: ASTM D 3462, laminated, multi-ply overlay construction, glass-fiber reinforced, mineral-granule surfaced, and self-sealing.

1. Algae Resistance: Granules treated to resist algae discoloration.
2. Color and Blends: As selected by Architect from manufacturer's full range.

2.2 UNDERLAYMENT MATERIALS

A. Self-Adhering Sheet Underlayment, Polyethylene Faced: ASTM D 1970, minimum of 40-mil-thick, slip-resisting, polyethylene-film-reinforced top surface laminated to SBS-modified asphalt adhesive, with release paper backing; cold applied.

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

a. Carlisle Coatings & Waterproofing, Inc.
b. GCP Applied Technologies (formerly W.R. Grace).
c. Henry Company.

B. Felt: ASTM D 226, Type II, asphalt-saturated organic felts, nonperforated.

2.3 RIDGE VENTS

A. Rigid Ridge Vent: Manufacturer's standard, rigid section high-density polypropylene or other UV-stabilized plastic ridge vent with nonwoven geotextile filter strips; for use under ridge shingles.

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

a. Air Vent, Inc.; a Gibraltar Industries company.
b. Cor-A-Vent, Inc.
c. GAF Materials Corporation.

2.4 ACCESSORIES

A. Asphalt Roofing Cement: ASTM D 4586, Type II, asbestos free.

B. Roofing Nails: ASTM F 1667; aluminum, stainless-steel, copper, or hot-dip galvanized-steel 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.

C. Felt Underlayment Nails: Aluminum, stainless-steel, or hot-dip galvanized-steel wire with low-profile capped heads or disc caps, 1-inch minimum diameter.

2.5 METAL FLASHING AND TRIM

A. General: Comply with requirements in Section 076200 - SHEET METAL FLASHING AND TRIM.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

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.

B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

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

3.2 UNDERLAYMENT INSTALLATION

A. General: Comply with underlayment manufacturer's written installation instructions applicable to products and applications indicated unless more stringent requirements apply.

B. Self-Adhering Sheet Underlayment: Install, wrinkle free, on roof deck. Comply with low-temperature installation restrictions of underlayment manufacturer if applicable. Install at locations indicated below, 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.

1. Eaves: Extend from edges of eaves 36 inches beyond interior face of exterior wall.
2. Rakes: Extend from edges of rake 36 inches beyond interior face of exterior wall.

3. Valleys: Extend from lowest to highest point 18 inches on each side.
4. Hips: Extend 18 inches on each side.
5. Ridges: Extend 36 inches on each side without obstructing continuous ridge vent slot.
6. Sidewalls: Extend beyond sidewall 18 inches and return vertically against sidewall not less than 4 inches.
7. Dormers, Chimneys, Skylights, and Other Roof-Penetrating Elements: Extend beyond penetrating element 18 inches and return vertically against penetrating element not less than 4 inches.
8. Roof Slope Transitions: Extend 18 inches on each roof slope.

C. Single-Layer Felt Underlayment: Install on roof deck parallel with and starting at the eaves. 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 [felt underlayment] [roofing] nails.

1. Install felt underlayment on 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.

3.3 METAL FLASHING INSTALLATION

A. General: Install metal flashings and other sheet metal to comply with requirements in Section 076200 - 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."

3.4 ASPHALT SHINGLE INSTALLATION

A. General: 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 with self-sealing strip face up at roof edge.

1. Extend asphalt shingles 3/4 inch over fasciae 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. Fasten asphalt shingle strips with a minimum of four roofing nails located according to manufacturer's written instructions.

E. Closed-Cut Valleys: Extend asphalt shingle strips from one side of valley 12 inches beyond center of valley. Use one-piece shingle strips without joints in valley. Fasten with extra nail in upper end of shingle. Install asphalt shingle courses from other side of valley and cut back to a

straight line 2 inches short of valley centerline. Trim upper concealed corners of cut-back shingle strips.

1. Do not nail asphalt shingles within 6 inches of valley center.
2. Set trimmed, concealed-corner asphalt shingles in a 3-inch-wide bed of asphalt roofing cement.

F. Ridge Vents: Install continuous ridge vents over asphalt shingles according to manufacturer's written instructions. Fasten with roofing nails of sufficient length to penetrate sheathing.

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.

1. Fasten ridge cap asphalt shingles to cover ridge vent without obstructing airflow.

END OF SECTION

SECTION 073126

SLATE SHINGLES

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS, which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Slate shingles.
2. Underlayment and accessories.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 061000 - ROUGH CARPENTRY for wood nailers and cants.
2. Section 076200 - SHEET METAL FLASHING AND TRIM.

1.3 DEFINITIONS

A. Roofing Terminology: See ASTM D 1079 and glossary in 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 Verification: For the following products, of sizes indicated, to verify color selected:

1. Slate Shingle: Full size, of each color, size, texture, and shape.
2. Ridge Cap: 12-inch-long Sample.
3. Fasteners: Three fasteners of each type, length, and finish.

C. Material Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each slate variety.

D. Maintenance Data: For roofing to include in maintenance manuals.

E. Warranty: Sample of special warranty.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain each color of slate shingle from single quarry capable of producing slate of consistent quality in appearance and physical properties.

B. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockups including related roofing materials.

a. Size: 48 inches long by 48 inches wide.

2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

C. Preinstallation Conference: Conduct conference at Project site. Comply with requirements in Division 01. Review methods and procedures related to roofing system including, but not limited to, the following:

1. Meet with the Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, and installers whose work interfaces with or affects roofing including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
5. Review structural loading limitations of roof deck during and after roofing.
6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.
7. Review governing regulations and requirements for insurance and certificates if applicable.
8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.

1.6 DELIVERY, STORAGE, AND HANDLING

A. 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.

1.7 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing to be performed according to manufacturer's written instructions and warranty requirements.

1.8 WARRANTY

A. Special Warranty: Standard form in which roofing Installer agrees to repair or replace slate roofing that fails in materials or workmanship within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

B. Special Project Warranty: Roofing Installer's Warranty, signed by roofing Installer, covering Work of this Section, in which roofing Installer agrees to repair or replace components of roofing that fail in materials or workmanship within the following warranty period:

1. Warranty Period: Five years from date of Substantial Completion.

1.9 EXTRA MATERIALS (ATTIC STOCK)

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Slate Shingles: 25 sq. ft. of each type and color, in unbroken bundles.

PART 2 - PRODUCTS

2.1 SLATE SHINGLES

A. Slate Shingles: ASTM C 406, Grade S1; hard, dense, and sound; chamfered edges, with nail holes machine punched or drilled and countersunk. No broken or cracked slates, no broken exposed corners, and no broken corners on covered ends that could sacrifice nailing strength or laying of a watertight roof.

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

a. Greenstone Slate Company, Inc.
b. New England Slate Company (The).
c. North Country Slate.
d. Structural Slate Company (The).
e. Tatko Stone Products, Inc.
f. U.S. Quarried Slate Products, Inc.
g. Vermont Structural Slate Company, Inc.

2. Thickness: Nominal 3/16 to 1/4 inch.
3. Surface Texture: Smooth.
4. Size: As indicated on the Drawings.
5. Nail Holes: Two per shingle.

6. Butt Shape: Standard square cut.
7. Color: As selected by Architect from manufacturer's full range.
8. Weather-Exposure Color Change: Unfading.

B. Starter Slate: Slate shingles with chamfered nail holes front-side punched.

1. Length: Exposure of slate shingle plus head lap.

C. Ridge Slate: Slate shingles fabricated with vertical grain orientation.

2.2 UNDERLAYMENT MATERIALS

A. Self-Adhering Sheet Underlayment, Polyethylene Faced: ASTM D 1970, minimum of 40-mil-thick, slip-resisting, polyethylene-film-reinforced top surface laminated to SBS-modified asphalt adhesive, with release paper backing; cold applied.

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

a. Carlisle Coatings & Waterproofing, Inc.
b. GCP Applied Technologies (formerly W.R. Grace).
c. Henry Company.

2.3 ACCESSORIES

A. Asphalt Roofing Cement: ASTM D 4586, Type II, asbestos free.

B. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied.

C. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane polymer sealant; of type, grade, class, and use classifications required to seal joints in slate-shingle roofing and remain watertight.

D. Slating Nails: ASTM F 1667, copper, smooth shanked, wire nails; 0.135-inch minimum thickness; sharp pointed; with 3/8-inch-minimum diameter flat head; of sufficient length to penetrate a minimum of 3/4 inch into sheathing.

1. Where nails are in contact with metal flashing, use nails made from same metal as flashing.

E. Wood Nailers and Beveled Cant Strips: Comply with requirements for pressure-preservative-treated wood in Section 061000 - ROUGH CARPENTRY.

2.4 METAL FLASHING AND TRIM

A. General: Comply with requirements in Section 076200 - SHEET METAL FLASHING AND TRIM.

B. Fabricate sheet metal flashing and trim to comply with recommendations that apply to design, dimensions, metal, and other characteristics of the item in SMACNA's "Architectural Sheet Metal Manual."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

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 roofing.

B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

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

3.2 UNDERLAYMENT INSTALLATION

A. General: Comply with underlayment manufacturer's written installation instructions applicable to products and applications indicated unless more stringent requirements apply.

B. Self-Adhering Sheet Underlayment: Install, wrinkle free, on roof deck. Comply with low-temperature installation restrictions of underlayment manufacturer if applicable. Install over entire roof deck 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 Section 076200 - SHEET METAL FLASHING AND TRIM.

1. Install metal flashings according to concrete roof tile manufacturer's written instructions and recommendations in NRCA's "The NRCA Roofing and Waterproofing Manual."

3.4 WOOD NAILERS

A. Install wood nailers at ridges, hips and rakes, and securely fasten to roof deck.

B. Install beveled wood cant at eaves and securely fasten to roof deck.

3.5 SLATE-SHINGLE INSTALLATION

A. General: Beginning at eaves, install slate shingles according to manufacturer's written instructions and to details and recommendations in NRCA's "The NRCA Roofing and Waterproofing Manual."

1. Install wood nailer strip cant at eave edges.
2. Install shingle starter course chamfered face down.

B. Install first and succeeding shingle courses with chamfered face up. Install full-width first course at rake edge.

1. Offset joints of uniform-width slate shingles by half the shingle width in succeeding courses.
2. Offset joints of random-width slate shingles a minimum of 3 inches (75 mm) in succeeding courses.

C. Maintain a 3-inch-minimum head lap between succeeding shingle courses.

D. Maintain uniform exposure of shingle courses between eaves and ridge.

E. Extend shingle starter course and first course 1 inch over fasciae at eaves.

F. Extend shingle starter course and succeeding courses 1 inch over fasciae at rakes.

G. Cut and fit slate neatly around roof vents, pipes, ventilators, and other projections through roof.

H. Hang slate with two slating nails for each shingle with nail heads lightly touching slate. Do not drive nails home drawing slates downward or leave nail head protruding enough to interfere with overlapping shingle above.

I. Ridges: Install ridge slate in saddle configuration.

1. Install and anchor wood nailer strips of thicknesses to match abutting courses of slate shingles, terminating nailer strip 3 to 4 inches from the eave. Cover with felt underlayment strip, extending to underlying slate but concealed by ridge slate.
2. Anchor ridge slate to supporting wood nailer strip with two nails for each slate shingle without nails penetrating underlying slate.
3. Cover heads of exposed nails at final ridge shingle with butyl sealant.

J. Hips: Install and anchor slate hips in saddle configuration.

1. Install and anchor wood nailer strips of thickness to match abutting courses of slate shingles. Cover nailer strip with felt underlayment strip, extending on to underlying slate but concealed by hip slate. Anchor hip slate to nailer strip with two nails located in upper third of hip-slate length.
2. Notch starter shingle and first shingle course at hip to fit around nailer strips so no wood is exposed at ridge eave.
3. Lay hip slate in bed of butyl sealant.

K. Closed Valleys: Cut slate shingles to form straight lines at closed valleys, trimming upper concealed corners of shingles. Maintain uniform gap at centerline of valley of 1/2 to 3/4 inch.

1. Do not nail shingles to valley metal flashings.

3.6 ADJUSTING AND CLEANING

A. Remove and replace damaged or broken slate shingles.

B. Remove excess slate and debris from Project site.

END OF SECTION

SECTION 074200

METAL WALL PANELS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Metal-faced composite wall panels and attachment systems.
2. Factory-formed and -assembled, foamed-insulation-core metal wall panels.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 054000 - COLD-FORMED METAL FRAMING for secondary support framing supporting metal wall panels.
2. Section 072100 - THERMAL INSULATION for insulation behind metal wall panels.
3. Section 076200 - SHEET METAL FLASHING AND TRIM for copings, flashings, and other sheet metal work not part of metal wall panel assemblies.
4. Section 079200 - JOINT SEALANTS for field-applied sealants not otherwise specified in this Section.

1.3 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design metal wall panel assembly, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. General: Provide metal wall panel assemblies that comply with performance requirements specified as determined by testing manufacturers' standard assemblies similar to those indicated for this Project, by a qualified testing and inspecting agency.

C. Structural Performance: Provide metal wall panel assemblies capable of withstanding the effects of gravity loads and loads and stresses within limits and under conditions indicated, based on testing according to ASTM E 1592 and ASTM E 330 as applicable.

1. Wind Loads: As required by Code.
2. Deflection Limits: Engineer metal wall panel assemblies to withstand test pressures with deflection no greater than 1/180 of the span and no evidence of material failure, structural distress, or permanent deformation exceeding 0.2 percent of the clear span, at code required loading.

D. Fire Test Performance: Passes NFPA 285, Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components.

E. Thermal Movements for Metal Wall Panels: Provide wall panel assemblies that allow for noiseless thermal movements resulting from the following range in ambient temperatures and that prevent buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects:

1. Ambient Temperature Range: Minus 20 to plus 180 deg F.

F. Seismic Performance: Metal wall panels shall withstand the effects of earthquake motions determined according to Code.

1. Component Importance Factor: 1.0 [1.5].

1.4 SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.

B. Shop Drawings: Show fabrication and installation layouts of metal wall panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details. Distinguish between factory- and field-assembled work.

1. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer licensed in the project location responsible for their preparation. All costs for professional engineering shall be included in the bid price for the Work of this Section.

C. Delegated-Design Submittal: For metal wall panel assembly indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

D. Exterior Wall Certification: Submit manufacturer’s certification that exterior wall panels, as designed in the assemblies indicated on the Drawings, has been tested to meet the requirements of NFPA 285 and passed.

E. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.

1. Metal Panels: 12 inches long by actual panel width. Include fasteners, closures, and other metal wall panel accessories. Include 4-way joint for panels.
2. Exposed Sealants: For each type and color of joint sealant required. Install joint sealants in 1/2-inch-wide joints formed between two 6-inch-long strips of material matching the appearance of metal wall panels adjacent to joint sealants.

F. Qualifications: Qualifications of professional engineer and qualifications of installer as specified.

1.5 QUALITY ASSURANCE

A. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data by a qualified professional engineer.

B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the state the project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of panels that are similar to those indicated for this Project in material, design, and extent.

C. Installer Qualifications: An employer of workers trained and approved by manufacturer.

1. Installer's responsibilities include fabricating and installing metal wall panel assemblies and providing professional engineering services needed to assume engineering responsibility.

D. Fabricator Qualifications: Certified by metal wall panel manufacturer to fabricate and install manufacturer's wall panel system.

E. Source Limitations: Obtain each type of metal wall panel through one source from a single manufacturer.

F. Fire Test Performance for Exterior Wall: Passes NFPA 285, Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components.

G. 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. Use manufacturer's standard test methods to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.

H. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01. Review methods and procedures related to metal wall panel assemblies including, but not limited to, the following:

1. Meet with The Owner, Architect, Owner’s insurer if applicable, testing and inspecting agency representative, metal wall panel Installer, metal wall panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal wall panels including installers of doors, windows, and louvers.
2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
3. Review methods and procedures related to metal wall panel installation, including manufacturer's written instructions.
4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
5. Review flashings, special siding details, wall penetrations, openings, and condition of other construction that will affect metal wall panels.
6. Review governing regulations and requirements for insurance, certificates, and testing and inspecting if applicable.

7. Review temporary protection requirements for metal wall panel assembly during and after installation.
8. Review wall panel observation and repair procedures after metal wall panel installation.
9. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

I. Mockups: Provide mock-ups as specified in Section 014330 - MOCK-UPS, coordinate with other trades as required.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, sheets, metal wall panels, and other manufactured items so as not to be damaged or deformed. Package metal wall panels for protection during transportation and handling.

B. Unload, store, and erect metal wall panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal wall panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal wall panels to ensure dryness, with positive slope for drainage of water. Do not store metal wall panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Store metal-faced composite wall panels vertically, covered with suitable weathertight and ventilated covering. Store metal-faced composite wall panels to ensure dryness, with positive slope for drainage of water. Do not store metal-faced composite wall panels in contact with other materials that might cause staining, denting, or other surface damage. Do not allow storage space to exceed 120 deg F.

E. Protect strippable protective covering on metal wall panels from exposure to sunlight and high humidity, except to extent necessary for period of metal wall panel installation.

1.7 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal wall panels to be performed according to manufacturers' written instructions and warranty requirements.

B. Field Measurements: Verify locations of structural members and wall opening dimensions by field measurements before metal wall panel fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, either establish framing and opening dimensions and proceed with fabricating metal wall panels without field measurements, or allow for field trimming of panels. Coordinate wall construction to ensure that actual building dimensions, locations of structural members, and openings correspond to established dimensions.

1.8 COORDINATION

A. Coordinate metal wall panel assemblies with rain drainage work, flashing, trim, and construction of girts, studs, soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal wall panel assemblies that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures, including rupturing, cracking, or puncturing.
b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

2. Warranty Period: Two years from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal wall panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 METAL-FACED COMPOSITE WALL PANELS

A. General: Provide factory-formed and -assembled metal-faced composite wall panels fabricated from two metal facings bonded, using no glues or adhesives, to solid extruded thermoplastic core; formed into profile for installation method indicated. Include attachment system components and accessories required for weathertight system.

B. Aluminum Composite Material Panels: Formed with 0.020-inch- (0.50-mm-) thick, aluminum sheet facings.

1. Acceptable Products: Subject to compliance with requirements, provide one of the following products:

a. 3A Composites USA, Inc.; Alucobond Plus (Basis of Design, product specific Type III EPD).
b. Arconic, Inc.; Reynobond FR.
c. Alpolic Materials, a division of Mitsubishi; Alpolic/pe Alpolic/fr.

d. Alucoil North America; Alucoil FR.
e. Firestone Building Products, LLC; UNA-FAB Series 1500, with fire-rated core.

2. Panel Thickness: 0.157 inch (4 mm).
3. Fire-Retardant Core: Noncombustible, with the following surface burning characteristics as determined by testing identical products per ASTM E 84 by UL or another testing and inspection agency acceptable to authorities having jurisdiction.

a. Flame-Spread Index: 25 or less.
b. Smoke- Development Index: 450 or less.

C. Attachment Assembly Components: Formed from extruded aluminum.

1. Include manufacturer's standard perimeter extrusions, panel stiffeners, panel clips and anchor channels.

D. Attachment Assembly: Manufacturer's standard rainscreen system.

2.2 FOAMED-INSULATION-CORE METAL WALL PANELS

A. General: Provide factory-formed and -assembled metal wall panels fabricated from two metal facing sheets and insulation core foamed-in-place during fabrication with joints between panels designed to form weathertight seals. Include accessories required for weathertight installation.

1. Panel Performance:

a. Flatwise Tensile Strength: 30 psi when tested according to ASTM C 297.
b. Humid Aging: Volume increase not greater than 6.0 percent and no delamination or metal corrosion when tested for 7 days at 140 deg F and 100 percent relative humidity according to ASTM D 2126.
c. Heat Aging: Volume increase not greater than 2.0 percent and no delamination, surface blistering, or permanent bowing when tested for 7 days at 200 deg F according to ASTM D 2126.
d. Cold Aging: Volume decrease not more than 1.0 percent and no delamination, surface blistering, or permanent bowing when tested for 7 days at minus 20 deg F according to ASTM D 2126.
e. Fatigue: No evidence of delamination, core cracking, or permanent bowing when tested to a 20-lbf/sq. ft. positive and negative wind load and with deflection of L/180 for 2 million cycles.
f. Autoclave: No delamination when exposed to 2-psi pressure at a temperature of 212 deg F for 2-1/2 hours.
g. Fire-Test-Response Characteristics: Class A according to ASTM E 108.

2. Isocyanurate Insulation-Core Performance:

a. Density: 2.0 to 2.6 lb/cu. ft. when tested according to ASTM D 1622.
b. Compressive Strength: Minimum 20 psi when tested according to ASTM D 1621.
c. Shear Strength: 26 psi when tested according to ASTM C 273.

B. Concealed-Fastener, Foamed-Insulation-Core Metal Wall Panels: Formed with tongue-and-groove panel edges; designed for sequential installation by interlocking panel edges and mechanically attaching panels to supports using concealed clips or fasteners.

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

    a. Aluma Shield Industries, Inc., a Member of Metecno Group; AW-300A Flush Wall Panel.
    b. CENTRIA Architectural Systems; Formawall 1000.
    c. Metl-Span; CF Architectural Wall Panel.

2. Facings: Fabricate panel with exterior and interior facings of same material and thickness.

    a. Material: Zinc-coated (galvanized) G90 steel sheet, 22 gauge thick at exterior panel and 26 gauge at interior panel.
    b. Exterior Finish, Fluoropolymer Three-Coat System: Manufacturer's standard three-coat, thermocured system consisting of specially formulated inhibitive primer, fluoropolymer color coat, and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 2605. Color and gloss as selected by Architect from manufacturer’s full range.
    c. Interior Facing Finish: Manufacturer's standard 0.2 mil primer with 0.6 mil acrylic.
    d. Exterior Surface: Smooth, flat.

3. Panel Thickness: 2.0 inches; 13/16 in. thick at reveals.
4. Panel Module: 24 in.

2.3 ACCESSORIES

A. Wall Panel Accessories: Provide components required for a complete metal wall panel assembly including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal wall panels, unless otherwise indicated.

B. Trim: Formed from 0.0179-inch-thick, zinc-coated (galvanized) steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal wall panels.

2.4 METAL FRAMING

A. Steel Sheet Components, General: Complying with ASTM C 645 requirements for metal and with ASTM A 653, G60, hot-dip galvanized zinc coating.

B. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches wall attachment flange of 7/8 inch, minimum bare metal thickness of 0.0179 inch and depth required to fit insulation thickness indicated.

C. Rainscreen System: Provide system that has been tested in accordance with AAMA 508 (Pressure Equalized Rain Screen Wall Cladding Test) – Standard Test Method for Water Penetration of Exterior Vented Rainscreen Panel System. The test requires a minimum airflow of 1 CFM / SF of weather wall area through the vented rainscreen system to replicate severe

storm and imperfection in air/vapor barrier system. While maintaining 1 CFM/SF airflow, the system must be able to pressure equalize and sustain zero pressure difference between the interior and exterior wall cavity without any water penetration.

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. Universe Systems, Division of Universe Corporation.
    b. LYMO Architectural Panel Systems Inc.
    c. POHL Inc. of America.
    d. Centria Architectural Systems.
    e. Metal Sales & Service, Inc.

2. Rout and return wall panel system with dry joints for rainscreen assembly; as approved by the Architect.

D. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

2.5 FABRICATION

A. General: Fabricate and finish metal wall panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

1. Form panel lines, breaks, and angles to be sharp and true, with surfaces free from warp and buckle.
2. Fabricate wall panels with panel stiffeners as required to maintain fabrication tolerances and to withstand design loads.

B. Metal-Faced Composite Wall Panels: Factory form panels. Trim and square edges of sheets with no displacement of face sheets or protrusion of core material.

1. Fabricate panels with panel stiffeners, as required to comply with deflection limits, attached to back of panels with structural silicone sealant or bond tape.
2. Fabricate panels with sharply cut edges, with no displacement of face sheets or protrusion of core material.
3. Dimensional Tolerances:

    a. Length: Plus 0.125 inch.
    b. Width: Plus 0.188 inch.
    c. Thickness: Plus or minus 0.008 inch.
    d. Panel Bow: 0.8 percent maximum of panel length or width.
    e. Squareness: 0.2 inch maximum.
    f. Surfaces: Free from warp or buckle with no rises and falls across the panel (local pumps and depressions) and maximum 0.062 inch (1.6 mm) bow or warp in concave or convex direction, measured perpendicular to normal plane.

C. Sheet Metal Accessories: Fabricate trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal, and other characteristics of item indicated.

1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
4. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.
5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended by metal wall panel manufacturer.

    a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured.

2.6 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 and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. High-Performance Organic Finish (2-Coat Fluoropolymer): AA-C12C40R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: conversion coating; Organic Coating: manufacturer's standard 2-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color coat, with color coat containing not less than 70 percent polyvinylidene fluoride resin by weight). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 2605 and with coating and resin manufacturers' written instructions.

1. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal wall panel supports, and other conditions affecting performance of work.

1. Examine primary and secondary wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal wall panel manufacturer.
2. Examine solid wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal wall panel manufacturer.
3. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.

B. Examine roughing-in for components and systems penetrating metal wall panels to verify actual locations of penetrations relative to seam locations of metal wall panels before metal wall panel installation.

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

3.2 PREPARATION

A. Clean substrates of substances harmful to insulation, including removing projections capable of interfering with insulation attachment.

B. Miscellaneous Framing: Install subgirts, base angles, sills, furring, and other miscellaneous wall panel support members and anchorage according to ASTM C 754 and metal wall panel manufacturer's written recommendations.

3.3 METAL WALL PANEL INSTALLATION, GENERAL

A. General: Install metal wall panels in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to girts and subgirts, unless otherwise indicated. Anchor metal wall panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Field cutting of metal wall panels by torch is not permitted.
2. Shim or otherwise plumb substrates receiving metal wall panels.
3. Rigidly fasten base end of metal wall panels and allow eave end free movement due to thermal expansion and contraction. Predrill panels.
4. Flash and seal metal wall panels with weather closures at eaves, rakes, and at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until weather barrier and flashings that will be concealed by metal wall panels are installed.
5. Install screw fasteners in predrilled holes.
6. Locate and space fastenings in uniform vertical and horizontal alignment.
7. Install flashing and trim as metal wall panel work proceeds.
8. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.

9. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete, and elsewhere as indicated or, if not indicated, as necessary for waterproofing.
10. Align bottom of metal wall panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
11. Provide weatherproof escutcheons for pipe and conduit penetrating exterior walls.

B. Fasteners, Aluminum Panels: Use aluminum or stainless-steel fasteners for surfaces exposed to the exterior and aluminum or galvanized steel fasteners for surfaces exposed to the interior.

C. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by metal wall panel manufacturer.

3.4 WALL PANEL INSTALLATION

A. General: Install attachment system required to support wall panels and to provide a complete weathertight wall system, including subgirts, perimeter extrusions, tracks, drainage channels, panel clips, and anchor channels.

1. Include attachment to supports, panel-to-panel joinery, panel-to-dissimilar-material joinery, and panel-system joint seals.
2. Do not begin installation until weather barrier and flashings that will be concealed by metal panels are installed.

B. Track-Support Installation: Provide manufacturer's standard horizontal and vertical tracks that provide support and complete secondary drainage system, draining to the exterior at horizontal joints. Install support system at locations, spacings, and with fasteners recommended by manufacturer. Attach panels to wall by interlocking tracks with perimeter extrusions attached to wall panels. Fully engage integral gaskets and leave horizontal and vertical joints with open reveal.

1. Attach routed-and-returned flanges of wall panels to perimeter extrusions with manufacturer's standard fasteners.

3.5 ACCESSORY INSTALLATION

A. General: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal wall panel assembly including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.

B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed 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 weather resistant.

1. Install exposed flashing and trim 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.

2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

3.6 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align metal wall panel units within installed tolerance of 1/4 inch in 20 feet nonaccumulative, on level, plumb, and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.7 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal wall panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal wall panel installation, clean finished surfaces as recommended by metal wall panel manufacturer. Maintain in a clean condition during construction.

B. After metal wall panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

C. Replace metal wall panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 074610

FIBER-CEMENT SIDING

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Fiber-cement siding and trim.
2. PVC trim.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 061000 - ROUGH CARPENTRY for wood furring, grounds, nailers, and blocking.
2. Section 061600 - SHEATHING for wall sheathing.

1.3 SUBMITTALS

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

B. Samples for Verification: For each type, color, texture, and pattern required.

1. 12-inch- (300-mm-) long-by-actual-width Sample of siding.
2. 12-inch- (300-mm-) long-by-actual-width Samples of trim and accessories.

C. Product Certificates: For each type of siding and trim, from manufacturer.

D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for fiber-cement siding.

E. Warranty: Sample of special warranty.

F. Maintenance Data: For each type of siding and trim and related accessories to include in maintenance manuals.

G. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Furnish full lengths of siding and trim including related accessories, in a quantity equal to 2 percent of amount installed.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain each type, color, texture, and pattern of siding and trim, including related accessories, from single source from single manufacturer.

B. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.

1. Build mockups for siding and trim including accessories.

a. Size: 48 inches long by 60 inches high.
b. Include outside corner on one end of mockup and inside corner on other end.

2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

C. Preinstallation Conference: Conduct conference at Project site. Comply with requirements in Division 01.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store materials in a dry, well-ventilated, weathertight place.

1.6 COORDINATION

A. Coordinate installation with flashings and other adjoining construction to ensure proper sequencing.

1.7 WARRANTY

A. Special Warranty: Standard form in which manufacturer agrees to repair or replace siding and trim that fail(s) in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including cracking, deforming, and fading.
b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

2. Fading is defined as loss of color, after cleaning with product recommended by manufacturer, of more than 5 Hunter color-difference units as measured according to ASTM D 2244.
3. Warranty Period: 25 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 FIBER-CEMENT SIDING AND TRIM

A. General: Siding made from fiber-cement board that complies with ASTM C 1186, Type A, Grade II; is classified as noncombustible when tested according to ASTM E 136; and has a flame-spread index of 25 or less when tested according to ASTM E 84.

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

    a. Cemplank.
    b. CertainTeed Corp.
    c. GAF Materials Corporation.
    d. James Hardie Building Products.
    e. Nichiha Fiber Cement.

2. Vertical Pattern: Panels 5/16 inches thick x 48 inches wide x 120 inches high in plain style and smooth texture.
3. Factory Priming: Manufacturer's standard acrylic primer.

B. Labeling: Provide fiber-cement siding that is tested and labeled according to ASTM C 1186 by a qualified testing agency acceptable to authorities having jurisdiction.

2.2 PVC TRIM

A. Cellular PVC Trim: Extruded, expanded PVC with a small-cell microstructure, made from UV- and heat-stabilized, rigid material.

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

    a. Ply-Trim, Inc.; DuraBoard.
    b. Royal Mouldings Limited; Pro Series Exterior Mouldings.
    c. Vycom Corp.; Azek.

2. Density: Not less than 31 lb/cu. ft.
3. Heat Deflection Temperature: Not less than 130 deg F, per ASTM D 648.
4. Coefficient of Thermal Expansion: Not more than 4.5 x 10-5 inches/inch x deg F.
5. Water Absorption: Not more than 1 percent, per ASTM D 570.
6. Flame-Spread Index: 75 or less, per ASTM E 84.

B. Joint Sealants: Provide a non-silicone acrylic or polyurethane joint sealant as recommended by the PVC manufacturer.

2.3 ACCESSORIES

A. Siding Accessories, General: Provide starter strips, edge trim, outside and inside corner caps, and other items as recommended by siding manufacturer for building configuration.

1. Provide accessories made from same material as adjacent siding unless otherwise indicated.

B. Decorative Accessories: Provide the following fiber-cement decorative accessories as indicated on the Drawings.

1. Colors for Decorative Accessories: As selected by Architect from manufacturer's full range of industry colors.

C. Flashing: Provide stainless-steel flashing complying with Section 076200 - SHEET METAL FLASHING AND TRIM at window and door heads and where indicated.

D. Fasteners:

1. For fastening fiber-cement and PVC, use stainless-steel fasteners.
2. For fastening to wood, use siding nails or ribbed bugle-head screws of sufficient length to penetrate a minimum of 1 inch into substrate.
3. For fastening PVC trim to wood, use #8 trim screws long enough to penetrate substrate 1-1/4 in.
4. For fastening to metal, use ribbed bugle-head screws of sufficient length to penetrate a minimum of 1/4 inch, or three screw-threads, into substrate.
5. Staples, small brads, and wire nails will not be accepted.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of siding and trim and related accessories.

B. 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 and trim manufacturer's written installation instructions applicable to products and applications indicated unless more stringent requirements apply.

1. Do not install damaged components.

B. Install fiber-cement siding and trim and related accessories.

1. Install fasteners no more than 24 inches o.c. horizontally and 2 inches from ends.
2. Install minimum of two fasteners at each bearing for PVC boards up to 6 in. wide, three fasteners for boards up to 10 in. wide.
3. Align fasteners to engage framing member behind sheathing.
4. Install siding for average 5 in. exposure, adjusting as required to align courses with window and door openings.
5. Install PVC trim with shiplap vertical joints bonded with manufacturer’s adhesive. Provide two fasteners at end of each board.

C. Install joint sealants as specified in Section 079200 - JOINT SEALANTS and to produce a weathertight installation.

3.4 ADJUSTING AND CLEANING

A. Remove damaged, improperly installed, or otherwise defective materials and replace with new materials complying with specified requirements.

B. Clean finished surfaces according to manufacturer's written instructions and maintain in a clean condition during construction.

END OF SECTION

SECTION 075400

THERMOPLASTIC MEMBRANE ROOFING

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Adhered membrane-roofing system.
2. Cover board.
3. Roof insulation.
4. Substrate Board (thermal barrier).
5. Vapor retarder.
6. Membrane clad metal flashing.
7. Flashing for equipment mounted on roofing and roofing penetrations.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 061000 - ROUGH CARPENTRY for wood nailers, curbs, and blocking.
2. Section 076200 - SHEET METAL FLASHING AND TRIM for metal roof penetration flashings, flashings, and counterflashings.
3. Section 079200 - JOINT SEALANTS for sealants.
4. Division 22 - PLUMBING for roof drains.
5. Division 23 - HEATING, VENTILATING, AND AIR CONDITIONING for roof curbs for HVAC equipment.

1.3 DEFINITIONS

A. Roofing Terminology: Refer to ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definition of terms related to roofing work in this Section.

1.4 PERFORMANCE REQUIREMENTS

A. General: Provide installed roofing membrane and base flashings that remain watertight; do not permit the passage of water; and resist specified uplift pressures, thermally induced movement, and exposure to weather without failure.

B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by roofing manufacturer based

on testing and field experience. PVC membrane shall be separated by specified cover board from extruded polystyrene insulation.

C. Roofing System Design: Roofing system shall be designed to withstand loads indicated on Drawings, but not less than loads required by Code.

D. Flashings: Provide base flashings, perimeter flashings, detail flashings and component materials that comply with requirements and recommendations in FMG 1-49 Loss Prevention Data Sheet for Perimeter Flashings; FMG 1-29 Loss Prevention Data Sheet for Above Deck Roof Components; NRCA Roofing and Waterproofing Manual (Fourth Edition) for Construction Details and SMACNA Architectural Sheet Metal Manual (Fifth Edition) for Construction Details, as applicable.

E. Energy Performance: Provide roofing system with Solar Reflectance Index (SRI) not less than 78 when calculated according to ASTM E 1980 based on testing identical products by a qualified testing agency.

F. Energy Star Listing: Roofing system shall be listed on the DOE's ENERGY STAR "Roof Products Qualified Product List" for low-slope roof products.

G. Exterior Fire-Test Exposure: ASTM E 108 or UL 790, Class A; for application and roof slopes indicated; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1.5 SUBMITTALS

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

B. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other Work.

1. Base flashings and membrane terminations.
2. Transitions to air barrier membrane.
3. Tapered insulation, including slopes.
4. Insulation fastening patterns.

C. Installer Certificates: Signed by roofing system manufacturer certifying that Installer is approved, authorized, or licensed by manufacturer to install roofing system.

D. Qualification Data: For Installer and manufacturer.

E. Manufacturer Certificates: Signed by roofing manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" Article.

1. Submit evidence of complying with performance requirements.

F. Product Test Reports: For components of roofing system, tests performed by manufacturer and witnessed by a qualified testing agency.

G. Inspection Report: Copy of roofing system manufacturer's inspection report of completed roofing installation.

H. Maintenance Data: For roofing system to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Source Limitations: Obtain components for roofing system from or approved by roofing system manufacturer.

B. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.

C. Roofing Inspector: Owner may engage a full-time roofing inspector during installation of the deck, insulation assembly, membrane, flashing and other appurtenances, and when a survey of the roof and roof drains is conducted. Cooperate with Owner's roofing inspector and allow unlimited access to roofing during construction.

D. Preinstallation Conference: Conduct conference at Project site. Comply with requirements in Division 01. Review methods and procedures related to roofing system including, but not limited to, the following:

1. Meet with the Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, and installers whose work interfaces with or affects roofing including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
5. Review structural loading limitations of roof deck during and after roofing.
6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.
7. Review governing regulations and requirements for insurance and certificates if applicable.
8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storing and mixing with other components.

B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.

1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.

C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

D. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

1.8 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

1.9 WARRANTY

A. Roofing Contractor’s Warranty: The roofing subcontractor shall supply Owner with a minimum two-year workmanship warranty for each roof. In the event any work related to the roofing, flashing, or metalwork is found to be defective within two years of substantial completion, the roofing contractor shall remove and replace such at no additional cost to the Owner. The roofing subcontractor’s warranty obligation shall run directly to the Owner, and a copy the roofing signed warranty shall be sent to the roofing system’s manufacturer.

1. The duration of the Roofing Contractor’s two-year warranty shall run concurrent with the roofing system’s manufacturer’s 20-year warranty.

B. Roofing Systems Manufacturer’s Warranty: The roofing manufacturer shall guarantee roof areas to be in a watertight condition, for a period of 20 years, from the date of final acceptance of the roofing system. The warranty shall be a 20-year no dollar limit (NDL), non-prorated total system labor and material warranty, for wind speed as required by Code or as indicated on the Drawings. Total system warranty shall include all roofing materials, related components and accessories including, but not limited to the substrate board, vapor retarder, insulation board, cover board, roofing membrane, membrane flashings, fasteners, adhesives, metal roof copings, metal roof edges and termination metals and roof drain assemblies. The manufacturer shall repair defects in materials and workmanship as promptly after observation as weather and site conditions permit.

PART 2 - PRODUCTS

2.1 THERMOPLASTIC POLYOLEFIN ROOFING MEMBRANE

A. Fabric-Reinforced Thermoplastic Polyolefin Sheet: Uniform, flexible sheet conforming to ASTM D 6878 and formed from a thermoplastic polyolefin, internally fabric or scrim reinforced, and as follows:

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

a. Carlisle SynTec Incorporated.
b. Firestone Building Products Company.
c. GAF Materials Corporation.
d. GenFlex Roofing Systems.

e. Johns Manville.
f. Versico Inc.

2. Thickness: 60 mils (1.5 mm) nominal.
3. Exposed Face Color: White.
4. Physical Properties:

a. Breaking Strength: 225 lbf; ASTM D 751, grab method.
b. Elongation at Break: 15 percent; ASTM D 751.
c. Tearing Strength: 55 lbf minimum; ASTM D 751, Procedure B.
d. Water Absorption: Less than 4 percent mass change after 166 hours' immersion at 158 deg F; ASTM D 471.

2.2 AUXILIARY MATERIALS

A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with membrane roofing.

1. Liquid-type auxiliary materials shall meet VOC limits of authorities having jurisdiction.
2. Adhesives and sealants that are not on the exterior side of weather barrier shall comply with the following limits for VOC content:

a. Plastic Foam Adhesives: 50 g/L.
b. Gypsum Board and Panel Adhesives: 50 g/L.
c. Multipurpose Construction Adhesives: 70 g/L.
d. Fiberglass Adhesives: 80 g/L.
e. Single-Ply Roof Membrane Adhesives: 250 g/L.
f. Single-Ply Roof Membrane Sealants: 450 g/L.
g. Nonmembrane Roof Sealants: 300 g/L.
h. Sealant Primers for Nonporous Substrates: 250 g/L.
i. Sealant Primers for Porous Substrates: 775 g/L.
j. Other Adhesives and Sealants: 250 g/L.

B. Sheet Flashing: Manufacturer's standard sheet flashing of same material, type, reinforcement, thickness, and color as sheet membrane.

C. TPO-Clad Metal Roof Flashing: Heat-weldable flashing designed to serve as gravel stop and fascia at perimeter of thermoplastic membrane roofing.

1. Composition: 24 gauge steel with G90 galvanized coating, with 0.035 in. TPO membrane laminated to the outside face. Provide unsupported width of membrane along edge to be welded to roofing membrane.
2. Profile: As shown on Drawings.
3. Product: Sure-Weld TPO Coated Metal by Carlisle
4. Exposed Face Color: Match membrane.

D. Bonding Adhesive: Manufacturer's recommended bonding adhesive.

E. Metal Termination Bars: Manufacturer's standard predrilled stainless steel or aluminum bars, approximately 1 by 1/8 inch thick; with anchors.

F. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening membrane to substrate, and acceptable to membrane roofing system manufacturer.

G. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, termination reglets, cover strips, and other accessories.

2.3 VAPOR RETARDER

A. Self-Adhering Sheet Vapor Retarder: ASTM D 1970, minimum 40-mil- thick film laminated to layer of rubberized asphalt adhesive; maximum permeance rating of 0.1 perm; cold-applied, with slip-resisting surface and release paper backing. Provide primer when recommended by vapor-retarder manufacturer.

B. Reinforced Fire-Retardant Vapor Retarder: 3-ply polyethylene and non-woven cord grid equal to Griffolyn TX-1200FR with prefabricated Griffolyn pipe boots, mastic-type Griffolyn Fab Tape at seams, and self-adhesive Griff-Tape at punctures by Reef Industries, Inc.

C. Loose-Laid Sheet Vapor Retarder: Minimum 10 mil polyethylene sheet with maximum permeance rating of 0.1 perm.

1. Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.

2.4 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. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, felt or glass-fiber mat facer on both major surfaces.

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

a. Atlas Roofing Corporation.
b. Carlisle SynTec Incorporated.
c. Firestone Building Products Company.
d. GAF Materials Corp.
e. GenFlex Roofing Systems.
f. Johns Manville International Inc.

2. Compressive Strength at Terraces: In accordance with ASCE 7-05, “Minimum Design Load for Building and other Structures”, pedestrian terraces are required to support a minimum live load of 100 psf. Use 40 psi insulation for when pavers are on pedestals and exclusive of planters and other heavy concentrated loads such as heavy wheel traffic.

C. Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope of 1/4 inch per 12 inches unless otherwise indicated.

D. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

2.5 INSULATION ACCESSORIES

A. General: Furnish roof insulation accessories recommended by insulation manufacturer for intended use and compatible with membrane roofing.

B. 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.

C. Cold Fluid-Applied Adhesive: Manufacturer's standard cold fluid-applied adhesive formulated to adhere roof insulation to substrate.

1. Cover Board Adhesive: Manufacturer’s cold fluid-applied adhesive formulated to adhere cover board to insulation substrate.

D. Cover Board: Provide the following, as required by roofing manufacturer to comply with performance requirements and provide specified warranty.

1. Cover Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, 1/2 or 5/8 inch thick, factory primed.

E. Substrate Board (Thermal Barrier): ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, Type X, 5/8 inch (16 mm) thick, factory primed.

2.6 WALKWAYS

A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, slip-resisting, surface-textured vinyl walkway pads or rolls approximately 3/16 inch thick, and acceptable to membrane roofing system manufacturer.

2.7 ELECTRIC BREACH DETECTION SYSTEM COMPONENTS

A. Testing Source:

1. Acceptable Sources: Employ electrical conduction methods from one of the following, as approved by waterproofing system manufacturer:

a. Detec Systems
a. Honza Group, Inc.
b. International Leak Detection Ltd.
c. Leak Detection USA

2. Basis of Design: Specifications are based on the following system. Subject to compliance with Project requirements and approval by waterproofing manufacturer, equivalent systems from acceptable sources will be approved:

a. International Leak Detection Ltd, “Electric Field Vector Mapping (EFVM)”.

B. Electric Breach Detection, General: Provide permanent network of testing loops, as required to test entire waterproofing assembly.

C. Conductor Network Materials:

1. Conductor Wire: Braided polyethylene interwoven with a minimum of six strands of stainless steel wire. Tensile strength of wire shall be no less than 180 lbs.
2. Accessory Materials: Connectors and other materials as needed for complete loop or network.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with the following requirements and other conditions affecting performance of roofing system:

1. Verify that roof openings and penetrations are in place and set and braced and that roof drains are securely clamped in place.
2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
3. Verify that surface plane flatness and fastening of steel roof deck comply with requirements in Section 053100 - STEEL DECKING.
4. Verify that minimum concrete drying period recommended by roofing system manufacturer has passed.
5. Verify that concrete substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
6. Verify that concrete curing compounds that will impair adhesion of roofing components to roof deck have been removed.
7. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrate of dust, debris, moisture, 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.

C. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

3.3 SUBSTRATE BOARD INSTALLATION

A. Install substrate board with long joints in continuous straight lines, perpendicular to roof slopes with end joints staggered between rows. Tightly butt substrate boards together.

1. Fasten substrate board to top flanges of steel deck to resist uplift pressure at corners, perimeter, and field of roof according to roofing system manufacturers' written instructions and as required to comply with performance requirements.

3.4 VAPOR-RETARDER INSTALLATION

A. Self-Adhering Sheet Vapor Retarder: Prime substrate if required by manufacturer. Install self-adhering sheet vapor retarder over area to receive vapor retarder, side, and end lapping each sheet a minimum of 3-1/2 inches and 6 inches, respectively. Seal laps by rolling.

B. Completely seal vapor retarder at side laps, end laps, terminations, obstructions, and penetrations to prevent air movement into roofing system.

C. Tie vapor retarder to wall air barrier. Coordinate construction sequence to ensure air barrier continuity at roof to wall interfaces.

3.5 INSULATION AND COVERBOARD INSTALLATION

A. Coordinate installing membrane roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.

B. Comply with membrane roofing system manufacturer's written instructions for installing roof insulation.

C. Install tapered insulation under area of roofing to conform to slopes indicated.

D. Install one or more layers of insulation under area of roofing to achieve required thickness. Install 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 and does not restrict flow of water.

F. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch with insulation.

1. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.

G. 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 to resist uplift pressure at corners, perimeter, and field of roof.
2. For insulation applied in multiple layers, loose-lay first layer and mechanically fasten top layer.

H. Mechanically Fastened Cover Boards: Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches in each direction. Loosely butt cover boards together and mechanically fasten to roof deck.

1. Mechanically fasten cover boards, unless otherwise indicated.
2. Fasten insulation to resist uplift pressure at corners, perimeter, and field of roof.

I. Adhered Cover Boards: Install cover boards over mechanically-fastened insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches in each direction. Adhere cover boards to mechanically-fastened insulation in ribbons of bead-applied adhesive or full-spread adhesive, as required to comply with performance and warranty requirements.

1. Locations for Adhered Cover Board Installation: Provide under green roof areas and elsewhere, where indicated.
2. Adhere cover boards to resist uplift pressure at corners, perimeter, and field of roof.

3.6 ADHERED ROOFING MEMBRANE INSTALLATION

A. Install roofing membrane over area to receive roofing according to membrane roofing system manufacturer's written instructions. Unroll roofing membrane and allow to relax before installing.

B. Start installation of roofing membrane in presence of membrane roofing system manufacturer's technical personnel.

C. Accurately align roofing membrane and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.

D. Bonding Adhesive: Apply solvent-based bonding adhesive to substrate and underside of roofing membrane at rate required by manufacturer and allow to partially dry before installing roofing membrane. Do not apply bonding adhesive to splice area of roofing membrane.

E. Mechanically or adhesively fasten roofing membrane securely at terminations, penetrations, and perimeter of roofing.

F. Apply roofing membrane with side laps shingled with slope of roof deck where possible.

G. Seams: Clean seam areas, overlap roofing membrane, and hot-air weld side and end laps of roofing membrane according to manufacturer's written instructions to ensure a watertight seam installation.

1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of roofing membrane.
2. Verify field strength of seams a minimum of twice daily and repair seam sample areas.
3. Repair tears, voids, and lapped seams in roofing membrane that does not meet requirements.

H. Spread sealant or mastic bed over deck drain flange at deck drains and securely seal roofing membrane in place with clamping ring.

3.7 BASE FLASHING INSTALLATION

A. Install sheet flashings and preformed flashing accessories and adhere to substrates according to membrane roofing system manufacturer's written instructions.

B. Apply solvent-based bonding adhesive to substrate and underside of sheet flashing at required rate and allow to partially dry. Do not apply bonding adhesive to seam area of flashing.

C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.

D. Clean splice areas, apply splicing cement (except for heat-welded application), and firmly roll side and end laps of overlapping sheets to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of sheet flashing terminations.

E. Terminate and seal top of sheet flashings.

3.8 WALKWAY INSTALLATION

A. Flexible Walkways: Install walkway products in locations indicated. Heat weld to substrate or adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.

3.9 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform roof tests and inspections and to prepare test reports.

B. Manufacturer’s Technical Representative: Engage a qualified manufacturer’s technical representative to perform roof tests and inspections and to prepare test reports.

C. Final Roof Inspection: Engage roofing system manufacturer's technical personnel to inspect roofing installation on completion and submit report to Architect.

1. Notify Architect and the Owner 48 hours in advance of date and time of inspection.

D. Electric Breach Detection: Confirm integrity of installed roofing membrane by testing membrane for holes, open seams and capillary defects that will allow water intrusion.

1. Electric Breach Detection Procedure:

a. Conduct testing after installing membrane and before placing pavers, test to verify membrane is watertight.
b. Schedule testing to best meet project demands and construction schedule with ample time to allow for repairs of defects and consequential retesting.
c. If breaches are found, conduct retest after repairs to membrane have been completed.
d. Conduct third and final test after paver placement to verify that no damage has been done to the membrane during installation of pavers.

2. Testing Procedure:

a. Attach EFVM impulse generator to conductor wire and ground or building structure creating a potential circuit. The circuit will complete if water finds a path to ground by way of a breech in membrane.
b. Create a continuous conducting “plate” above the membrane by wetting some or all of the test area with water. Test only areas that are wetted.

c. Deliver a one second long 40 volt potential electrical impulse to the conductor wire at an average rate of one impulse every two or three seconds.
d. Detect the presence or absence of electrical flow across the surface of the membrane by systematically contacting the wet field with two noninvasive probes and reading the potentiometer linked between them.

3. Results of Testing:

a. If, after a systematic search, no concentration of electrical flow is found, the installed membrane in that area tested is determined to be free of breaches, seam and capillary defects and will be considered waterproof at that time.
b. If concentrations of electrical flow are found, trace and identify all contact points and therefore any breaches in the membrane. Document on a drawing and provide a written report, immediately if possible, showing the exact location of breaches found in the installed membrane in the area tested.
c. Retest repaired defects.
d. Record each day's test results with a written description and photographs of all breaches and any corrections made and a schematic CAD drawing and provide three copies of the report at the completion of the roofing work.

4. Engage an independent testing agency to observe testing and examine underside of decks and terminations for evidence of leaks during testing.
5. When all areas have been tested, submit Final Report stating that the waterproofing system is "totally waterproof" consistent with warranty requirements of the roofing system manufacturer.

E. Repair or remove and replace components of membrane roofing system where test results or inspections indicate that they do not comply with specified requirements.

F. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.10 PROTECTING AND CLEANING

A. Protect membrane-roofing system from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and the Owner.

B. Correct deficiencies in or remove membrane-roofing system that does not comply with requirements, repair substrates, and repair or reinstall membrane-roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION

SECTION 076100

SHEET METAL ROOFING

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Custom-fabricated sheet metal roofing:

a. Standing-seam metal roofing.
b. Accessories.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 061000 - ROUGH CARPENTRY for wood nailers, curbs, and blocking.
2. Section 076200 - SHEET METAL FLASHING AND TRIM for fasciae, copings, and flashings that are not part of sheet metal roofing.
3. Section 079200 - JOINT SEALANTS for field-applied sheet metal roofing sealants.

1.3 PERFORMANCE REQUIREMENTS

A. General: Provide complete sheet metal roofing system, including, but not limited to, custom-fabricated metal roof pans, cleats, clips, anchors and fasteners, sheet metal flashing and drainage components related to sheet metal roofing, fascia panels, trim, underlayment, and accessories as indicated and as required for a weathertight installation.

B. Fabricate and install roofing capable of resisting forces required by Code according to recommendations in FMG Loss Prevention Data Sheet 1-49.

C. Thermal Movements: Provide sheet metal roofing that allows for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of sheet metal roofing thermal movements. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

D. Water Infiltration: Provide sheet metal roofing that does not allow water infiltration to building interior, with metal flashing and connections of sheet metal roofing lapped to allow moisture to run over and off the material.

1.4 SUBMITTALS

A. Product Data: For each product indicated. Include details of construction relative to materials, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Show fabrication and installation layouts of sheet metal roofing, including plans, elevations, and keyed references to termination points. Distinguish between shop- and field-assembled work. Include the following:

1. Details for forming sheet metal roofing, including seams and dimensions.
2. Details for joining and securing sheet metal roofing, including layout of fasteners, clips, and other attachments. Include pattern of seams.
3. Details of termination points and assemblies, including fixed points.
4. Details of expansion joints, including showing direction of expansion and contraction.
5. Details of roof penetrations.
6. Details of edge conditions, including eaves, ridges, valleys, rakes, crickets, and counter flashings.
7. Details of special conditions.
8. Details of connections to adjoining work.
9. Details of the following accessory items, at a scale of not less than 1-1/2 inches per 12 inches:

    a. Flashing and trim.
    b. Roof curbs.
    c. Gutters and downspouts.

C. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:

1. Sheet Metal Roofing: 12 inches long by actual pan width, including finished seam. Include fasteners, cleats, closures, and other attachments.
2. Trim and Closures: 12 inches long. Include fasteners and other exposed accessories.
3. Accessories: 12-inch-long Samples for each type of accessory.

D. Qualification Data: For Installer and manufacturer.

E. Maintenance Data: For roofing system to include in maintenance manuals.

F. Inspection Report: Copy of roofing system manufacturer's inspection report of completed roofing installation.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain components for roofing system from or approved by roofing system manufacturer.

B. Sheet Metal Roofing Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" unless more stringent requirements are specified or shown on Drawings.

C. Copper Roofing Standard: Comply with CDA's "Copper in Architecture Handbook." Conform to dimensions and profiles shown unless more stringent requirements are indicated.

D. Preinstallation Conference: Conduct conference at Project site. Comply with requirements in Division 01. Review methods and procedures related to roofing system including, but not limited to, the following:

1. Meet with the Architect; Architect, Owner's insurer if applicable; testing and inspecting agency representative; roofing Installer; roofing system manufacturer's representative; deck Installer; and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
5. Review structural loading limitations of roof deck during and after roofing.
6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.
7. Review governing regulations and requirements for insurance and certificates if applicable.
8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver sheet metal roofing pans, components, and other sheet metal roofing materials so as not to be damaged or deformed. Package sheet metal roofing materials for protection during transportation and handling.

B. Unload, store, and erect sheet metal roofing materials in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack materials on platforms or pallets, covered with suitable weathertight and ventilated covering. Store sheet metal roofing materials to ensure dryness. Do not store sheet metal roofing materials in contact with other materials that might cause staining, denting, or other surface damage.

D. Protect strippable protective covering on sheet metal roofing from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal roofing installation.

1.7 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

1.8 WARRANTY

A. Special Warranty on Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace sheet metal roofing that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

B. Special Installer's Warranty: Roofing Installer's warranty, on warranty form at end of this Section, signed by Roofing Installer, in which Roofing Installer agrees to repair or replace components of custom-fabricated sheet metal roofing that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures.
b. Loose parts.
c. Wrinkling or buckling.
d. Failure to remain weathertight, including uncontrolled water leakage.
e. Deterioration of metals, metal finishes, and other materials beyond normal weathering, including nonuniformity of color or finish.
f. Galvanic action between sheet metal roofing and dissimilar materials.

2. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 ROOFING SHEET METALS

A. Metallic-Coated Steel Sheet, Prepainted with Coil Coating: Steel sheet metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.

1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 coating designation; structural quality.
2. Surface: Smooth, flat finish.
3. Thickness: 0.0276 inch, unless otherwise indicated.
4. Exposed Finishes: Apply the following coil coating, as specified or indicated on Drawings: Fluoropolymer Three-Coat System: Manufacturer's standard three-coat, thermocured system consisting of specially formulated inhibitive primer, fluoropolymer color coat, and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight, with a minimum total dry film thickness of 1.5 mil; complying with AAMA 2605. Color as selected by Architect from manufacturer’s full range, including metallics.

B. Aluminum Sheet: ASTM B 209, alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required.

1. Thickness: 0.032 inch, unless otherwise indicated.
2. Surface: Smooth, flat finish.
3. Exposed Finishes: Apply the following coil coating, as specified or indicated on Drawings: Fluoropolymer Three-Coat System: Manufacturer's standard three-coat, thermocured system consisting of specially formulated inhibitive primer, fluoropolymer color coat, and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight, with a minimum total dry film thickness of 1.5 mil; complying with AAMA 2605. Color as selected by Architect from manufacturer’s full range, including metallics.

2.2 UNDERLAYMENT MATERIALS

A. Self-Adhering, High-Temperature Sheet: 30 to 40 mils thick minimum, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.

1. Thermal Stability: Stable after testing at 240 deg F; ASTM D 1970.
2. Low Temperature Flexibility: Passes after testing at minus 20 deg F; ASTM D 1970.
3. Available Products:

   a. Carlisle Coatings & Waterproofing, Div. of Carlisle Companies Inc.; Dri-Start "HR" High Performance Roofing Underlayment.
   b. Grace, W. R. & Co.; Vycor Ultra.
   c. Henry Company; Perma-Seal PE.
   d. TC MiraDRI; WIP 300HT.

B. Slip Sheet: Building paper, minimum 5 lb/100 sq. ft., rosin sized.

2.3 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for a complete roofing system and as recommended by fabricator for sheet metal roofing.

B. Fasteners: Self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads.

1. Exposed Fasteners: Heads matching color of sheet metal roofing by means of plastic caps or factory-applied coating.
2. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws with hex washer head.
3. Blind Fasteners: Stainless steel rivets.

C. Sealing Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealing tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape.

D. Elastomeric Joint Sealant: ASTM C 920, of base polymer, type, grade, class, and use classifications required to produce joints in sheet metal roofing that will remain weathertight and as recommended by roll-formed sheet metal roofing manufacturer for installation indicated.

E. Expansion-Joint Sealant: For hooked-type expansion joints, which must be free to move, provide nonsetting, nonhardening, nonmigrating, heavy-bodied polyisobutylene sealant.

F. Bituminous Coating: Cold-applied asphalt mastic, ASTM D 1187, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.4 ACCESSORIES

A. Sheet Metal Roofing Accessories: Provide components required for a complete sheet metal roofing assembly including trim, copings, fasciae, corner units, ridge closures, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of sheet metal roofing, unless otherwise indicated.

1. Closures: Provide closures at eaves and ridges, fabricated of same metal as sheet metal roofing.
2. Clips: Minimum 0.0625-inch-thick, stainless steel panel clips designed to withstand negative-load requirements.
3. Cleats: For mechanically seaming into joints and formed from the following materials:

    a. Metallic-Coated Steel and Aluminum Roofing: 0.0250-inch- thick stainless steel.
    b. Copper and Zinc-Tin Alloy-Coated Copper Roofing: 16-oz./sq. ft. copper sheet.

4. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.

B. Flashing and Trim: Formed from same material and with same finish as sheet metal roofing, minimum 0.0179-inch-thick. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers.

1. Pipe and Penetration Flashing: Premolded, flashing sleeve or pipe collar with flexible metal ring bonded to sloped base. Intended to provide weatherproof seal and to isolate pipe movement from vibration and expansion/contraction.

C. Roof Curbs: Fabricated from same material and finish as sheet metal roofing, minimum thickness matching the sheet metal roofing; with bottom of skirt profiled to match roof panel profiles; with weatherproof top box and integral full-length cricket. Fabricate curb sub framing of nominal 0.062-inch- thick, angle-, C-, or Z-shaped galvanized steel or stainless steel sheet. Fabricate curb and sub framing to withstand indicated loads of size and height indicated. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

1. Factory insulate curbs with 1-inch- thick, rigid insulation.
2. Factory install wood nailers at tops of curbs.
3. Fabricate curb units with water diverter or cricket and with height tapered to match slope to level tops of units.

D. Hanging Gutters: Fabricate to cross-section indicated, complete with end pieces, outlet tubes, and other accessories as required. Fabricate in minimum 96-inch long sections. Furnish flat-stock gutter spacers and gutter brackets fabricated from same metal as gutters, of size recommended by SMACNA but not less than twice the gutter thickness. Fabricate expansion joints, expansion-joint covers, and gutter accessories from same metal as gutters.

1. Gutter Style: As indicated on Drawings.
2. Expansion Joints: Lap type.
3. Gutters with Girth up to 20 Inches: Fabricate from the following materials:

    a. Galvanized Steel: 0.028 inch thick.
    b. Aluminum: 0.040 inch thick.

4. Gutters with Girth greater than 20 Inches: Fabricate from materials and minimum thicknesses recommended by SMACNA.

E. Downspouts: Fabricate downspouts complete with mitered elbows. Furnish with metal hangers, from same material as downspouts, and anchors.

1. Downspout Shape: As indicated on Drawings.
2. Hanger Style: As indicated on Drawings.
3. Downspouts: Fabricate from the following materials:

    a. Galvanized Steel: 0.022 inch thick.
    b. Aluminum: 0.032 inch thick.

F. Splash Blocks: Provide precast concrete splash blocks.

2.5 FABRICATION

A. General: Custom fabricate sheet metal roofing to comply with details shown and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions (pan width and seam height), geometry, metal thickness, and other characteristics of installation indicated. Fabricate sheet metal roofing and accessories at the shop to greatest extent possible.

1. Standing-Seam Roofing: Form standing-seam pans with finished seam height of 1 inch

B. General: Fabricate roll-formed sheet metal roofing panels to comply with details shown and roll-formed sheet metal roofing manufacturer's written instructions.

C. Fabricate sheet metal roofing to allow for expansion in running work sufficient to prevent leakage, damage, and deterioration of the Work. Form exposed sheet metal work to fit substrates without excessive oil canning, buckling, and tool marks, true to line and levels indicated, and with exposed edges folded back to form hems.

1. Lay out sheet metal roofing so cross seams, when required, are made in direction of flow with higher pans overlapping lower pans. Stagger cross seams.
2. Fold and cleat eaves and transverse seams in the shop.
3. Form and fabricate sheets, seams, strips, cleats, valleys, ridges, edge treatments, integral flashings, and other components of metal roofing to profiles, patterns, and drainage arrangements shown and as required for leakproof construction.

D. Expansion Provisions: Where lapped or bayonet-type expansion provisions in the Work cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with sealant (concealed within joints).

E. Sealant Joints: Where movable, nonexpansion-type joints are indicated or required to produce weathertight seams, form metal to provide for proper installation of elastomeric sealant, in compliance with SMACNA standards.

F. Metal Protection: Where dissimilar metals will contact each other, protect against galvanic action by painting contact surfaces with bituminous coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by manufacturers of dissimilar metals or by fabricator.

G. Sheet Metal Accessories: Custom fabricate flashings and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated. Obtain field measurements for accurate fit before shop fabrication.

1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
2. Seams: Fabricate nonmoving seams with flat-lock seams.
3. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.
4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
5. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

    a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" for application but not less than thickness of metal being secured.

2.6 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 and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, sheet metal roofing supports, and other conditions affecting performance of work.

1. Examine solid roof sheathing to verify that sheathing joints are supported by framing or blocking 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 sheet metal roofing.
3. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.

B. Examine roughing-in for components and systems penetrating sheet metal roofing to verify actual locations of penetrations relative to seam locations of sheet metal roofing before sheet metal roofing installation.

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

3.2 PREPARATION

A. Install flashings and other sheet metal to comply with requirements specified in Section 076200 - SHEET METAL FLASHING AND TRIM.

3.3 UNDERLAYMENT INSTALLATION

A. Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free, on roof sheathing under sheet metal roofing. Apply primer if required by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer rather than nails for installing underlayment at low temperatures. Apply over entire roof in shingle fashion to shed water, with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Roll laps with roller. Cover underlayment within 14 days.

B. Install flashings to cover underlayment to comply with requirements specified in Section 076200 - SHEET METAL FLASHING AND TRIM.

C. Apply slip-sheet over underlayment before installing sheet metal roofing.

3.4 INSTALLATION, GENERAL

A. General: Install sheet metal roofing perpendicular to purlins or supports. Anchor sheet metal roofing and other components of the Work securely in place, with provisions for thermal and structural movement. Install fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for a complete roofing system and as recommended by fabricator for sheet metal roofing.

1. Field cutting of sheet metal roofing by torch is not permitted.

2. Rigidly fasten eave end of sheet metal roofing and allow ridge end free movement due to thermal expansion and contraction. Predrill roofing.
3. Provide metal closures at each side of ridge caps.
4. Flash and seal sheet metal roofing with weather closures at eaves, rakes, and at perimeter of all openings. Fasten with self-tapping screws.
5. Locate and space fastenings in uniform vertical and horizontal alignment.
6. Install ridge caps as sheet metal roofing work proceeds.
7. Locate roofing splices over, but not attached to, structural supports. Stagger roofing splices and end laps to avoid a four-panel lap splice condition.
8. Lap metal flashing over sheet metal roofing to allow moisture to run over and off the material.

B. Fasteners: Use fasteners of sizes that will not penetrate completely through substrate.

1. Steel Roofing: Use stainless-steel fasteners.

C. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by fabricator of sheet metal roofing or manufacturers of dissimilar metals.

D. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.

E. Fascia: Align bottom of sheet metal roofing and fasten with blind rivets, bolts, or self-tapping screws. Flash and seal sheet metal roofing with weather closures where fasciae meet soffits, along lower panel edges, and at perimeter of all openings.

3.5 CUSTOM-FABRICATED SHEET METAL ROOFING INSTALLATION

A. Fabricate and install work with lines and corners of exposed units true and accurate. Form exposed faces flat and free of buckles, excessive waves, and avoidable tool marks, considering temper and reflectivity of metal. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant. Fold back sheet metal to form a hem on concealed side of exposed edges, unless otherwise indicated.

1. Install cleats to hold sheet metal panels in position. Attach each cleat with two fasteners to prevent rotation.
2. Nail cleats not more than 12 inches o.c. Bend tabs over nails.

B. Seal joints as shown and as required for leakproof construction. Provide low-slope transverse seams using cleats where backup of moisture may occur.

1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 deg F, set joint members for 50 percent movement either way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F.
2. Prepare joints and apply sealants to comply with requirements in Section 079200 - Joint Sealants.

C. Provide expansion cleats in roof panels that exceed 30 feet in length.

D. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets to be soldered to a width of 1-1/2 inches, except reduce pre-tinning where pre-tinned surface would show in completed Work.

1. Do not solder metallic-coated steel or aluminum sheet.
2. Do not use torches for soldering. Heat surfaces to receive solder and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.

E. Standing-Seam Roofing: Attach standing-seam metal pans to substrate with cleats, double-nailed at 12 inches o.c. Install pans reaching from eave to ridge before moving to adjacent pans. Lock each pan to pan below with transverse seam. Before pans are locked, apply continuous bead of sealant to top flange of lower pan. Crimp standing seams by folding over twice so cleat and pan edges are completely engaged.

1. Loose-lock pans at eave edges to continuous cleats and flanges on back edges of gutters.
2. Fold over seams after crimping at ridges and hips.

3.6 ACCESSORY INSTALLATION

A. General: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete sheet metal roofing assembly including trim, copings, ridge closures, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.

B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed 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 weather resistant.

1. Install exposed flashing and trim 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.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

C. Pipe and Penetration Flashing: Form flashing around pipe penetration and sheet metal roofing. Fasten and seal to sheet metal roofing as recommended by SMACNA.

D. Roof Curbs: Install curbs at locations indicated on Drawings. Set roof curb so top surface of roof curb is level. Install flashing around bases where they meet sheet metal roofing.

3.7 ROOF-EDGE DRAINAGE INSTALLATION

A. General: Install sheet metal roof drainage items to produce complete roof drainage system according to SMACNA recommendations and as indicated. Coordinate installation of roof perimeter flashing with installation of roof drainage system.

B. Hanging Gutters: Join sections with riveted and soldered joints or with lapped joints sealed with sealant. Provide for thermal expansion. Attach gutters at eave or fascia to firmly anchored gutter brackets or straps spaced not more than 36 inches apart. Provide end closures and seal watertight with sealant. Slope to downspouts.

1. Fasten gutter spacers to front and back of gutter.
2. Loosely lock straps to front gutter bead and anchor to roof deck.
3. Anchor and loosely lock back edge of gutter to continuous cleat.
4. Anchor back of gutter that extends onto roof deck with cleats spaced not more than 24 inches apart.
5. Anchor gutter with spikes and ferrules spaced not more than 24 inches apart.
6. Install gutter with expansion joints at locations indicated, but not exceeding, 50 feet apart. Install expansion-joint caps.

C. Downspouts: Join sections with 1-1/2-inch telescoping joints.

1. Provide hangers with fasteners designed to hold downspouts securely to walls. Locate hangers at top and bottom and at approximately 60 inches o.c. in between.
2. Connect downspouts to underground drainage system indicated.

D. Splash Blocks: Install where downspouts discharge onto low-slope roofs and where indicated. Set in cement or sealant compatible with roofing membrane.

3.8 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align sheet metal roofing within installed tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.9 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

1. Steel and Aluminum Materials: Clean off excess sealants.
2. Copper Materials: Clean and neutralize flux materials. Clean off excess solder and sealants.

B. Remove temporary protective coverings and strippable films, if any, as sheet metal roofing is installed. On completion of sheet metal roofing installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain in a clean condition during construction.

C. Replace panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

3.10 ROOFING INSTALLER'S WARRANTY

A. WHEREAS _____ of _____, herein called the "Roofing Installer," has performed roofing and associated work ("work") on the following project:

1. Owner: <**Insert name of Owner**>.
2. Address: <**Insert address**>.
3. Building Name/Type: <**Insert information**>.
4. Address: <**Insert address**>.
5. Area of Work: <**Insert information**>.
6. Acceptance Date: _____.
7. Warranty Period: <**Insert time**>.
8. Expiration Date: _____.

B. AND WHEREAS Roofing Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said work against leaks and faulty or defective materials and workmanship for designated Warranty Period,

C. NOW THEREFORE Roofing Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period he will, at his own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in a watertight condition.

D. This Warranty is made subject to the following terms and conditions:

1. Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:

    a. lightning;

    b. peak gust wind speed exceeding <**Insert mph (m/sec)**>;
    c. fire;
    d. failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
    e. faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work;
    f. vapor condensation on bottom of roofing; and
    g. activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.

2. When work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.
3. Roofing Installer is responsible for damage to work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of work.

4. During Warranty Period, if Owner allows alteration of work by anyone other than Roofing Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void on date of said alterations, but only to the extent said alterations affect work covered by this Warranty. If Owner engages Roofing Installer to perform said alterations, Warranty shall not become null and void unless Roofing Installer, before starting said work, shall have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate work, thereby reasonably justifying a limitation or termination of this Warranty.
5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray-cooled surface, flooded basin, or other use or service more severe than originally specified, this Warranty shall become null and void on date of said change, but only to the extent said change affects work covered by this Warranty.
6. Owner shall promptly notify Roofing Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.
7. This Warranty is recognized to be the only warranty of Roofing Installer on said work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of original work according to requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

E. IN WITNESS THEREOF, this instrument has been duly executed this _____ day of _____, _____.

1. Authorized Signature: _____.
2. Name: _____.
3. Title: _____.

END OF SECTION

SECTION 076200

SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Sheet metal flashing and trim for the following applications:

a. Through-wall flashing.
b. Formed wall flashing and trim.
c. Formed low-slope roof flashing and trim.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 042000 - UNIT MASONRY for through-wall flashings in masonry.
2. Section 061000 - ROUGH CARPENTRY for wood nailers, curbs, and blocking.
3. Section 072700 - AIR BARRIERS for perimeter terminations at air and vapor barrier assembly.
4. Section 074200 - METAL WALL PANELS for factory-formed metal wall panels and flashing and trim not part of sheet metal flashing and trim.
5. Section 075400 - THERMOPLASTIC MEMBRANE ROOFING for installing sheet metal flashing and trim integral with roofing membrane.
6. Section 079200 - JOINT SEALANTS for field-applied sheet metal flashing and trim sealants.
7. Section 079500 - EXPANSION CONTROL for manufactured sheet metal expansion-joint covers.

1.3 PERFORMANCE REQUIREMENTS

A. General: Install sheet metal flashing and trim to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failing, rattling, leaking, and fastener disengagement.

B. Fabricate and install roof edge flashing and copings capable of resisting Wind Zone forces required by Code according to recommendations in FMG Loss Prevention Data Sheet 1-49.

C. Thermal Movements: Provide sheet metal flashing and trim that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by

preventing buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of sheet metal and trim thermal movements. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F material surfaces.

D. Water Infiltration: Provide sheet metal flashing and trim that do not allow water infiltration to building interior.

1.4 SUBMITTALS

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

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Show layouts of sheet metal flashing and trim, including plans and elevations. Distinguish between shop- and field-assembled work. Include the following:

1. Identify material, thickness, weight, and finish for each item and location in Project.
2. Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.
3. Details for fastening, joining, supporting, and anchoring sheet metal flashing and trim, including fasteners, clips, cleats, and attachments to adjoining work.
4. Details of expansion-joint covers, including showing direction of expansion and contraction.

C. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:

1. Sheet Metal Flashing: 12 inches long. Include fasteners, cleats, clips, closures, and other attachments.
2. Trim: 12 inches long. Include fasteners and other exposed accessories.
3. Accessories: Full-size Sample.

1.5 QUALITY ASSURANCE

A. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual." Conform to dimensions and profiles shown unless more stringent requirements are indicated.

B. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

1. Meet with the Owner, Architect and Owner’s insurer if applicable, Installer, and installers whose work interfaces with or affects sheet metal flashing and trim including installers of roofing materials, roof accessories, unit skylights, and roof-mounted equipment.
2. Review methods and procedures related to sheet metal flashing and trim.
3. Examine substrate conditions for compliance with requirements, including flatness and attachment to structural members.

4. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver sheet metal flashing materials and fabrications undamaged. Protect sheet metal flashing and trim materials and fabrications during transportation and handling.

B. Unload, store, and install sheet metal flashing materials and fabrications in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack materials on platforms or pallets, covered with suitable weathertight and ventilated covering. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage.

1.7 COORDINATION

A. Coordinate installation of sheet metal flashing and trim with interfacing and adjoining construction to provide a leakproof, secure, and noncorrosive installation.

PART 2 - PRODUCTS

2.1 SHEET METALS

A. Aluminum Sheet: ASTM B 209, Alloy 3003, 3004, 3105, or 5005. Thickness as specified in this Section. Temper suitable for forming and structural performance required, but not less than H14, finished as follows:

1. High-Performance Organic Finish (2-Coat Fluoropolymer): AA-C12C40R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: conversion coating; Organic Coating: manufacturer's standard 2-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color coat, with color coat containing not less than 70 percent polyvinylidene fluoride resin by weight). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 2605 and with coating and resin manufacturers' written instructions.

a. Color and Gloss: As selected by Architect from manufacturer's full range.

B. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304, with No. 2D dull, cold-rolled finish. Thickness as specified in this Section.

2.2 UNDERLAYMENT MATERIALS

A. Felts: ASTM D 226, Type II (No. 30), asphalt-saturated organic felt, nonperforated.

B. Slip Sheet: Rosin-sized paper, minimum 3 lb/100 sq. ft.

2.3 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation.

B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads.

1. Exposed Fasteners: Heads matching color of sheet metal by means of plastic caps or factory-applied coating.
2. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws, gasketed, with hex washer head.
3. Blind Fasteners: High-strength aluminum or stainless-steel rivets.

C. Solder for Stainless Steel: ASTM B 32, Grade Sn60, with acid flux of type recommended by stainless-steel sheet manufacturer.

D. Sealing Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealing tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape.

E. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

F. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.

G. Isolation Coating: ASTM D 1187, cold-applied asphalt emulsion, VOC compliant, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

H. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.4 FABRICATION, GENERAL

A. General: Custom 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 indicated. Shop fabricate items where practicable. Obtain field measurements for accurate fit before shop fabrication.

B. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.

C. Fabricate sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.

1. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
2. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.

D. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA recommendations.

E. Expansion Provisions: Where lapped or bayonet-type expansion provisions in the Work cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with elastomeric sealant concealed within joints.

F. Conceal fasteners and expansion provisions where possible on exposed-to-view sheet metal flashing and trim, unless otherwise indicated.

G. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

1. Thickness: As recommended by SMACNA's "Architectural Sheet Metal Manual" for application but not less than thickness of metal being secured.

2.5 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

A. Roof Edge Flashing (Gravel Stop) and Fascia Caps: Fabricate in minimum 96-inch-long, but not exceeding 10-foot- long, sections. Furnish with 6-inch-wide joint cover plates.

1. Joint Style: Butt, with 12-inch-wide concealed backup plate.
2. Fabricate from the following material:

a. Aluminum: 0.050 inch (1.27 mm) thick.

B. Copings: Fabricate in minimum 96-inch-long, but not exceeding 10-foot-long, sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support edge of external leg and drill elongated holes for fasteners on interior leg. Miter corners, seal, and solder or weld watertight.

1. Joint Style: Butt, with 12-inch-wide concealed backup plate.
2. Fabricate copings from the following material:

a. Aluminum: 0.050 inch (1.27 mm) thick.

C. Roof and Roof to Wall Transition Expansion-Joint Cover: Fabricate from the following material:

1. Stainless Steel: 0.025 inch (0.64 mm) thick.

D. Base Flashing: Fabricate from the following material:

1. Stainless Steel: 0.019 inch (0.48 mm) thick.

E. Counterflashing: Fabricate from the following material:

1. Stainless Steel: 0.019 inch (0.48 mm) thick.

F. Roof-Penetration Flashing: Fabricate from the following material:

1. Stainless Steel: 0.019 inch (0.48 mm) thick.

G. Roof-Drain Flashing: Fabricate from the following material:

1. Stainless Steel: 0.016 inch (0.40 mm) thick.

H. Splash Pans: Fabricate from the following material:

1. Stainless Steel: 0.0187 inch thick.

2.6 WALL SHEET METAL FABRICATIONS

A. Through-Wall Flashing, Typical: Fabricate continuous flashings in minimum 96-inch-long, but not exceeding 12 foot long, sections, under copings, at shelf angles, and where indicated. Fabricate discontinuous lintel, sill, and similar flashings to extend 6 inches beyond each side of wall openings. Form with 2-inch-high end dams. Fabricate from the following material:

1. Stainless Steel: 0.016 inch (0.40 mm) thick.

B. Through-Wall Flashing, in Masonry: Through-wall flashing in masonry is specified in Section 042000 – UNIT MASONRY.

2.7 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions and other conditions affecting performance of work.

1. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.

1. Torch cutting of sheet metal flashing and trim is not permitted.

B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by fabricator or manufacturers of dissimilar metals.

1. Coat side of stainless-steel sheet metal flashing and trim with isolation coating where flashing and trim will contact wood, ferrous metal, or cementitious construction.
2. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip-sheet or install a course of polyethylene underlayment.
3. Bed flanges in thick coat of asphalt roofing cement where required for waterproof performance.

C. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.

D. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and elastomeric sealant.

E. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.

1. Space cleats not more than 12 inches apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.

F. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with elastomeric sealant concealed within joints.

G. Fasteners: Use fasteners of sizes that will penetrate substrate not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.

1. Aluminum: Use aluminum or stainless steel fasteners.
2. Stainless Steel: Use stainless-steel fasteners.

H. Seal joints with elastomeric sealant as required for watertight construction.

1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 deg F set joint members for 50 percent movement either way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F.
2. Prepare joints and apply sealants to comply with requirements in Section 079200 - JOINT SEALANTS.

I. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pretin edges of sheets to be soldered to a width of 1-1/2 inches except where pretinned surface would show in finished Work.

1. Do not solder aluminum sheet.
2. Stainless-Steel Soldering: Pretin edges of uncoated sheets to be soldered using solder recommended for stainless steel and phosphoric acid flux. Promptly wash off acid flux residue from metal after soldering.
3. Do not use open-flame torches for soldering. Heat surfaces to receive solder and flow solder into joints. Fill joints completely. Completely remove flux and spatter from exposed surfaces.

J. Aluminum Flashing: Rivet or weld joints in uncoated aluminum where necessary for strength.

3.3 ROOF FLASHING INSTALLATION

A. General: Install sheet metal roof flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions,] and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, set units true to line, and level as indicated. Install work with laps, joints, and seams that will be permanently watertight.

B. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending a minimum of 4 inches (100 mm) over base flashing. Install stainless steel draw band and tighten.

C. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches over base flashing. Lap counterflashing joints a minimum of 4 inches and bed with elastomeric sealant.

1. Secure in a waterproof manner by means of snap-in installation and sealant.

D. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Install flashing as follows:

1. Seal with elastomeric sealant and clamp flashing to pipes penetrating roof except for flashing on vent piping.

3.4 WALL FLASHING INSTALLATION

A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to SMACNA recommendations and as indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.

B. Through-Wall Flashing in Masonry: Installation of through-wall flashing in masonry is specified in Section 042000 - UNIT MASONRY.

3.5 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder and sealants.

C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed. On completion of installation, clean finished surfaces, including removing unused

fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain in a clean condition during construction.

D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 077100

ROOF SPECIALTIES

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Roof-edge drainage systems.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 061000 - ROUGH CARPENTRY for wood nailers, curbs, and blocking.
2. Section 079200 - JOINT SEALANTS for sealants.

1.3 PERFORMANCE REQUIREMENTS

A. General Performance: Roof specialties shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of thermal movements. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F material surfaces.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For roof specialties. Include plans, elevations, expansion-joint locations, keyed details, and attachments to other work. Distinguish between plant- and field-assembled work. Include the following:

1. Details for expansion and contraction; locations of expansion joints, including direction of expansion and contraction.

2. Pattern of seams and layout of fasteners, cleats, clips, and other attachments.
3. Details of termination points and assemblies, including fixed points.
4. Details of special conditions.

C. Samples for Verification: For roof-edge drainage systems made from 12-inch lengths of full-size components including fasteners, cover joints, accessories, and attachments.

1.5 QUALITY ASSURANCE

A. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.

1. Build mockup of typical roof edge, including gutter and downspout approximately 10 feet long, including supporting construction, seams, attachments, and accessories.
2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

B. Preinstallation Conference: Conduct conference at Project site.

1. Meet with Owner, Architect, Owner's insurer if applicable, Installer, and installers whose work interfaces with or affects roof specialties including installers of roofing materials and accessories.
2. Examine substrate conditions for compliance with requirements, including flatness and attachment to structural members.
3. Review special roof details, roof drainage, and condition of other construction that will affect roof specialties.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not store roof specialties in contact with other materials that might cause staining, denting, or other surface damage. Store roof specialties away from uncured concrete and masonry.

B. Protect strippable protective covering on roof specialties from exposure to sunlight and high humidity, except to extent necessary for the period of roof specialties installation.

PART 2 - PRODUCTS

2.1 EXPOSED METALS

A. Aluminum Sheet: ASTM B 209, Alloy 3003, 3004, 3105, or 5005. Thickness as specified in this Section. Temper suitable for forming and structural performance required, but not less than H14, finished as follows:

1. High-Performance Organic Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

a. Fluoropolymer 3-Coat System: Manufacturer's standard 3-coat, thermocured system consisting of specially formulated inhibitive primer, fluoropolymer color

coat, and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight, with a minimum total dry film thickness of 1.5 mil; complying with AAMA 2605.

1) Color: As selected by Architect from manufacturer's full range.

B. Copper Sheet: ASTM B 370, cold-rolled copper sheet, H00 or H01 temper.

1. Non-Patinated Exposed Finish: Mill.

C. Zinc Alloy Sheet/Coils:

1. Titanium Zinc Alloy whose base is electrolytic high grade fine zinc (DIN EN1179) with a 99.995 % Zn degree of purity and alloying additives of + 0.1% copper and + 0.1% titanium in accordance with DIN EN 988.

a. Pre-Weathered: pickling process (no phosphating)

1) Blue-Gray

2. Pre-Weathered Roofing: Backside coated zinc by manufacturer.

2.2 CONCEALED METALS

A. Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304.

2.3 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.

B. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to meet performance requirements. Furnish the following unless otherwise indicated:

1. Exposed Penetrating Fasteners: Gasketed screws with hex washer heads matching color of sheet metal.
2. Fasteners for Copper Sheet: Copper, hardware bronze, or passivated Series 300 stainless steel.
3. Fasteners for Zinc-Coated Copper Sheet: Series 300 stainless steel.

C. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.

D. Solder for Copper: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead.

2.4 ROOF-EDGE DRAINAGE SYSTEMS

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

1. ATAS International, Inc.
2. Berger Building Products, Inc.
3. Cheney Flashing Company.

4. Hickman Company, W. P.
5. Merchant & Evans, Inc.
6. Metal-Era, Inc.
7. Metal-Fab Manufacturing, LLC.
8. MM Systems Corporation.

B. Gutters: Manufactured in uniform section lengths not exceeding 12 feet, with matching corner units, ends, outlet tubes, and other accessories. Elevate back edge at least 1 inch above front edge. Furnish flat-stock gutter straps, gutter brackets, expansion joints, and expansion-joint covers fabricated from same metal as gutters.

1. Fabricate from the following exposed metal:

a. Aluminum: 0.050 inch (1.27 mm) thick.

2. Gutter Profile: As indicated according to SMACNA's "Architectural Sheet Metal Manual."
3. Corners: Factory mitered and soldered.
4. Gutter Supports: As indicated with finish matching the gutters.
5. Gutter Accessories: Bronze wire ball downspout strainer,

C. Downspouts: Plain round complete with mitered elbows, manufactured from the following exposed metal. Furnish with metal hangers, from same material as downspouts, and anchors.

1. Aluminum: 0.040 inch (1.02 mm) thick.

D. Conductor Heads: Manufactured conductor heads, each with flanged back and stiffened top edge and of dimensions and shape indicated, complete with outlet tube that nests into upper end of downspout.

1. Fabricate from the following exposed metal:

a. Aluminum: 0.040 inch (1.02 mm) thick.

2.5 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.

B. Examine walls, roof edges, and parapets for suitable conditions for roof specialties.

C. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

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

3.2 INSTALLATION, GENERAL

A. General: Install roof specialties according to manufacturer's written instructions. Anchor roof specialties securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required to complete roof-specialty systems.

1. Install roof specialties level, plumb, true to line and elevation; with limited oil-canning and without warping, jogs in alignment, buckling, or tool marks.
2. Provide uniform, neat seams with minimum exposure of solder and sealant.
3. Install roof specialties to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before manufacture.
4. Torch cutting of roof specialties is not permitted.
5. Do not use graphite pencils to mark metal surfaces.

B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.

C. Expansion Provisions: Allow for thermal expansion of exposed roof specialties.

1. Space movement joints at a maximum of 12 feet with no joints within 18 inches of corners or intersections unless otherwise shown on Drawings.
2. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures.

D. Fastener Sizes: Use fasteners of sizes that will penetrate wood blocking or sheathing not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.

E. Seal joints as required for watertight construction. Place sealant to be completely concealed in joint. Do not install sealants at temperatures below 40 deg F

F. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets to be soldered to a width of 1-1/2 inches except reduce pre-tinning where pre-tinned surface would show in completed Work. Tin edges of uncoated copper sheets using solder for copper. Do not use torches for soldering. Heat surfaces to receive solder and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.

3.3 ROOF-EDGE DRAINAGE-SYSTEM INSTALLATION

A. General: Install components to produce a complete roof-edge drainage system according to manufacturer's written instructions. Coordinate installation of roof perimeter flashing with installation of roof-edge drainage system.

B. Gutters: Join and seal gutter lengths. Allow for thermal expansion. Attach gutters to firmly anchored gutter supports spaced not more than 24 inches apart. Attach ends with rivets and solder to make watertight. Slope to downspouts.

1. Install gutter with expansion joints at locations indicated but not exceeding 50 feet apart. Install expansion joint caps.

C. Downspouts: Join sections with manufacturer's standard telescoping joints. Provide hangers with fasteners designed to hold downspouts securely to walls and 1 inch away from walls; locate fasteners at top and bottom and at approximately 60 inches o.c.

1. Provide elbows at base of downspout to direct water away from building.

D. Conductor Heads: Anchor securely to wall with elevation of conductor top edge 1 inch below gutter discharge.

3.4 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder and sealants.

C. Remove temporary protective coverings and strippable films as roof specialties are installed. On completion of installation, clean finished surfaces including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain roof specialties in a clean condition during construction.

D. Replace roof specialties that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 078100

APPLIED FIREPROOFING

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Standard Durability sprayed fire-resistive materials for concealed spaces not exposed to view or weather, non-high-rise construction.
2. Intermediate Durability sprayed fire-resistive materials for interior spaces, concealed or exposed to view only, and not exposed to weather, high-rise construction.
3. Medium Durability sprayed fire-resistive materials for interior spaces exposed to view and abrasion (in final construction) but not to weather.
4. High Durability sprayed fire-resistive materials for exposed spaces, including at loading docks, at parking garages, and where exposed to weather.
5. Exposed thin-film mastic and intumescent fire-resistive coatings.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 033000 - CAST-IN-PLACE CONCRETE for concrete protecting structural steel.
2. Section 042000 - UNIT MASONRY for masonry protecting structural steel.
3. Section 051200 - STRUCTURAL STEEL FRAMING for surface conditions required for structural steel receiving sprayed fire-resistive materials.
4. Section 078410 - PENETRATION FIRESTOPPING for firestopping and firesafing insulation.
5. Section 092110 - GYPSUM BOARD ASSEMBLIES for fire-resistance-rated assemblies.
6. Section 092120 - GYPSUM BOARD SHAFT-WALL ASSEMBLIES for fire-resistance-rated assemblies.

1.3 SUBMITTALS

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

B. Shop Drawings: Structural framing plans indicating the following:

1. Locations and types of surface preparations required before applying sprayed fire-resistive material.
2. Extent of sprayed fire-resistive material for each construction and fire-resistance rating, including the following:

a. Applicable fire-resistance design designations of a qualified testing and inspecting agency acceptable to authorities having jurisdiction.
b. Minimum thicknesses needed to achieve required fire-resistance ratings of structural components and assemblies.

3. Treatment of sprayed fire-resistive material after application.

C. Samples for Verification: For each type of colored, exposed sprayed fire-resistive material, two Samples, each 4 inches square, of each color, texture, and material formulation to be applied. Where finishes involve normal color and texture variations, include Sample sets showing the full range of variations expected.

D. Qualification Data: For Installer, manufacturer, and testing agency.

E. Compatibility and Adhesion Test Reports: From sprayed fire-resistive material manufacturer indicating the following:

1. Materials have been tested for bond with substrates.
2. Materials have been verified by sprayed fire-resistive material manufacturer to be compatible with substrate primers and coatings.
3. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for proposed sprayed fire-resistive materials.

1. Engineering Evaluation: Provide engineering evaluation of modification of submitted fire-resistance design, if required to comply with required fire-test-response characteristics, specified under Quality Assurance Article herein.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: A firm or individual certified, licensed, or otherwise qualified by sprayed fire-resistive material manufacturer as experienced and with sufficient trained staff to install manufacturer's products according to specified requirements. A manufacturer's willingness to sell its sprayed fire-resistive materials to Contractor or to an installer engaged by Contractor does not in itself confer qualification on the buyer.

B. Testing Agency Qualifications: An independent approved testing agency, acceptable to authorities having jurisdiction, with the experience and capability to conduct the testing indicated, as documented in accordance with local State Building Code.

C. Source Limitations: Obtain sprayed fire-resistive materials through one source from a single manufacturer for each type of material.

D. Sprayed Fire-Resistive Materials Testing: By an approved testing and inspecting agency engaged by Contractor or manufacturer to test for compliance with specified requirements for performance and test methods.

1. Sprayed fire-resistive materials are randomly selected for testing from bags bearing the applicable classification marking of UL or another testing and inspecting agency acceptable to authorities having jurisdiction.

2. Testing is performed on specimens of sprayed fire-resistive materials that comply with laboratory testing requirements specified in Part 2 and are otherwise identical to installed fire-resistive materials, including application of accelerant, sealers, topcoats, tamping, troweling, rolling, and water overspray, if any of these are used in final application.
3. Testing is performed on specimens whose application the independent testing and inspecting agency witnessed during preparation and conditioning. Include in test reports a full description of preparation and conditioning of laboratory test specimens.

E. Compatibility and Adhesion Testing: Engage a qualified testing and inspecting agency to test for compliance with requirements for specified performance and test methods.

1. Test for bond per ASTM E 736 and requirements in UL's "Fire Resistance Directory" for coating materials. Provide bond strength indicated in referenced fire-resistance design, but not less than minimum specified in Part 2.
2. Verify that manufacturer, through its own laboratory testing or field experience, has not found primers or coatings to be incompatible with sprayed fire-resistive material.

F. Fire-Test-Response Characteristics: Provide sprayed fire-resistive materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify bags containing sprayed fire-resistive materials with appropriate markings of applicable testing and inspecting agency.

1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another testing and inspecting agency acceptable to authorities having jurisdiction, for sprayed fire-resistive material serving as direct-applied protection tested per ASTM E 119.

    a. Steel members shall be considered restrained unless specifically noted otherwise. Structural design capacity for framing members shall be assumed as “fully-loaded”. Non-load restricted fire-resistance designs shall be utilized for steel beams and joists requiring more than a 1 hour rating. Fire-resistance designs that indicate a load restriction factor are not permitted for steel beams and joists requiring more than a 1 hour rating.
    b. As required by Code, the individual beam and joist must match the assembly rating ratings.

2. Surface-Burning Characteristics: ASTM E 84, limits in accordance with applicable local Building Code.

G. Provide products containing no detectable asbestos as determined according to the method specified in 40 CFR 763, Subpart E, Appendix E, Section 1, "Polarized Light Microscopy."

H. Code-Required Inspections: Notify Architect and Owner’s independent testing agency a minimum of 72 hours prior to commencing work of this Section, for Code-required special inspections.

I. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01. Review methods and procedures related to sprayed fire-resistive materials including, but not limited to, the following:

1. Review and finalize construction schedule and verify sequencing and coordination requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to Project site in original, unopened packages with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, shelf life if applicable, and fire-resistance ratings applicable to Project.

B. Use materials with limited shelf life within period indicated. Remove from Project site and discard materials whose shelf life has expired.

C. Store materials inside, under cover, aboveground, and kept dry until ready for use. Remove from Project site and discard wet or deteriorated materials.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not apply sprayed fire-resistive material when ambient or substrate temperature is 40 deg F or lower unless temporary protection and heat is provided to maintain temperature at or above this level for 24 hours before, during, and for 24 hours after product application.

B. Ventilation: Ventilate building spaces during and after application of sprayed fire-resistive material. Use natural means or, if they are inadequate, forced-air circulation until fire-resistive material dries thoroughly. Comply with manufacturer’s recommended ventilation procedures.

1.7 COORDINATION

A. Sequence and coordinate application of sprayed fire-resistive materials with other related work specified in other Sections to comply with the following requirements:

1. Provide temporary enclosure as required to confine spraying operations and protect the environment.
2. Provide temporary enclosures for applications to prevent deterioration of fire-resistive material due to exposure to weather and to unfavorable ambient conditions for humidity, temperature, and ventilation.
3. Avoid unnecessary exposure of fire-resistive material to abrasion and other damage likely to occur during construction operations subsequent to its application.
4. Do not apply fire-resistive material to metal roof deck substrates until concrete topping, if any, has been completed. For metal roof decks without concrete topping, do not apply fire-resistive material to metal roof deck substrates until roofing has been completed; prohibit roof traffic during application and drying of fire-resistive material.
5. Do not apply fire-resistive material to metal floor deck substrates until concrete topping has been completed.
6. Except for thin-film intumescent fireproofing, do not begin applying fire-resistive material until clips, hangers, supports, sleeves, and other items penetrating fire protection are in place.
7. Defer installing ducts, piping, and other items that would interfere with applying fire-resistive material until application of fire protection is completed.
8. Do not install enclosing or concealing construction until after fire-resistive material has been applied, inspected, and tested and corrections have been made to defective applications.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form, signed by Contractor and by Installer, in which manufacturer agrees to repair or replace sprayed fire-resistive materials that fail in materials or workmanship within specified warranty period. Failures include, but are not limited to, the following:

1. Cracking, flaking, spalling, or eroding in excess of specified requirements; peeling; or delaminating of sprayed fire-resistive materials from substrates.
2. Not covered under the warranty are failures due to damage by occupants and the Owner's maintenance personnel, exposure to environmental conditions other than those investigated and approved during fire-response testing, and other causes not reasonably foreseeable under conditions of normal use.

B. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. VOC Content: Products shall comply with VOC content limits of authorities having jurisdiction and the following VOC limits when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

1. Flat Paints and Coatings: 50 g/L.
2. Nonflat Paints and Coatings: 150 g/L.
3. Primers, Sealers, and Undercoaters: 200 g/L.
4. Anticorrosive and Antirust Paints Applied to Ferrous Metals: 250 g/L.

2.2 STANDARD DURABILITY SPRAYED FIRE-RESISTIVE MATERIALS

A. General: For standard density sprayed fire-resistive materials for concealed spaces not exposed to view or weather, non-high-rise construction, provide manufacturer's standard products complying with requirements indicated for material composition and physical properties representative of installed products.

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. Carboline Company, subsidiary of RPM International, Fireproofing Products Div.; AD Southwest Fireproofing Type 5GP.
b. GCP Applied Technologies (formerly W.R. Grace); Monokote Type MK-6/HY.
c. Isolatek International, Cafco Products; Cafco 300.

B. Material Composition: Cementitious sprayed fire-resistive material consisting of factory-mixed, dry formulation of portland cement binders and lightweight mineral or synthetic aggregates mixed with water at Project site to form a slurry or mortar for conveyance and application, per ASTM E 1513.

C. Physical Properties: Minimum values, unless otherwise indicated, or higher values required to attain designated fire-resistance ratings, measured per standard test methods referenced with each property as follows:

1. Dry Density: 15 lb/cu. ft. for average and individual densities regardless of density indicated in referenced fire-resistance design, or greater if required to attain fire-resistance ratings indicated, per ASTM E 605 or AWCI Technical Manual 12-A, Section 5.4.5, "Displacement Method."
2. Thickness: Provide minimum average thickness required for fire-resistance design indicated according to the following criteria, but not less than 0.375 inch, per ASTM E 605:

    a. Where the referenced fire-resistance design lists a thickness of 1 inch or greater, the minimum allowable individual thickness of sprayed fire-resistive material is the design thickness minus 0.25 inch.
    b. Where the referenced fire-resistance design lists a thickness of less than 1 inch but more than 0.375 inch, the minimum allowable individual thickness of sprayed fire-resistive material is the greater of 0.375 inch or 75 percent of the design thickness.
    c. No reduction in average thickness is permitted for those fire-resistance designs whose fire-resistance ratings were established at densities of less than 15 lb/cu. ft.

3. Bond Strength: 150 lbf/sq. ft. minimum per ASTM E 736 under the following conditions:

    a. Field test sprayed fire-resistive material that is applied to flanges of wide-flange, structural-steel members on surfaces matching those that will exist for remainder of steel receiving fire-resistive material.
    b. If surfaces of structural steel receiving sprayed fire-resistive material are primed or otherwise painted for coating materials, perform series of bond tests in accordance with ASTM E736 while using criteria of acceptance in UL's "Fire Resistance Directory."
    c. Minimum thickness of sprayed fire-resistive material tested in laboratory shall be 0.75 inch.

4. Compressive Strength: Minimum 1200 psf as determined in the laboratory per ASTM E 761. Minimum thickness of sprayed fire-resistive material tested shall be 0.75 inch and minimum dry density shall be as specified, but not less than 15 lb/cu. ft.
5. Corrosion Resistance: No evidence of corrosion per ASTM E 937.
6. Deflection: No cracking, spalling, or delamination per ASTM E 759.
7. Effect of Impact on Bonding: No cracking, spalling, or delamination per ASTM E 760.
8. Air Erosion: Maximum weight loss of 0.025 g/sq. ft. in 24 hours per ASTM E 859. For laboratory tests, minimum thickness of sprayed fire-resistive material is 0.75 inch maximum dry density is 15 lb/cu. ft. test specimens are not prepurged by mechanically induced air velocities, and tests are terminated after 24 hours.
9. Fungal Resistance: No observed growth on specimens per ASTM G 21.

2.3 INTERMEDIATE DURABILITY SPRAYED FIRE-RESISTIVE MATERIALS (HIGH-RISE)

A. General: For standard density sprayed fire-resistive materials for interior spaces, or exposed to view only, and not exposed to weather, at high-rise construction and FM insured projects, provide manufacturer's standard products complying with requirements indicated for material composition and physical properties representative of installed products.

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. Carboline Company, subsidiary of RPM International, Fireproofing Products Div.; Type 5MD.
    b. GCP Applied Technologies (formerly W.R. Grace); Monokote Type MK-10HB.
    c. Isolatek International, Inc. Cafco 300 HS or Cafco 400 AC.

B. Material Composition: Cementitious sprayed fire-resistive material consisting of factory-mixed, dry formulation of portland cement binders and lightweight mineral or synthetic aggregates mixed with water at Project site to form a slurry or mortar for conveyance and application, per ASTM E 1513.

C. Physical Properties: Minimum values, unless otherwise indicated, or higher values required to attain designated fire-resistance ratings, measured per standard test methods referenced with each property as follows:

1. Dry Density: 15 lb/cu. ft. for average and individual densities regardless of density indicated in referenced fire-resistance design, or greater if required to attain fire-resistance ratings indicated, per ASTM E 605 or AWCI Technical Manual 12-A, Section 5.4.5, "Displacement Method."
2. Thickness: Provide minimum average thickness required for fire-resistance design indicated according to the following criteria, but not less than 0.375 inch, per ASTM E 605:

    a. Where the referenced fire-resistance design lists a thickness of 1 inch or greater, the minimum allowable individual thickness of sprayed fire-resistive material is the design thickness minus 0.25 inch.
    b. Where the referenced fire-resistance design lists a thickness of less than 1 inch but more than 0.375 inch, the minimum allowable individual thickness of sprayed fire-resistive material is the greater of 0.375 inch or 75 percent of the design thickness.
    c. No reduction in average thickness is permitted for those fire-resistance designs whose fire-resistance ratings were established at densities of less than 15 lb/cu. ft.

3. Bond Strength: 430 lbf/sq. ft. minimum per ASTM E 736 under the following conditions:

    a. Field test sprayed fire-resistive material that is applied to flanges of wide-flange, structural-steel members on surfaces matching those that will exist for remainder of steel receiving fire-resistive material.
    b. If surfaces of structural steel receiving sprayed fire-resistive material are primed or otherwise painted for coating materials, perform series of bond tests in accordance with ASTM E736 while using criteria of acceptance in UL's "Fire Resistance Directory."
    c. Minimum thickness of sprayed fire-resistive material tested in laboratory shall be 0.75 inch.

4. Compressive Strength: 10 lbf/sq. in. as determined in the laboratory per ASTM E 761. Minimum thickness of sprayed fire-resistive material tested shall be 0.75 inch and minimum dry density shall be as specified, but not less than 15 lb/cu. ft.
5. Corrosion Resistance: No evidence of corrosion per ASTM E 937.

6. Deflection: No cracking, spalling, or delamination per ASTM E 759.
7. Effect of Impact on Bonding: No cracking, spalling, or delamination per ASTM E 760.
8. Air Erosion: Maximum weight loss of 0.025 g/sq. ft. in 24 hours per ASTM E 859. For laboratory tests, minimum thickness of sprayed fire-resistive material is 0.75 inch maximum dry density is 15 lb/cu. ft. test specimens are not prepurged by mechanically induced air velocities, and tests are terminated after 24 hours.
9. Fungal Resistance: No observed growth on specimens per ASTM G 21.

2.4 MEDIUM-DURABILITY CEMENTITIOUS SPRAYED FIRE-RESISTIVE MATERIALS

A. General: For medium-density sprayed fire-resistive materials for interior spaces exposed to view and abrasion (in final construction) but not to weather provide manufacturer's standard products complying with requirements indicated for material composition and for minimum physical properties of each product listed, measured by standard test methods referenced with each property.

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. Carboline Company, subsidiary of RPM International, Fireproofing Products Div.; AD Southwest Fireproofing Type 7GP.
b. GCP Applied Technologies (formerly W.R. Grace); Monokote Type Z-106/HY.
c. Isolatek International Corp., Cafco Products.; Cafco 300 or Cafco 400.

B. Material Composition: Cementitious sprayed fire-resistive material consisting of factory-mixed, dry formulation of portland cement binders and lightweight mineral or synthetic aggregates mixed with water at Project site to form a slurry or mortar for conveyance and application, per ASTM E 1513.

C. Physical Properties: Minimum values, unless otherwise indicated, or higher values required to attain designated fire-resistance ratings, measured per standard test methods referenced with each property as follows:

1. Dry Density: 22 lb/cu. ft. for average and individual densities regardless of density indicated in referenced fire-resistance design, or greater if required to attain fire-resistance ratings indicated, per ASTM E 605 or AWCI Technical Manual 12-A, Section 5.4.5, "Displacement Method."
2. Thickness: Provide minimum average thickness required for fire-resistance design indicated according to the following criteria, but not less than 0.375 inch, per ASTM E 605:

a. Where the referenced fire-resistance design lists a thickness of 1 inch or greater, the minimum allowable individual thickness of sprayed fire-resistive material is the design thickness minus 0.25 inch.
b. Where the referenced fire-resistance design lists a thickness of less than 1 inch but more than 0.375 inch, the minimum allowable individual thickness of sprayed fire-resistive material is the greater of 0.375 inch or 75 percent of the design thickness.
c. No reduction in average thickness is permitted for those fire-resistance designs whose fire-resistance ratings were established at densities of less than 22 lb/cu. ft.

3. Bond Strength: 430 lbf/sq. ft. minimum per ASTM E 736 under the following conditions:

    a. Field test sprayed fire-resistive material that is applied to flanges of wide-flange, structural-steel members on surfaces matching those that will exist for remainder of steel receiving fire-resistive material.
    b. If surfaces of structural steel receiving sprayed fire-resistive material are primed or otherwise painted for coating materials, perform series of bond tests in accordance with ASTM E736 while using criteria of acceptance in UL's "Fire Resistance Directory."
    c. Minimum thickness of sprayed fire-resistive material tested in laboratory shall be 0.75 inch.

4. Compressive Strength: 100 psi as determined in the laboratory per ASTM E 761. Minimum thickness of sprayed fire-resistive material tested shall be 0.75 inch and minimum dry density shall be as specified, but not less than 22 lb/cu. ft.
5. Corrosion Resistance: No evidence of corrosion per ASTM E 937.
6. Deflection: No cracking, spalling, or delamination per ASTM E 759.
7. Effect of Impact on Bonding: No cracking, spalling, or delamination per ASTM E 760.
8. Air Erosion: Maximum weight loss of 0.025 g/sq. ft. in 24 hours per ASTM E 859. For laboratory tests, minimum thickness of sprayed fire-resistive material is 0.75 inch maximum dry density is 15 lb/cu. ft. test specimens are not prepurged by mechanically induced air velocities, and tests are terminated after 24 hours.
9. Fungal Resistance: No observed growth on specimens per ASTM G 21.

2.5 HIGH-DURABILITY CEMENTITIOUS SPRAYED FIRE-RESISTIVE MATERIALS

A. General: For high-density sprayed fire-resistive materials for exposed spaces, including at loading docks, at parking garages, and where exposed to weather, provide manufacturer's standard products complying with requirements indicated for material composition and for minimum physical properties of each product listed, measured by standard test methods referenced with each property.

    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. Carboline Company, subsidiary of RPM International, Fireproofing Products Div.; AD Southwest Fireproofing Type 7HD.
        b. GCP Applied Technologies (formerly W.R. Grace); Monokote Type Z146.
        c. Isolatek International Corp., Cafco Products.; Fendolite MII.

B. Material Composition: Cementitious sprayed fire-resistive material consisting of factory-mixed, dry formulation of portland cement binders and lightweight mineral or synthetic aggregates mixed with water at Project site to form a slurry or mortar for conveyance and application, per ASTM E 1513.

C. Physical Properties: Minimum values, unless otherwise indicated, or higher values required to attain designated fire-resistance ratings, measured per standard test methods referenced with each property as follows:

1. Dry Density: 40 lb/cu. ft. for average and individual densities regardless of density indicated in referenced fire-resistance design, or greater if required to attain fire-resistance ratings indicated, per ASTM E 605.
2. Thickness: Provide minimum average thickness required for fire-resistance design indicated according to the following criteria, but not less than 0.375 inch, per ASTM E 605:

    a. Where the referenced fire-resistance design lists a thickness of 1 inch or greater, the minimum allowable individual thickness of sprayed fire-resistive material is the design thickness minus 0.25 inch.
    b. Where the referenced fire-resistance design lists a thickness of less than 1 inch but more than 0.375 inch, the minimum allowable individual thickness of sprayed fire-resistive material is the greater of 0.375 inch or 75 percent of the design thickness.
    c. No reduction in average thickness is permitted for those fire-resistance designs whose fire-resistance ratings were established at densities of less than 40 lb/cu. ft.

3. Bond Strength: 10,000 lbf/sq. ft. minimum per ASTM E 736 under the following conditions:

    a. Field test sprayed fire-resistive material that is applied to flanges of wide-flange, structural-steel members on surfaces matching those that will exist for remainder of steel receiving fire-resistive material.
    b. If surfaces of structural steel receiving sprayed fire-resistive material are primed or otherwise painted for coating materials, perform series of bond tests in accordance with ASTM E736 while using criteria of acceptance in UL's "Fire Resistance Directory."
    c. Minimum thickness of sprayed fire-resistive material tested in laboratory shall be 0.75 inch.

4. Compressive Strength: Minimum 500 psi as determined in the laboratory per ASTM E 761. Minimum thickness of sprayed fire-resistive material tested shall be 0.75 inch and minimum dry density shall be as specified, but not less than 40 lb/cu. ft.
5. Corrosion Resistance: No evidence of corrosion per ASTM E 937.
6. Deflection: No cracking, spalling, or delamination per ASTM E 759.
7. Effect of Impact on Bonding: No cracking, spalling, or delamination per ASTM E 760.
8. Air Erosion: Maximum weight loss of 0.025 g/sq. ft. in 24 hours per ASTM E 859. For laboratory tests, minimum thickness of sprayed fire-resistive material is 0.75 inch maximum dry density is 15 lb/cu. ft. test specimens are not prepurged by mechanically induced air velocities, and tests are terminated after 24 hours.
9. Fungal Resistance: No observed growth on specimens per ASTM G 21.

2.6 EXPOSED THIN-FILM MASTIC AND INTUMESCENT FIRE-RESISTIVE COATINGS (MIFRC)

A. Conditioned Interior Space Conditions: Coatings limited to interior climate controlled spaces having no exposure to condensation, and where the relative humidity and temperature are controlled according to the manufacturers recommendations or to not more than 75 percent, which ever is less, during the application and curing of the coating, the construction and the occupancy of the building.

1. Isolatek International Corp., Cafco Products; Cafco SprayFilm WB 4 with topcoat.
2. Carboline.: Thermo-Sorb VOC without topcoat.

3. Sherwin Williams; Firetex FX5120 without topcoat.

B. Interior General Use Conditions: Coatings limited to interior service where protection of the coating during application and curing, the construction and the occupancy of the building are as recommended by the product manufacturer for the specific application.

1. Carboline; Firefilm III.
2. Carboline; Thermo-Sorb VOC.
3. Isolatek Internaiontal Corp., Cafco Products; Cafco SprayFilm WB-5 Basecoat and Topseal.

C. Exterior Use Conditions: Coatings for exterior use or interior use where exterior environmental conditions exist.

1. Isolatek International Corp., Cafco Products; Cafco SprayFilm-WB 4 with Topseal.
2. International Paint, LLC; Interchar 212 with topcoat.
3. Carboline.; Thermo-Lag E100 with topcoat.

D. Thin-Film Mastic and Intumescent Fire-Resistive Coating: Factory-mixed formulation.

1. Approved by manufacturer and authorities having jurisdiction for interior or exterior use.
2. Multicomponent system consisting of primer, intumescent base coat and topcoat.
3. Systems shall comply with applicable VOC requirements and meet OTC emission regulations.

E. Color and Gloss: As indicated by manufacturer's designations.

2.7 AUXILIARY FIRE-RESISTIVE MATERIALS

A. General: Provide auxiliary fire-resistive materials that are compatible with sprayed fire-resistive materials and substrates and are approved by UL or another testing and inspecting agency acceptable to authorities having jurisdiction for use in fire-resistance designs indicated.

B. Substrate Primers: For use on each substrate and with each sprayed fire-resistive product, provide primer that complies with one or more of the following requirements:

1. Primer's bond strength complies with requirements specified in UL's "Fire Resistance Directory," for coating materials based on a series of bond tests per ASTM E 736.
2. Primer is identical to those used in assemblies tested for fire-test-response characteristics of sprayed fire-resistive material per ASTM E 119 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.

C. Adhesive for Bonding Fire-Resistive Material: Product approved by manufacturer of sprayed fire-resistive material.

D. Metal Lath: Expanded metal lath fabricated from material of weight, configuration, and finish required to comply with fire-resistance designs indicated and fire-resistive material manufacturer's written recommendations. Include clips, lathing accessories, corner beads, and other anchorage devices required to attach lath to substrates and to receive sprayed fire-resistive material.

E. Reinforcing Fabric for Use with Intumescent Coatings: Glass-fiber fabric of type, weight, and form required to comply with fire-resistance designs indicated, approved by manufacturer of thin-film mastic and intumescent coating fire-resistive material.

F. Topcoats: Provide fireproofing manufacturer recommended topcoats for exposed fireproofing.

1. Color and Gloss: Provide custom colors as selected by Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrates and other conditions affecting performance of work. A substrate is in satisfactory condition if it complies with the following:

1. Substrates comply with requirements in the Section where the substrate and related materials and construction are specified.
2. Substrates are free of dirt, oil, grease, release agents, rolling compounds, mill scale, loose scale, incompatible primers, incompatible paints, incompatible encapsulants, or other foreign substances capable of impairing bond of fire-resistive materials with substrates under conditions of normal use or fire exposure.
3. Objects penetrating fire-resistive material, including clips, hangers, support sleeves, and similar items, are securely attached to substrates.
4. Substrates are not obstructed by ducts, piping, equipment, and other suspended construction that will interfere with applying fire-resistive material.

B. Verify that concrete work on steel deck has been completed.

C. Verify that roof construction, installation of rooftop HVAC equipment, and other related work are completed.

D. Conduct tests according to fire-resistive material manufacturer's written recommendations to verify that substrates are free of substances capable of interfering with bond.

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

3.2 PREPARATION

A. Cover other work subject to damage from fallout or overspray of fire-resistive materials during application.

B. Clean substrates of substances that could impair bond of fire-resistive material, including dirt, oil, grease, release agents, rolling compounds, mill scale, loose scale, and incompatible primers, paints, and encapsulants.

C. For exposed applications, repair substrates to remove surface imperfections that could affect uniformity of texture and thickness in finished surface of sprayed fire-resistive material. Remove minor projections and fill voids that would telegraph through fire-resistive products after application.

3.3 APPLICATION, GENERAL

A. Comply with fire-resistive material manufacturer's written instructions for mixing materials, application procedures, and types of equipment used to mix, convey, and spray on fire-resistive material, as applicable to particular conditions of installation and as required to achieve fire-resistance ratings indicated.

B. Apply sprayed fire-resistive material that is identical to products tested as specified in Part 1 "Quality Assurance" Article and substantiated by test reports, with respect to rate of application, accelerator use, sealers, topcoats, tamping, troweling, water overspray, or other materials and procedures affecting test results.

C. Install metal lath and reinforcing fabric, as required, to comply with fire-resistance ratings and fire-resistive material manufacturer's written recommendations for conditions of exposure and intended use. Securely attach lath and fabric to substrate in position required for support and reinforcement of fire-resistive material. Use anchorage devices of type recommended in writing by sprayed fire-resistive material manufacturer. Attach accessories where indicated or required for secure attachment of lath and fabric to substrate.

D. Coat substrates with bonding adhesive before applying fire-resistive material where required to achieve fire-resistance rating or as recommended in writing by sprayed fire-resistive material manufacturer for material and application indicated.

E. Extend fire-resistive material in full thickness over entire area of each substrate to be protected. Unless otherwise recommended in writing by sprayed fire-resistive material manufacturer, install body of fire-resistive covering in a single course.

F. Spray apply fire-resistive materials to maximum extent possible. Following the spraying operation in each area, complete the coverage by trowel application or other placement method recommended in writing by sprayed fire-resistive material manufacturer.

G. Where sealers are used, apply products that are tinted to differentiate them from sprayed fire-resistive material over which they are applied.

3.4 APPLICATION, CONCEALED SPRAYED FIRE-RESISTIVE MATERIALS

A. Apply concealed sprayed fire-resistive material in thicknesses and densities not less than those required to achieve fire-resistance ratings designated for each condition.

B. Cure concealed sprayed fire-resistive material according to product manufacturer's written recommendations.

3.5 APPLICATION, EXPOSED SPRAYED FIRE-RESISTIVE MATERIALS

A. Apply exposed sprayed fire-resistive material in thicknesses and densities not less than those required to achieve fire-resistance ratings designated for each condition, but apply in greater thicknesses and densities if indicated.

B. Provide a uniform finish complying with description indicated for each type of material and matching Architect's sample or, if none, finish approved for field-erected mockup.

C. Apply exposed cementitious sprayed fire-resistive materials to produce the following finish:

1. Even, spray-textured finish, produced by rolling flat surfaces of fire-protected members with a damp paint roller to remove drippings and excessive roughness.

D. Cure exposed sprayed fire-resistive material according to product manufacturer's written recommendations.

3.6 APPLICATION, EXPOSED MASTIC AND INTUMESCENT FIRE-RESISTIVE COATINGS

A. Apply exposed thin-film mastic and intumescent fire-resistive coatings in thicknesses and densities not less than those required to achieve fire-resistance ratings designated for each condition.

B. Apply mastic and intumescent fire-resistive coating as follows:

1. Install reinforcing fabric as required to obtain designated fire-resistance rating and where indicated.
2. Finish: Even, spray-textured finish produced by lightly rolling flat surfaces of fire-protected members before fire-resistive material dries, to smooth out surface irregularities and to seal in surface fibers.

3.7 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections and prepare test reports, as required by 2015 IBC 1705.15.

1. Cooperate with testing agency, provide access.

B. Remove and replace applications of sprayed fire-resistive material that do not pass tests and inspections for cohesion and adhesion, for density, or for both and retest as specified above.

C. Apply additional sprayed fire-resistive material, per manufacturer's written instructions, where test results indicate that thickness does not comply with specified requirements, and retest as specified above.

D. Field inspect intumescent materials in accordance with AWCI Tech Manual 12B.

3.8 CLEANING, PROTECTING, AND REPAIR

A. Cleaning: Immediately after completing spraying operations in each containable area of Project, remove material overspray and fallout from surfaces of other construction and clean exposed surfaces to remove evidence of soiling.

B. Protect sprayed fire-resistive material, according to advice of product manufacturer and Installer, from damage resulting from construction operations or other causes so fire protection will be without damage or deterioration at time of Substantial Completion.

C. Coordinate application of sprayed fire-resistive material with other construction to minimize need to cut or remove fire protection. As installation of other construction proceeds, inspect sprayed fire-resistive material and patch any damaged or removed areas.

D. Repair or replace work that has not successfully protected steel.

END OF SECTION

SECTION 078410

PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Through-penetration firestop systems for penetrations through fire-resistance-rated constructions, including both empty openings and openings containing penetrating items.

B. Related Work: The following items are not included in this Section and will be performed under the designated Sections:

1. Section 078440 - FIRE-RESISTIVE JOINT SYSTEMS for fire-resistive joint sealers.
2. Section 079200 - JOINT SEALANTS for standard joint sealers.
3. Division 21 - FIRE SUPPRESSION for fire-protection piping penetrations.
4. Division 22 - PLUMBING for piping penetrations.
5. Division 23 - HEATING, VENTILATING AND AIR CONDITIONING for duct and piping penetrations.
6. Division 26 - ELECTRICAL for cable and conduit penetrations.

1.3 COORDINATION

A. Jobsite conditions of each through-penetration firestop system must meet all details of the UL-Classified System selected. If jobsite conditions do not match any UL-classified systems, contact firestop manufacturer for alternative systems or Engineer Judgment Drawings.

B. Coordinate work with other trades to assure that penetration-opening sizes are appropriate for penetrant locations.

C. Verify that the schedule is current at the time of construction, and that each referenced system is suitable for the intended application.

1.4 PERFORMANCE REQUIREMENTS

A. General: For penetrations through fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.

B. Penetrations in Fire-Resistance-Rated Walls: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa).

1. Fire-resistance-rated walls include fire walls, fire-barrier walls, smoke-barrier walls and fire partitions.
2. F-Rating: Not less than the fire-resistance rating of constructions penetrated.

C. Penetrations in Horizontal Assemblies: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa).

1. Horizontal assemblies include floors, floor/ceiling assemblies and ceiling membranes of roof/ceiling assemblies.
2. F-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated.
3. T-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.

D. Penetrations in Smoke Barriers: Provide penetration firestopping with ratings determined per UL 1479.

1. L-Rating: Not exceeding 5.0 cfm/sq. ft. (0.025 cu. m/s per sq. m) of penetration opening at 0.30-inch wg (74.7 Pa) at both ambient and elevated temperatures.

E. Exposed Penetration Firestopping:

1. Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.
2. For through-penetration firestop systems exposed to view, traffic, moisture, and physical damage, provide products that, after curing, do not deteriorate when exposed to these conditions both during and after construction.

    a. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems demonstrating no evidence of water leakage when tested according to UL 1479.
    b. For floor penetrations with annular spaces exceeding 4 inches in width and exposed to possible loading and traffic, provide firestop systems capable of supporting floor loads involved, either by installing floor plates or by other means.

F. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.

1.5 SUBMITTALS

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

B. Shop Drawings: For each through-penetration firestop system, show each type of construction condition penetrated, relationships to adjoining construction, and type of penetrating item. Include firestop design designation of qualified testing and inspecting agency that evidences compliance with requirements for each condition indicated.

1. Submit documentation, including illustrations, from a qualified testing and inspecting agency that is applicable to each through-penetration firestop system configuration for construction and penetrating items.

C. Through-Penetration Firestop System Schedule: Indicate locations of each through-penetration firestop system, along with the following information:

1. Types of penetrating items.
2. Types of constructions penetrated, including fire-resistance ratings and, where applicable, thicknesses of construction penetrated.
3. Through-penetration firestop systems for each location identified by firestop design designation of qualified testing and inspecting agency.

D. Qualification Data: For Installer.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Either a firm that has been approved by FMG according to FMG 4991, "Approval of Firestop Contractors" or a firm experienced in installing through-penetration firestop systems similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction of a minimum of five projects with a record of successful performance. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements.

B. Installation Responsibility: Assign installation of through-penetration firestop systems and fire-resistive joint systems in Project to a single qualified installer.

C. Source Limitations: Obtain through-penetration firestop systems, for each kind of penetration and construction condition indicated, through one source from a single manufacturer.

D. Fire-Test-Response Characteristics: Provide through-penetration firestop systems that comply with the following requirements and those specified in Part 1 "Performance Requirements" Article:

1. Firestopping tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is UL or another agency performing testing and follow-up inspection services for firestop systems acceptable to authorities having jurisdiction.
2. Through-penetration firestop systems are identical to those tested per testing standard referenced in "Part 1 Performance Requirements" Article. Provide rated systems complying with the following requirements:

a. Through-penetration firestop system products bear classification marking of qualified testing and inspecting agency.
b. Through-penetration firestop systems correspond to those indicated by reference to through-penetration firestop system designations listed in the UL “Fire Resistance Directory.”

E. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver through-penetration firestop system products to Project site in original, unopened containers or packages with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, lot number, shelf life if applicable, qualified testing and inspecting agency's classification marking applicable to Project, curing time, and mixing instructions for multicomponent materials.

B. Store and handle materials for through-penetration firestop systems to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not install through-penetration firestop systems when ambient or substrate temperatures are outside limits permitted by through-penetration firestop system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

B. Ventilate through-penetration firestop systems per manufacturer's written instructions by natural means or, where this is inadequate, forced-air circulation.

1.9 COORDINATION

A. Coordinate construction of openings and penetrating items to ensure that through-penetration firestop systems are installed according to specified requirements.

B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration firestop systems.

C. Do not cover up through-penetration firestop system installations that will become concealed behind other construction until each installation has been examined building inspector, if required by authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, through-penetration firestop systems that may be incorporated into the Work include, but are not limited to the following:

1. Hilti, Inc.
2. BioFireshield; RectorSeal Corporation.
3. Specified Technologies, Inc. (STI).
4. 3M; Fire Protection Products Division.

2.2 FIRESTOPPING MATERIALS

A. VOC Content: Penetration firestopping sealants and sealant primers shall comply with the following limits for VOC content:

1. Sealants: 250 g/L.
2. Sealant Primers for Nonporous Substrates: 250 g/L.

3. Sealant Primers for Porous Substrates: 775 g/L.
4. Methylene chloride and perchloroethylene may not be intentionally added to sealants.

B. Compatibility: Provide through-penetration firestop systems that are compatible with one another; with the substrates forming openings; and with the items, if any, penetrating through-penetration firestop systems, under conditions of service and application, as demonstrated by through-penetration firestop system manufacturer based on testing and field experience.

C. Materials: Provide through-penetration firestop systems containing primary materials and fill materials which are part of the tested assemblies indicated in the approved Through-Penetration Firestop System Schedule submittal. Fill materials are those referred to in directories of referenced testing and inspecting agencies as "fill," "void," or "cavity" materials.

1. Basis of Design:

a. BioFireshield; RectorSeal Smoke and Acoustic Sealant.
b. Hilti; CP 606 Flexible Firestop Sealant.
c. Hilti; CP 653 BA Firestop Speed Sleeve.
d. Hilti; FS-ONE Intumescent Firestop Sealant.

D. Accessories: Provide components for each through-penetration firestop system that are needed to install fill materials and to comply with Part 1 "Performance Requirements" Article. Use only components specified by through-penetration firestop system manufacturer and approved by qualified testing and inspecting agency for firestop systems indicated.

E. Endothermic Mats: 3M Interam Endothermic Mats by 3M Fire Protection Products; located in rated walls behind cabinet unit heaters, fire extinguisher cabinets and electrical panels where there are space limitations to maintain the wall rating.

2.3 MIXING

A. For those products requiring mixing before application, comply with through-penetration firestop system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of work. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning: Clean out openings immediately before installing through-penetration firestop systems to comply with firestop system manufacturer's written instructions and with the following requirements:

1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of through-penetration firestop systems.
2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with through-penetration firestop systems. Remove loose particles remaining from cleaning operation.
3. Remove laitance and form-release agents from concrete.

B. Priming: Prime substrates where recommended in writing by through-penetration firestop system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

C. Masking Tape: Use masking tape to prevent through-penetration firestop systems from contacting adjoining surfaces that will remain exposed on completion of Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from firestop system materials. Remove tape as soon as possible without disturbing firestop system's seal with substrates.

3.3 THROUGH-PENETRATION FIRESTOP SYSTEM INSTALLATION

A. General: Install through-penetration firestop systems to comply with Part 1 "Performance Requirements" Article and with firestop system manufacturer's written installation instructions and published drawings for products and applications indicated.

B. Install forming/damming/backing materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.

C. Install fill materials for firestop systems by proven techniques to produce the following results:

1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 FIELD QUALITY CONTROL

A. Inspecting Agency: Owner will engage a qualified testing agency to perform tests and inspections and prepare test reports, as required by 2015 IBC 1705.17 and 1705.17.1. Independent inspecting agency shall comply with ASTM E 2174 requirements including those related to qualifications, conducting inspections, and preparing test reports

B. Where deficiencies are found, repair or replace through-penetration firestop systems so they comply with requirements.

C. Proceed with enclosing through-penetration firestop systems with other construction only after inspection reports are issued and firestop installations comply with requirements.

3.5 CLEANING AND PROTECTING

A. Clean off excess fill materials adjacent to openings as Work progresses by methods and with cleaning materials that are approved in writing by through-penetration firestop system manufacturers and that do not damage materials in which openings occur.

B. Provide final protection and maintain conditions during and after installation that ensure that through-penetration firestop systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated through-penetration firestop systems immediately and install new materials to produce systems complying with specified requirements.

END OF SECTION

SECTION 078440

FIRE-RESISTIVE JOINT SYSTEMS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the Work of this Section, including but not limited to fire-resistive joint systems for the following:

1. Floor-to-floor joints.
2. Floor-to-wall joints.
3. Head-of-wall joints.
4. Wall-to-wall joints.
5. Perimeter fire-resistive joint systems consisting of floor-to-wall joints between perimeter edge of fire-resistance-rated floor assemblies and exterior curtain walls.

B. Related Work: The following items are not included in this Section and will be performed under the designated Sections:

1. Section 078410 - PENETRATION FIRESTOPPING for firestopping.
2. Division 21 - FIRE SUPPRESSION for fire-protection piping penetrations.
3. Division 22 - PLUMBING for piping penetrations.
4. Division 23 - HEATING, VENTILATING AND AIR CONDITIONING for duct and piping penetrations.
5. Division 26 - ELECTRICAL for cable and conduit penetrations.

1.3 PERFORMANCE REQUIREMENTS

A. General: Provide fire-resistive joint systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of assembly in which fire-resistive joint systems are installed.

B. For fire-resistive systems exposed to view, provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

1.4 SUBMITTALS

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

B. Shop Drawings: For each fire-resistive joint system, show each kind of construction condition in which joints are installed; also show relationships to adjoining construction. Include fire-

resistive joint system design designation of testing and inspecting agency acceptable to authorities having jurisdiction that demonstrates compliance with requirements for each condition indicated.

1. Submit documentation, including illustrations, from a qualified testing and inspecting agency that is applicable to each fire-resistive joint system configuration for construction and penetrating items.

C. Fire-Resistive Joint Systems Schedule: For each fire-resistive joint system. Include location and design designation of qualified testing agency.

1. Where Project conditions require modification to a qualified testing agency's illustration for a particular fire-resistive joint system condition, submit illustration, with modifications marked, approved by fire-resistive joint system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

D. Product Certificates: For each type of fire-resistive joint system, signed by product manufacturer.

E. Qualification Data: For Installer.

F. Field quality-control test reports.

G. Research/Evaluation Reports: For each type of fire-resistive joint system.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A firm experienced in installing through-penetration fire stop systems similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction of a minimum of five projects with a record of successful performance. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements. Evidence of FMG 4991 approval is acceptable for installer qualifications, but not mandatory.

B. Installation Responsibility: Assign installation of through-penetration firestop systems and fire-resistive joint systems in Project to a single qualified installer.

C. Source Limitations: Obtain fire-resistive joint systems, for each kind of joint and construction condition indicated, through one source from a single manufacturer.

D. Fire-Test-Response Characteristics: Provide fire-resistive joint systems that comply with the following requirements and those specified in Part 1 "Performance Requirements" Article:

1. Fire-resistance tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is UL or another agency performing testing and follow-up inspection services for fire-resistive joint systems acceptable to authorities having jurisdiction.
2. Fire-resistive joint systems are identical to those tested per methods indicated in Part 1 "Performance Requirements" Article and comply with the following:

a. Fire-resistive joint system products bear classification marking of qualified testing and inspecting agency.

b. Fire-resistive joint systems correspond to those indicated by referencing system designations of the qualified testing and inspecting agency.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver fire-resistive joint system products to Project site in original, unopened containers or packages with qualified testing and inspecting agency's classification marking applicable to Project and with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, lot number, shelf life, curing time, and mixing instructions for multicomponent materials.

B. Store and handle materials for fire-resistive joint systems to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not install fire-resistive joint systems when ambient or substrate temperatures are outside limits permitted by fire-resistive joint system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

B. Ventilate fire-resistive joint systems per manufacturer's written instructions by natural means or, if this is inadequate, forced-air circulation.

1.8 COORDINATION

A. Coordinate construction of joints to ensure that fire-resistive joint systems are installed according to specified requirements.

B. Coordinate sizing of joints to accommodate fire-resistive joint systems.

C. Do not cover up through-penetration firestop system installations that will become concealed behind other construction until each installation has been examined building inspector, if required by authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, fire-resistive joint systems that may be incorporated into the Work include, but are not limited to the following:

1. Hilti, Inc.
2. BioFireshield; RectorSeal Corporation.
3. Specified Technologies, Inc. (STI).
4. 3M; Fire Protection Products Division.

2.2 FIRE-RESISTIVE JOINT SYSTEMS

A. VOC Content: Provide fire-resistive joint system sealants that comply with the following limits for VOC content:

1. Architectural Sealants: 250 g/L.
2. Sealant Primers for Nonporous Substrates: 250 g/L.
3. Sealant Primers for Porous Substrates: 775 g/L.
4. Methylene chloride and perchloroethylene may not be intentionally added to sealants.

B. General: Where required, provide fire-resistive joint systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of assemblies in or between which fire-resistive joint systems are installed. Fire-resistive joint systems shall accommodate building movements without impairing their ability to resist the passage of fire and hot gases.

C. Joints in or between Fire-Resistance-Rated Construction: Provide fire-resistive joint systems with ratings determined per ASTM E 1966 or UL 2079.

D. Joints at Exterior Curtain-Wall/Floor Intersections: Provide fire-resistive joint systems with rating determined by ASTM E 119 based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa) or ASTM E 2307.

1. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of the floor assembly.

E. Joints in Smoke Barriers: Provide fire-resistive joint systems with ratings determined per UL 2079.

1. L-Rating: Not exceeding 5.0 cfm/ft (0.00775 cu. m/s x m) of joint at 0.30 inch wg (74.7 Pa) at both ambient and elevated temperatures.

F. Compatibility: Provide fire-resistive joint systems that are compatible with joint substrates, under conditions of service and application, as demonstrated by fire-resistive joint system manufacturer based on testing and field experience.

G. Accessories: Provide components of fire-resistive joint systems, including primers and forming materials, that are needed to install fill materials and to comply with Part 1 "Performance Requirements" Article. Use only components specified by fire-resistive joint system manufacturer and approved by the qualified testing and inspecting agency for systems indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for joint configurations, substrates, and other conditions affecting performance of work.

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

3.2 PREPARATION

A. Surface Cleaning: Clean joints immediately before installing fire-resistive joint systems to comply with fire-resistive joint system manufacturer's written instructions and the following requirements:

1. Remove from surfaces of joint substrates foreign materials that could interfere with adhesion of fill materials.
2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with fill materials. Remove loose particles remaining from cleaning operation.
3. Remove laitance and form-release agents from concrete.

B. Priming: Prime substrates where recommended in writing by fire-resistive joint system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

C. Masking Tape: Use masking tape to prevent fill materials of fire-resistive joint system from contacting adjoining surfaces that will remain exposed on completion of Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from fire-resistive joint system materials. Remove tape as soon as possible without disturbing fire-resistive joint system's seal with substrates or damaging adjoining surfaces.

3.3 INSTALLATION

A. General: Install fire-resistive joint systems to comply with Part 1 "Performance Requirements" Article and fire-resistive joint system manufacturer's written installation instructions for products and applications indicated.

B. Install forming/packing/backing materials and other accessories of types required to support fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.

C. Install fill materials for fire-resistive joint systems by proven techniques to produce the following results:

1. Fill voids and cavities formed by openings and forming/packing/backing materials as required to achieve fire-resistance ratings indicated.
2. Apply fill materials so they contact and adhere to substrates formed by joints.
3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 FIELD QUALITY CONTROL

A. Inspecting Agency: Owner will engage a qualified testing agency to perform tests and inspections and prepare test reports, as required by 2015 IBC 1705.17 and 1705.17.2. Independent inspecting agency shall comply with ASTM E 2393 requirements including those related to qualifications, conducting inspections, and preparing test reports.

B. Testing Services: Inspecting of completed installations of fire-resistive joint systems shall take place in successive stages as installation of fire-resistive joint systems proceeds. Do not proceed with installation of joint systems for the next area until inspecting agency determines completed work shows compliance with requirements.

1. Inspecting agency shall state in each report whether inspected fire-resistive joint systems comply with or deviate from requirements.

C. Remove and replace fire-resistive joint systems where inspections indicate that they do not comply with specified requirements.

D. Additional inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

E. Proceed with enclosing fire-resistive joint systems with other construction only after inspection reports are issued and fire-resistive joint systems comply with requirements.

3.5 CLEANING AND PROTECTING

A. Clean off excess fill materials adjacent to joints as Work progresses by methods and with cleaning materials that are approved in writing by fire-resistive joint system manufacturers and that do not damage materials in which openings occur.

B. Provide final protection and maintain conditions during and after installation that ensure fire-resistive joint systems are without damage or deterioration at time of Substantial Completion. If damage or deterioration occurs despite such protection, cut out and remove damaged or deteriorated fire-resistive joint systems immediately and install new materials to produce fire-resistive joint systems complying with specified requirements.

END OF SECTION

SECTION 079200

JOINT SEALANTS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Joint sealants and fillers.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 042000 - UNIT MASONRY for masonry control and expansion joint fillers and gaskets.
2. Section 088000 - GLAZING for glazing sealants.
3. Section 092110 - GYPSUM BOARD ASSEMBLIES for sealing perimeter joints of gypsum board partitions to reduce sound transmission.
4. Section 093000 - TILING for sealing of expansion, contraction, control, and isolation joints in tile surfaces.
5. Section 095100 - ACOUSTICAL CEILINGS for sealing edge moldings at perimeters of acoustical ceilings.

1.3 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.

1.4 SUBMITTALS

A. Product Data: For each product indicated.

B. Samples for Verification: For each type and color of joint sealant required, provide Samples with joint sealants in 1/2-inch- wide joints formed between two 6-inch-long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

C. Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.
4. Joint-sealant color.

D. Qualification Data: For Installer and qualified testing agency.

E. Product Test Reports: Based on comprehensive testing of product formulations performed by a qualified testing agency, indicating that sealants comply with requirements.

F. Preconstruction Field Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on preconstruction testing specified in "Quality Assurance" Article.

G. Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:

1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

H. Field Test Report Log: For each elastomeric sealant application.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized Installer who is approved or licensed for installation of elastomeric sealants required for this Project.

B. Product Testing: Test joint sealants using a qualified testing agency.

1. Testing Agency Qualifications: Qualified according to ASTM C 1021 to conduct the testing indicated.

C. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

D. 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. Use manufacturer's standard test method to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.

a. Adhesion Testing: Use ASTM C 794 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
b. Compatibility Testing: Use ASTM C 1087 to determine sealant compatibility when in contact with joint sealant backing and glazing and gasket materials.

2. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
3. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures including use of specially formulated primers.

4. Testing will not be required if joint-sealant manufacturers submit joint preparation data that are based on previous testing of current sealant products for adhesion to, and compatibility with, joint substrates and other materials matching those submitted.

E. Preconstruction Field-Adhesion Testing: Before installing elastomeric sealants, field test their adhesion to Project joint substrates as follows:

1. Locate test joints where indicated on Project or, if not indicated, as directed by Architect.
2. Conduct field tests for each application indicated below:

    a. Each type of elastomeric sealant and joint substrate indicated.
    b. Each type of nonelastomeric sealant and joint substrate indicated.

3. Notify Architect seven days in advance of dates and times when test joints will be erected.

    a. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193.

        1) For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.

4. Report whether sealant in joint connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each type of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
5. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

F. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

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.

1.7 WARRANTY

A. 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.

B. 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: Five years from date of Substantial Completion.

C. Special warranties specified in this Article exclude deterioration or failure of joint sealants from the following:

1. Movement of the structure caused by stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
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 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. VOC Content: Provide interior sealants and sealant primers that comply with the following limits for VOC content:

1. Architectural Sealants: 250 g/L.
2. Sealant Primers for Nonporous Substrates: 250 g/L.
3. Sealant Primers for Porous Substrates: 775 g/L.
4. Methylene chloride and perchloroethylene may not be intentionally added to sealants.

C. Colors of Exposed Joint Sealants: Provide colors as selected by the Architect from manufacturer’s full range of standard and custom colors; maximum of five colors, three standard colors and two custom colors.

2.2 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: Elastomeric sealants shall 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 Contact with Food: Where elastomeric sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600 or ANSI/NSF Standard 51.

D. Exterior Silicone Sealant, Single-Component Neutral-Curing Type:

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

a. Dow Corning Corporation; 790.
b. GE Silicones; SilPruf LM SCS2700.
c. Pecora Corporation; 864.
d. Tremco Inc.; Spectrem 1.

2. Extent of Use: Exterior joints in vertical and soffit surfaces.

E. Exterior Urethane Sealant, Multicomponent Pourable (Self-Leveling) Type for Pedestrian Traffic: ASTM C 920, Type M, Grade P, Class 25, Use T, M, & O.

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

a. Meadows, W. R., Inc.; POURTHANE.
b. Pecora Corporation; Urexpan NR-200.
c. Sika; Sikaflex-2c SL.
d. Tremco Inc.; THC-901.

2. Extent of Use: Exterior joints in horizontal surfaces.

F. Interior Sanitary Silicone Sealant, Single-Component Mildew-Resistant, Acid-Curing (Acetoxy) Type: ASTM C 920, Type S, Grade NS, Class 25, Use NT, G, A, and O.

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

a. Bostik; Pure Silicone.
b. Dow Corning Corporation; 786 Mildew Resistant.
c. GE Silicones; Sanitary SCS1700.
d. Pecora; 898NST.
e. Sika; Sikasil GP.
f. Tremco; Tremsil 200.

2. Extent of Use: Interior sanitary joints at toilet rooms, kitchens, and other wet areas.

G. Interior Acrylic Latex Sealant: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.

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

a. Henkel Corp.; Loctite Polyseamseal Acrylic Caulk with Silicone.
b. Pecora Corporation; AC-20+.

c. Tremco Inc.; Tremflex 834.

2. Extent of Use: Interior non-moving joints.

2.3 JOINT-SEALANT BACKING

A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C 1330, Type B (bicellular material with a surface skin) or other type, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

1. Basis of Design: Armacell Canada Inc.; ITP Standard Backer Rod.

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.4 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

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

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
2. Clean 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 concrete, masonry, unglazed surfaces of ceramic tile, and exterior insulation and finish systems.
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 metal, glass, porcelain enamel, and glazed surfaces of ceramic tile.

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 OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. 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.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

E. 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.

F. 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.

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

SECTION 079500

EXPANSION CONTROL

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Architectural expansion joint systems for interior and exterior joints as scheduled on the Drawings and specified in this Section.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 033000 - CAST-IN-PLACE CONCRETE for block-outs for architectural joint systems in concrete floors, decks, and walls.
2. Section 078446 - FIRE-RESISTIVE JOINT SYSTEMS for fire-resistive joints not associated with expansion control assemblies.
3. Section 079200 - JOINT SEALANTS for elastomeric sealants and preformed compressed-foam sealants without metal frames.

1.3 DEFINITIONS

A. Architectural Joint System: Any filler or cover used to span, fill, cover, or seal a joint, except expanding foam seals and poured or foamed in-place sealants.

B. Cyclic Movement: Periodic change between widest and narrowest joint widths in an automatically mechanically controlled system.

C. Fire Barriers: Any material or material combination, when fire tested after cycling, designated to resist passage of flame and hot gases through a movement joint.

D. Maximum Joint Width: Widest linear gap a joint system tolerates and performs its designed function without damaging its functional capabilities.

E. Minimum Joint Width: Narrowest linear gap a joint system tolerates and performs its designed function without damaging its functional capabilities.

F. Movement Capability: Value obtained from the difference between widest and narrowest widths of a joint opening typically expressed in numerical values (mm or inches) or a percentage of nominal value of joint width.

G. Nominal Joint Width: Width of linear gap indicated as representing the conditions existing when architectural joint systems will be installed or, if no nominal joint width is indicated, a width equal to the sum of maximum and minimum joint widths divided by two.

1.4 PERFORMANCE REQUIREMENTS

A. General: Provide factory-fabricated architectural joint systems capable of withstanding the types of loads and of accommodating the kinds of movement, and the other functions for which they are designed including those specified below, without failure. Types of failure include those listed in Appendix X3 of ASTM E 1399.

1. Vehicular Traffic Joints: Support vehicular traffic across joint, including construction equipment and full-loaded fire apparatus.
2. Pedestrian Traffic Joints: Support pedestrian traffic across joint.
3. Exterior Joints: Maintain continuity of weather enclosure.
4. Joints in Fire-Resistance-Rated Assemblies: Maintain fire-resistance ratings of assemblies.
5. Joints in Smoke Barriers: Maintain integrity of smoke barrier.
6. Joints in Acoustically Rated Assemblies: Inhibit passage of airborne noise.
7. Other Joints: Where indicated, provide joint systems that prevent penetration of water, moisture, and other substances deleterious to building components or content.
8. Seismic Performance: Expansion control systems shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

    a. The term "withstand" means "the system will remain in place without separation of any parts when subjected to the seismic forces specified and the system will be fully operational after the seismic event."
    b. Component Importance Factor is 1.5.

9. Joints in Surfaces with Architectural Finishes: Serve as finished architectural joint closures.

1.5 SUBMITTALS

A. Product Data: Include manufacturer's product specifications, construction details, material and finish descriptions, and dimensions of individual components and seals.

B. Shop Drawings: For each joint system specified, provide the following:

1. Placement Drawings: Include line diagrams showing entire route of each joint system, plans, elevations, sections, details, joints, splices, locations of joints and splices, and attachments to other Work. Where joint systems change planes, provide Isometric Drawings depicting how components interconnect to achieve continuity of joint covers and fillers.

C. Samples for Verification: Full-size units 6 inches long of each type of joint system indicated; in sets for each finish, color, texture, and pattern specified, showing the full range of variations expected in these characteristics.

D. Product Test Reports: From a qualified testing agency indicating architectural joint systems comply with requirements, based on comprehensive testing of current products.

1.6 QUALITY ASSURANCE

A. Source Limitations: Obtain architectural joint systems through one source from a single manufacturer. Coordinate compatibility with adjoining joint systems specified in other Sections.

B. Fire-Test-Response Characteristics: Where indicated, provide joint systems incorporating fire barriers that are identical to those of assemblies tested for fire resistance per UL 2079 or ASTM E 1966, including hose-stream test of vertical wall assemblies and wall-to-ceiling assemblies, by a testing and inspecting agency acceptable to authorities having jurisdiction.

1. Hose Stream Test: Wall-to-wall and wall-to-ceiling systems shall be subjected to hose stream testing.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Balco, Inc.
2. Construction Specialties, Inc.
3. JointMaster/InPro Corporation.
4. Michael Rizza Company, LLC.
5. MM Systems Corporation.
6. Nystrom, Inc.
7. Watson Bowman Acme Corp.; a BASF Construction Chemicals business.

2.2 MATERIALS

A. Aluminum: ASTM B 221, alloy 6063-T5 for extrusions; ASTM B 209, alloy 6061-T6 for sheet and plate.

1. Apply manufacturer's standard protective coating on aluminum surfaces to be placed in contact with cementitious materials.

B. Stainless Steel: ASTM A 666, Type 304 with No. 2B finish, unless otherwise indicated, for plates, sheet, and strips.

C. Preformed Seals: Single or multicellular extruded elastomeric seals designed with or without continuous, longitudinal, internal baffles. Formed to be installed in frames or with anchored flanges, in color indicated or, if not indicated, as selected by Architect from manufacturer's standard colors.

D. Strip Seals: Elastomeric membrane or tubular extrusions with a continuous longitudinal internal baffle system throughout complying with ASTM E 1783; used with compatible frames, flanges, and molded-rubber anchor blocks.

E. Compression Seals: Preformed, elastomeric extrusions having internal baffle system complying with ASTM E 1612 in sizes and profiles indicated or as recommended by manufacturer.

F. Preformed Cellular Foams: Nonextruded, low-density, crosslinked, nitrogen-blown ethylene-vinyl-acetate copolymer extruded, compressible foam.

G. Fire Barriers: Any material or material combination, when fire tested after cycling, designated to resist the passage of flame and hot gases through a movement joint.

H. Accessories: Manufacturer's standard anchors, clips, fasteners, set screws, spacers, flexible moisture barrier and filler materials, drain tubes, lubricants, adhesives, and other accessories compatible with material in contact, as indicated or required for complete installations.

2.3 ARCHITECTURAL JOINT SYSTEMS

A. General: Provide joint systems of design, basic profile, materials, and operation indicated. Provide units with the capability to accommodate joint widths indicated and variations in adjacent surfaces.

1. Furnish units in longest practicable lengths to minimize number of end joints. Provide hairline mitered corners where joint changes directions or abuts other materials.
2. Include closure materials and transition pieces, tee-joints, corners, curbs, cross-connections, and other accessories as required to provide continuous joint systems.
3. Frames for Strip Seals: Designed with semiclosed cavity that provides a mechanical lock for seals of type indicated.
4. Public Area Seals: Non-slip seals designed for installation on treads and risers and to lie flat with adjacent surfaces, and complying with ADA guidelines for public areas.

2.4 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.

2.5 ALUMINUM FINISHES

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.

2.6 STAINLESS-STEEL FINISHES

A. Remove tool and die marks and stretch lines or blend into finish.

B. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.

C. Bright, Directional Polish: No. 4 finish.

D. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prepare substrates according to architectural joint system manufacturer's written instructions.

B. Coordinate and furnish anchorages, Placement Drawings, and instructions for installing joint systems to be embedded in or anchored to concrete or to have recesses formed into edges of concrete slab for later placement and grouting-in of frames.

C. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary to secure joint systems to in-place construction, including threaded fasteners with drilled-in expansion shields for masonry and concrete where anchoring members are not embedded in concrete. Provide fasteners of metal, type, and size to suit type of construction indicated and to provide for secure attachment of joint systems.

D. Provide the services of a surveyor licensed in the state the project is located prior to and after paving substrate to confirm alignment of joint.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for handling and installing architectural joint assemblies and materials, unless more stringent requirements are indicated.

B. Coordinate installation of architectural joint assembly materials and associated work so complete assemblies comply with assembly performance requirements.

C. Terminate exposed ends of exterior architectural joint assemblies with factory-fabricated termination devices to maintain waterproof system.

D. Install factory-fabricated transitions between building expansion-joint cover assemblies and roof expansion-joint assemblies to provide continuous, uninterrupted, watertight construction.

E. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required to install joint systems.

1. Install joint cover assemblies in true alignment and proper relationship to joints and adjoining finished surfaces measured from established lines and levels.
2. Allow adequate free movement for thermal expansion and contraction of metal to avoid buckling.
3. Set covers in horizontal surfaces at elevations that place exposed surfaces flush with adjoining finishes.
4. Locate covers in continuous contact with adjacent surfaces.
5. Securely attach in place with required accessories.
6. Locate anchors at interval recommended by manufacturer, but not less than 3 inches from each end and not more than 24 inches o.c.

F. Continuity: Maintain continuity of joint systems with a minimum number of end joints and align metal members. Cut and fit ends to produce joints that will accommodate thermal expansion and contraction of metal to avoid buckling of frames. Adhere flexible filler materials, if any, to frames with adhesive or pressure-sensitive tape as recommended by manufacturer.

G. Extruded Preformed Seals: Install seals to comply with manufacturer's written instructions and with minimum number of end joints.

1. For straight sections, provide preformed seals in continuous lengths.
2. Vulcanize or heat-weld field splice joints in preformed seal material to provide watertight joints using procedures recommended by manufacturer.
3. Apply adhesive, epoxy, or lubricant adhesive approved by manufacturer to both frame interfaces before installing preformed seals.
4. Seal transitions according to manufacturer's written instructions.
5. Install foam seals with adhesive recommended by manufacturer and heat seal all splices.

H. Joint Systems with Seals: Seal end joints within continuous runs and joints at transitions according to manufacturer's written instructions to provide a watertight installation.

I. Seismic Seals: Install interior seals in continuous lengths. Install exterior seal in standard lengths and vulcanize or heat-weld field splice joints to provide watertight joints using manufacturer's recommended procedures. Seal transitions and end joints according to manufacturer's written instructions.

J. Fire Barriers: Install fire barriers to provide continuous, uninterrupted fire resistance throughout length of joint, including transitions and end joints.

3.3 CLEANING AND PROTECTION

A. Do not remove protective covering until finish work in adjacent areas is complete. When protective covering is removed, clean exposed metal surfaces to comply with manufacturer's written instructions.

END OF SECTION

SECTION 081110

HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Standard hollow-metal steel doors.
2. Standard hollow-metal steel frames.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 042000 - UNIT MASONRY for building anchors into masonry construction.
2. Section 087100 - DOOR HARDWARE for door hardware for steel doors.
3. Section 088000 - GLAZING for glazed lites.
4. Section 092110 - GYPSUM BOARD ASSEMBLIES for insulation.
5. Section 099000 - PAINTING AND COATING for field painting steel doors and frames.

1.3 SUBMITTALS

A. Product Data: Include construction details, material descriptions, core descriptions, label compliance, fire-resistance rating, temperature-rise ratings, and finishes for each type of steel door and frame specified.

B. Shop Drawings:

1. Elevations of each door design.
2. Details of doors, including vertical and horizontal edge details and metal thicknesses.
3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
4. Locations of reinforcement and preparations for hardware.
5. Details of each different wall opening condition.
6. Details of anchorages, joints, field splices, and connections.
7. Details of accessories.
8. Details of moldings, removable stops, and glazing.
9. Details of conduit and preparations for power, signal, and control systems.

C. Schedule: Provide a schedule of hollow metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with door hardware schedule.

D. Qualification Data: For Installer.

E. Product Test Reports: Based on evaluation of comprehensive fire tests performed by a qualified testing agency, for each type of standard steel door and frame.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

B. Source Limitations: Obtain standard steel doors and frames through one source from a single manufacturer.

C. Fire-Rated Door, Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings and temperature-rise limits indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.

1. Smoke- and Draft-Control Assemblies: Provide an assembly with gaskets listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL 1784 and installed in compliance with NFPA 105.

D. Fire-Rated, Borrowed-Light Assemblies (Including Sidelights and Transoms): Complying with NFPA 80 and listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9.

E. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver doors and frames palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch-high wood blocking. Do not store in a manner that traps excess humidity.

1. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.7 COORDINATION

A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

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. Ceco Door Products; an ASSA ABLOY Group Company.
2. CURRIES Company; an ASSA ABLOY Group Company.
3. de LaFontaine
4. Deronde Steel Doors and Frames.
5. Mesker Door Inc.
6. Pioneer Industries, Inc.
7. Philipp Manufacturing Company.
8. Republic Builders Products Company.
9. Steelcraft; an Allegion (formerly Ingersoll-Rand) company.

2.2 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Metallic-Coated, (Galvanized) Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 metallic coating.

D. Frame Anchors: ASTM A 591/A 591M, Commercial Steel (CS), 40Z coating designation; mill phosphatized.

1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.

E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.

F. Powder-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow metal frames of type indicated.

G. Insulation: Comply with requirements in Section 092110 - GYPSUM BOARD ASSEMBLIES.

H. Glazing: Comply with requirements in Section 088000 - GLAZING.

2.3 STANDARD STEEL DOORS

A. General: Provide doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces, unless otherwise indicated. Comply with ANSI A250.8.

1. Design: Flush panel.
2. Core Construction: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, mineral-board, or vertical steel-stiffener core that produces doors complying with ANSI A250.8.

    a. Fire Door Core: As required to provide fire-protection and temperature-rise ratings indicated.
    b. Thermal-Rated (Insulated) Exterior Doors: Where indicated, provide doors fabricated with thermal-resistance value (R-value) of not less than 2.5 when tested according to ASTM C 1363.

3. Top and Bottom Edges: Closed with flush or inverted 0.042-inch-thick end closures or channels of same material as face sheets.
4. Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."

B. Exterior Doors: Face sheets fabricated from metallic-coated (galvanized) steel sheet. Provide doors complying with requirements indicated below by referencing ANSI A250.8 for level and model and ANSI A250.4 for physical-endurance level:

1. Level 3 and Physical Performance Level A (Extra Heavy Duty), Model 2

C. Interior Doors: Face sheets fabricated from cold-rolled steel sheet. Provide doors complying with requirements indicated below by referencing ANSI A250.8 for level and model and ANSI A250.4 for physical-endurance level:

1. Level 2 and Physical Performance Level B (Heavy Duty), Model 2 (Seamless), 1-3/4 inches thick.

D. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.

E. Fabricate concealed stiffeners and hardware reinforcement from either cold- or hot-rolled steel sheet.

2.4 STANDARD STEEL FRAMES

A. General: Comply with ANSI A250.8 and with details indicated for type and profile.

B. Exterior Frames: Fabricated from metallic-coated (galvanized) steel sheet.

1. Fabricate frames with full profile welded joints.
2. Frames for Level 3 Steel Doors: 0.067-inch-thick steel sheet.

C. Interior Frames: Fabricated from cold-rolled steel sheet.

1. Fabricate frames with full profile welded joints.
2. Frames for Level 2 Steel Doors: 0.053-inch-thick steel sheet.

D. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcement plates from same material as frames.

2.5 FRAME ANCHORS

A. Jamb Anchors:

1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
2. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch thick.
3. Compression Type for Drywall Slip-on Frames: Adjustable compression anchors.
4. Postinstalled Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch-diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.

B. Floor Anchors: Formed from same material as frames, not less than 0.042 inch (1.0 mm) thick, and as follows:

1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.
2. Separate Topping Concrete Slabs: Adjustable-type anchors with extension clips, allowing not less than 2-inch height adjustment. Terminate bottom of frames at finish floor surface.

2.6 HOLLOW METAL PANELS

A. Provide hollow metal panels of same materials, construction, and finish as specified for adjoining hollow metal work.

2.7 STOPS AND MOLDINGS

A. Moldings for Glazed Lites in Doors: Minimum 0.032 inch thick, fabricated from same material as door face sheet in which they are installed.

B. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch high unless otherwise indicated.

C. Loose Stops for Glazed Lites in Frames: Minimum 0.032 inch thick, fabricated from same material as frames in which they are installed.

2.8 LOUVERS

A. Provide louvers for interior doors, where indicated, that comply with SDI 111C, with blades or baffles formed of 0.020-inch-thick, cold-rolled steel sheet set into 0.032-inch-thick steel frame.

1. Sightproof Louver: Stationary louvers constructed with inverted V-shaped or Y-shaped blades.

2. Fire-Rated Automatic Louvers: Louvers constructed with movable blades closed by actuating fusible link, and listed and labeled for use in fire-rated door assemblies of type and fire-resistance rating indicated by same testing and inspecting agency that established fire-resistance rating of door assembly.

2.9 ACCESSORIES

A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.

B. Ceiling Struts: Minimum 1/4-inch-thick by 1-inch-wide steel.

2.10 FABRICATION

A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.

B. Tolerances: Fabricate hollow metal work to tolerances indicated in SDI 117.

C. Hollow Metal Doors:

1. Exterior Doors: Provide weep-hole openings in bottom of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
2. Glazed Lites: Factory cut openings in doors.
3. Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted.

D. Hollow Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.

1. Full Profile Welded Frames: Weld joints continuously; grind, fill, dress, and make smooth, flush, and not visible.
2. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as doorframe. Fasten members at crossings and to jambs by butt welding.
3. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
5. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
6. Jamb Anchors: Provide number and spacing of anchors as follows:

a. Masonry Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:

1) Two anchors per jamb up to 60 inches high.
2) Three anchors per jamb from 60 to 90 inches high.
3) Four anchors per jamb from 90 to 120 inches high.
4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.

b. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:

1) Three anchors per jamb up to 60 inches high.
2) Four anchors per jamb from 60 to 90 inches high.
3) Five anchors per jamb from 90 to 96 inches high.
4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
5) Two anchors per head for frames above 42 inches wide and mounted in metal-stud partitions.

c. Compression Type: Not less than two anchors in each jamb.
d. Postinstalled Expansion Type: Locate anchors not more than 6 inches from top and bottom of frame. Space anchors not more than 26 inches o.c.

7. Door Silencers: Except on weather-stripped doors, drill stops to receive door silencers as follows. Keep holes clear during construction.

a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

E. Fabricate concealed stiffeners, edge channels, and hardware reinforcement from either cold- or hot-rolled steel sheet.

F. Hardware Preparation: Factory prepare hollow metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Section 087100 - DOOR HARDWARE.

1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
2. Reinforce doors and frames to receive nontemplated, mortised and surface-mounted door hardware.
3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 - ELECTRICAL.

G. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints.

1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow metal work.
2. Multiple Glazed Lites: Provide fixed and removable stops and moldings, so that each glazed lite is capable of being removed independently.
3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
4. Provide loose stops and moldings on inside of hollow metal work.
5. Coordinate rabbet width between fixed and removable stops with type of glazing and type of installation indicated.

2.11 STEEL FINISHES

A. Prime Finish: Apply manufacturer's standard epoxy primer immediately after cleaning and pretreating.

1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.
2. Refer to Section 099000 – PAINTING AND COATING for field-applied coating.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.

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

3.2 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

B. Prior to installation, adjust and securely brace welded hollow metal frames for squareness, alignment, twist, and plumbness to the following tolerances:

1. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
2. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
3. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
4. Plumbness: Plus or minus 1/16 inch, measured at jambs on a perpendicular line from head to floor.

C. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.

B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11.

1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.

    a. At fire-protection-rated openings, install frames according to NFPA 80.
    b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
    c. Install frames with removable glazing stops located on secure side of opening.
    e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
    f. Check plumbness, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.

2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.

    a. Floor anchors may be set with powder-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.

3. Metal-Stud Partitions: Solidly pack insulation behind frames.
4. Masonry Walls: Coordinate installation of frames to allow for filling space between frames and masonry with insulation.
5. Concrete Walls: Solidly fill space between frames and concrete with insulation.
6. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
7. In-Place Gypsum Board Partitions: Secure frames in place with postinstalled expansion anchors through floor anchors at each jamb. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
8. Ceiling Struts: Extend struts vertically from top of frame at each jamb to overhead structural supports or substrates above frame 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. Provide adjustable wedged or bolted anchorage to frame jamb members.
9. Installation Tolerances: Adjust hollow metal door frames for squareness, alignment, twist, and plumb to the following tolerances:

    a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
    b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
    c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
    d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.

C. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.

1. Non-Fire-Rated Standard Steel Doors:

    a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.

b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.

2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
3. Smoke-Control Doors: Install doors according to NFPA 105.

D. Glazing: Comply with hollow metal manufacturer's written instructions.

1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

3.4 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.

C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

D. Metallic-Coated (Galvanized) Surfaces: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION

SECTION 081400

FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Solid-core flush wood doors.
2. Factory finishing for wood doors.
3. Factory fitting flush wood doors to frames and factory machining for hardware.
4. Louvers and glass lites for flush wood doors.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 064020 - INTERIOR ARCHITECTURAL WOODWORK for wood door frames.
2. Section 081430 - STILE AND RAIL WOOD DOORS for other wood doors.
3. Section 087100 - DOOR HARDWARE for hardware for wood doors.
4. Section 088000 - GLAZING for glass and glazing requirements.
5. Section 099000 - PAINTING AND COATING for field finishing of opaque wood doors.

1.3 SUBMITTALS

A. Product Data: For each type of product, including the following:

1. Door core and edge construction, face type, louvers, and trim for openings.
2. Factory-finishing specifications.

B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each type of door; construction details not covered in Product Data; and the following:

1. Door schedule indicating door and frame location, type, size, fire protection rating, and swing.
2. Door elevations, dimension and locations of hardware, lite and louver cutouts, and glazing thicknesses.
3. Details of frame for each frame type, including dimensions and profile.
4. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
5. Dimensions and locations of blocking for hardware attachment.
6. Dimensions and locations of mortises and holes for hardware.

7. Clearances and undercuts.
8. Requirements for veneer matching.
9. Doors to be factory primed or finished and application requirements.

C. Samples for Verification:

1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches for each material and finish. For each wood species and transparent finish, provide set of three samples showing typical range of finish color, sheen, and grain to be expected in finished work.
2. Frames for light openings, 6 inches long, for each material, type, and finish required.

D. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain flush wood doors through one source from a single manufacturer.

B. Quality Standard: Comply with AWI/AWMAC/WI's "Architectural Woodwork Standards," current edition.

C. Quality Standard: In addition to requirements specified, comply with WDMA I.S.1-A, "Architectural Wood Flush Doors."

1. WDMA I.S.1-A Performance Grade: Extra Heavy Duty.

D. Fire-Rated Door Inspector Qualifications: Inspector for field quality-control inspections of fire-rated door assemblies shall comply with qualifications set forth in NFPA 80, Section 5.2.3.1 and the following:

E. Egress Door Inspector Qualifications: Inspector for field quality-control inspections of egress door assemblies shall comply with qualifications set forth in NFPA 101, Section 7.2.1.15.4 and the following:

F. 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 at positive pressure according to NFPA 252 or UL 10C.

1. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
2. Temperature-Rise Limit: At vertical exit enclosures and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.

G. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing in accordance with UL 1784 and installed in compliance with NFPA 105.

H. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Package doors individually in plastic bags or cardboard cartons.

C. Mark each door on top rail with opening number used on Shop Drawings.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, and HVAC system is operating and maintaining temperature and relative humidity at levels designed for building occupants for the remainder of construction period.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form, signed by manufacturer, Installer, and Contractor, in which manufacturer agrees to repair or replace doors that are defective in materials or workmanship, have warped (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section, or show telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.

1. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
2. Warranty shall include hardware installation and replacement of glass and glazing.
3. Warranty shall be in effect during the following period of time from date of Substantial Completion:

a. Solid-Core Interior Doors: Life of installation.

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. Lambton Doors; EnviroDesign Series.
2. Masonite Architectural; Aspiro and Graham Series (formerly Algoma and Marshfield).

a. Cendura Series is not acceptable.

3. Oregon Doors; Architectural Series.
4. VT Industries Inc.; Eggers and Heritage collections.

2.2 DOOR CONSTRUCTION, GENERAL

A. Doors for Transparent Finish:

1. Typical Veneer:

a. Grade: AWI Premium, with AWI Grade AA faces, 4 inch veneer width.
b. Species and Cut: Select White Maple, plain sawn/sliced.
c. Match between Veneer Leaves: Book match.
d. Assembly of Veneer Leaves on Door Faces: Center-balance.

2. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
3. Transom Match: Continuous match.
4. Stiles: Same species as face.
5. Cross-Banding: 1/8 in. high density fiberboard, no added formaldehyde (NAF).
6. Adhesives: WDMA T.M.-6, Type I.

B. Doors for Opaque Finish:

1. Grade: Premium.
2. Faces for Interior Doors: Either medium-density overlay (MDO) or high-density fiberboard (HDF).
3. Stiles: Match face.
4. Cross-Banding: 1/8 in. high density fiberboard, no added formaldehyde (NAF).
5. Adhesives: WDMA T.M.-6, Type I.
6. Factory Primer: Manufacturer’s standard water-based low VOC primer.

2.3 SOLID-CORE DOORS

A. Cores: Comply with the following requirements:

1. Composite Wood, General: CARB II compliant or made with binder containing no added formaldehyde (NAF).
2. Particle Core: ANSI A 208.1, Grade 1-LD-2.
3. Agrifiber Core: ANSI A 208.1, Grade 1-LD-2.
4. Structural Composite Lumber Core: WDMA I.S.10, Timberstrand LSL.
5. Provide doors with structural composite lumber cores instead of particleboard cores at locations where exit devices are indicated or where light or louver cutouts exceed 40% of the door area.

B. Interior Veneer-Faced Doors:

1. Construction: Five plies, hot-pressed, with stiles and rails bonded to core, then entire unit abrasive planed before veneering.

C. Fire-Rated Doors:

1. Construction: Construction and core specified above for type of face indicated or manufacturer's standard mineral-core construction as needed to provide fire rating indicated.

a. Fire Retardant Mineral Core, with no added formaldehyde cross-banding.

2. Blocking: For mineral-core doors, provide composite blocking with improved screw-holding capability approved for use in doors of fire ratings indicated as needed to eliminate through-bolting hardware.

3. 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.

    a. Screw-Holding Capability: 550 lbf per WDMA T.M.-10.

4. Pairs: Provide fire-rated pairs with fire-retardant stiles matching face veneer that are labeled and listed for kinds of applications indicated without formed-steel edges and astragals. Provide stiles with concealed intumescent seals.

2.4 LOUVERS AND LIGHT FRAMES

A. Wood Louvers: Door manufacturer's standard solid-wood louvers, unless otherwise indicated.

1. Wood Species: Same species as door faces.
2. Profile: Flat.

B. Fire Door Louvers (not required on 20 min. doors): Metal louvers with fusible link and closing device, listed and labeled for use in doors with fire rating of one and one-half hours and less.

1. Metal and Finish: Galvanized steel, 0.0396 inch thick, hot-dip zinc coated and factory primed for paint finish.

C. Wood Beads for Light Openings in Wood Doors: Provide manufacturer's standard wood beads unless otherwise indicated.

1. Wood Species: Same species as door faces.
2. Profile: Manufacturer's standard shape.
3. At wood-core doors with 20-minute fire-protection ratings, provide wood beads and metal glazing clips approved for such use.

D. 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.

2.5 GLAZING SYSTEMS

A. Glazing: Provide factory installed glass products in accordance with requirements in Section 088000 - GLAZING.

2.6 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated, with the following uniform clearances and bevels, unless otherwise indicated:

1. Comply with clearance requirements of referenced quality standard for fitting. Comply with requirements in NFPA 80 for fire-rated doors.

B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, ANSI/BHMA/DHI A115-W series standards, and hardware templates.

1. Coordinate measurements of hardware mortises in metal frames to verify dimensions and alignment before factory machining. Drill pilot holes for screws for butt hinges and lock fronts at the factory.
2. Metal Astragals: Factory prime and premachine astragals and formed-steel edges for hardware for pairs of fire-rated doors to receive concealed vertical rod exit devices.

C. Transom and Side Panels: Fabricate matching panels with same construction, exposed surfaces, and finish as specified for associated doors. Finish bottom edges of transoms and top edges of rabbeted doors same as door stiles.

1. Fabricate door and transom panels with full-width, solid-lumber meeting rails. Provide factory-installed spring bolts for concealed attachment into jambs of metal doorframes.

D. Openings: Cut and trim openings through doors to comply with applicable requirements of referenced standards for kind(s) of door(s) required.

1. Light Openings: Trim openings with moldings of material and profile indicated.
2. Louvers: Factory install louvers in prepared openings.
3. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 088000 - GLAZING.

2.7 FACTORY FINISHING

A. Doors for Opaque Finish: Factory prime faces and edges of doors, including cutouts, with one coat of wood primer specified in Section 099000 - PAINTING AND COATING.

B. Doors for Transparent Finish: Factory finish doors that are indicated to receive transparent finish. Finish faces and edges of doors, including cutouts.

C. Transparent Finish:

1. Grade: Premium.
2. Finish: WDMA TR-8, UV cured acrylated polyester or urethane.
3. Staining: Provide water-based stain, custom color as selected by Architect.
4. Sheen: Satin.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and installed door frames, with Installer present, before hanging doors.

1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
2. Reject doors with defects.

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

3.2 INSTALLATION

A. Hardware: For installation, see Section 087100 - DOOR HARDWARE.

B. Install doors to comply with manufacturer's written instructions, referenced quality standard, and as indicated.

1. Install fire-rated doors in corresponding fire-rated frames according to NFPA 80.
2. Install smoke- and draft-control doors according to NFPA 105.

C. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

D. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.3 FIELD QUALITY CONTROL

A. Inspection Agency: Engage a qualified inspector to perform inspections and to furnish reports to Architect.

B. Inspections:

1. Fire-Rated Door Inspections: Inspect each fire-rated door in accordance with NFPA 80, Section 5.2.
2. Egress Door Inspections: Inspect each door equipped with panic hardware, each door equipped with fire exit hardware, each door located in an exit enclosure, each electrically controlled egress door, and each door equipped with special locking arrangements in accordance with NFPA 101, Section 7.2.1.15.

C. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.

D. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

E. Prepare and submit separate inspection report for each fire-rated door assembly indicating compliance with each item listed in NFPA 80 and NFPA 101.

3.4 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Protection: Provide temporary protection to ensure work being without damage or deterioration at time of final acceptance. Remove protections and reclean as necessary immediately before final acceptance.

C. 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.

END OF SECTION

SECTION 081430

STILE AND RAIL WOOD DOORS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Stile and rail wood doors, for exterior and interior.
2. Factory finishing for wood doors.
3. Factory fitting stile and rail wood doors to frames and factory machining for hardware.
4. Louvers and glass lites for flush wood doors.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 081400 - FLUSH WOOD DOORS for flush wood doors.
2. Section 087100 - DOOR HARDWARE for hardware for wood doors.
3. Section 088000 - GLAZING for glass and glazing requirements.
4. Section 099000 - PAINTING AND COATING for field-finishing wood doors.

1.3 SUBMITTALS

A. Product Data: For each type of door.

1. Include details of construction and glazing.
2. Include factory-finishing specifications.

B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data, including those for stiles, rails, panels, and moldings (sticking); and other pertinent data.

1. Indicate dimensions and locations of mortises and holes for hardware.
2. Indicate dimensions and locations of cutouts.
3. Indicate requirements for veneer matching.
4. Indicate doors to be factory finished and finish requirements.
5. Indicate fire ratings for fire doors.

C. Samples for Initial Selection: For factory-finished doors.

D. Samples for Verification: Corner sections of doors, approximately 8 by 10 inches, with door faces and edgings representing typical range of color and grain for each species of veneer and solid lumber required.

E. Product Certificates: Signed by door manufacturers.

F. Warranty: Special warranty specified in this Section.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of stile and rail wood door through one source from a single manufacturer.

B. Source Limitations: Obtain stile and rail wood doors of special design and construction from same fabricator as work in Section 064020 - INTERIOR ARCHITECTURAL WOODWORK.

C. Quality Standard for Doors of Special Design and Construction: Comply with AWI's "Architectural Woodwork Quality Standards" unless more stringent requirements are specified.

D. Fire-Rated Wood Doors and Frames: Doors and frames complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 252 or UL 10C.

1. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
2. Temperature-Rise Limit: At vertical exit enclosures and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.

E. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control, based on testing according to UL 1784.

F. Safety Glass: Provide products complying with testing requirements in 16 CFR 1201, for Category II materials, unless those of Category I are expressly indicated and permitted.

G. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Package doors individually in opaque plastic bags.

C. Mark each door on top and bottom edge with opening number used on Shop Drawings.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install interior doors until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature between 60 and

90 deg F and relative humidity between 25 and 55 percent during the remainder of the construction period.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form, signed by manufacturer, Installer, and Contractor, in which manufacturer agrees to repair or replace doors that are defective in materials or workmanship, and have warped (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.

1. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
2. Warranty shall be in effect during the following period of time from date of Substantial Completion:

a. Exterior Doors: Two years.
b. Interior Doors: Five years.

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. Masonite Architectural; Maiman Stile & Rail Doors (formerly Harring).
2. VT Industries Inc.; Eggers Stile & Rail Doors.

2.2 STILE AND RAIL WOOD DOORS

A. General: Use only materials that comply with referenced quality standards unless more stringent requirements are specified.

1. Assemble exterior doors and sidelites, including components, with wet-use adhesives complying with ASTM D 5572 for finger joints and ASTM D 5751 for joints other than finger joints.
2. Assemble interior doors, frames, and sidelites, including components, with either dry-use or wet-use adhesives complying with ASTM D 5572 for finger joints and ASTM D 5751 for joints other than finger joints.

B. Construction, General:

1. Grade of Doors for Transparent Finish: Premium.
2. Wood Species and Cut for Transparent Finish:

a. Exterior Doors: Mahogany.
b. Interior Doors: Match existing.

3. Panel Designs: Drawings indicate panel designs. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

C. Door Construction for Transparent Finish:

1. Stile and Rail Construction: Clear lumber; may be edge glued for width. Select lumber for similarity of grain and color, and arrange for optimum match between adjacent pieces.
2. Raised-Panel Construction: Clear lumber, edge glued for width. Select lumber for similarity of grain and color, and arrange for optimum match between adjacent pieces.

D. Exterior Doors:

1. Stile and Rail Widths: As indicated.
2. Molding Profile: As indicated.
3. Raised-Panel Thickness: As indicated.
4. Glass for Openings: Uncoated, clear, insulating-glass units made from 2 lites of 3.0-mm-thick, fully tempered glass with 1/4-inch interspace complying with Section 088000 - GLAZING.

E. Interior Doors:

1. Stile and Rail Widths: As indicated.
2. Molding Profile: As indicated.
3. Raised-Panel Thickness: As indicated.
4. Glass for Openings: Uncoated, clear, fully tempered float glass, 5.0 mm thick complying with Section 088000 - GLAZING.

F. Interior Fire-Rated Doors (20-Minute Rating): Fire-rated doors with 1-3/4-inch-thick stiles and rails and veneered raised panels not less than 1-1/8 inches thick, complying with requirements indicated for interior doors.

1. Edge Construction: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges.
2. Pairs: Provide fire-rated pairs with fire-retardant stiles matching face veneer that are labeled and listed for kinds of applications indicated without formed-steel edges and astragals. Provide stiles with concealed intumescent seals.
3. Positive Pressure Fire Doors - Category A - with intumescent concealed in the door edges.

2.3 INTERIOR FIRE-RATED WOOD DOOR FRAMES

A. Available Manufacturers:

1. Algoma Hardwoods, Inc.
2. Eggers Industries; Architectural Door Division.
3. Maiman Company (The).
4. VT Industries Inc.

B. Frames, complete with casings, fabricated from solid fire-retardant-treated wood or from veneered fire-retardant particleboard, fire-retardant medium-density fiberboard, or mineral board.

1. Species: Maple.

2.4 GLAZING SYSTEMS

A. Glazing: Provide factory installed glass products in accordance with requirements in Section 088000 - GLAZING.

B. Glazed Openings: Trim openings indicated for glazing with solid wood moldings, with one side removable.

2.5 FABRICATION

A. Fabricate stile and rail wood doors in sizes indicated for Project-site fitting.

B. Factory fit doors to suit frame-opening sizes indicated, with the following uniform clearances and bevels, unless otherwise indicated:

1. Clearances: Provide 1/8 inch at heads, jambs, and between pairs of doors. Provide 1/2 inch from bottom of door to top of decorative floor finish or covering. Where threshold is shown or scheduled, provide 3/8 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 at lock and hinge edges.
3. Bevel fire-rated doors 1/8 inch in 2 inches on lock edge; trim stiles and rails only to extent permitted by labeling agency.

C. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, DHI A115-W Series standards, and hardware templates.

1. Coordinate measurements of hardware mortises in metal frames to verify dimensions and alignment before factory machining.

D. Exterior Doors: Factory treat exterior doors after fabrication with water-repellent preservative to comply with WDMA I.S.4. Flash top of out swinging doors with manufacturer's standard metal flashing.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and substrates, with Installer present, for suitable conditions where wood stile and rail doors and fire-rated wood doorframes will be installed.

1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with plumb jambs and level heads.
2. Reject doors with defects.

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

3.2 INSTALLATION

A. Install fire-rated wood door frames level, plumb, true, and aligned with adjacent materials. Use concealed shims where necessary for alignment.

1. Countersink fasteners, fill surface flush, and sand smooth.

B. Hardware: For installation, see Section 087100 – DOOR HARDWARE.

C. Install wood doors to comply with manufacturer's written instructions and with referenced quality standard, and as indicated.

1. Install fire-rated doors in corresponding fire-rated frames according to NFPA 80.
2. Install smoke- and draft-control doors according to NFPA 105.

D. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

E. Field-Finished Doors: Refer to the following for finishing requirements:

1. Section 099000 - PAINTING AND COATING.

3.3 ADJUSTING AND PROTECTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Protection: Provide temporary protection to ensure work being without damage or deterioration at time of final acceptance. Remove protections and reclean as necessary immediately before final acceptance.

C. 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.

END OF SECTION

SECTION 083110

ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Access doors and frames for walls and ceilings.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 033000 - CAST-IN-PLACE CONCRETE for blocking out openings for access doors and frames in concrete.
2. Section 042000 - UNIT MASONRY for anchoring and grouting access door frames set in masonry construction.
3. Section 087100 - DOOR HARDWARE for rim cylinder locks and master keying.

1.3 SUBMITTALS

A. Product Data: For each type of access door and frame indicated. Include construction details, fire ratings, materials, individual components and profiles, and finishes.

B. Shop Drawings: Show fabrication and installation details of access doors and frames for each type of substrate. Include plans, elevations, sections, details, and attachments to other work.

C. Samples: For each door face material, at least 3 by 5 inches in size, in specified finish.

D. Access Door and Frame Schedule: Provide complete access door and frame schedule, including types, locations, sizes, latching or locking provisions, and other data pertinent to installation.

E. Ceiling Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted items including access doors and frames, lighting fixtures, diffusers, grilles, speakers, sprinklers, and special trim are shown and coordinated with each other.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of access door and frame through one source from a single manufacturer.

B. Fire-Rated Access Doors and Frames: Units complying with NFPA 80 that are identical to access door and frame assemblies tested for fire-test-response characteristics per the following test method and that are listed and labeled by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

1. NFPA 252 for vertical access doors and frames.
2. ASTM E 119 for horizontal access doors and frames.

C. Size Variations: Obtain Architect's acceptance of manufacturer's standard-size units, which may vary slightly from sizes indicated.

1.5 COORDINATION

A. Verification: Determine specific locations and sizes for access doors needed to gain access to concealed plumbing, mechanical, or other concealed work, and indicate in the schedule specified in "Submittals" Article.

PART 2 - PRODUCTS

2.1 STEEL MATERIALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

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. Steel Sheet: Electrolytic zinc-coated, ASTM A 879/A 879M with cold-rolled steel sheet substrate complying with ASTM A 1008/A 1008M, Commercial Steel (CS), exposed.

C. Steel Finishes: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Surface Preparation for Steel Sheet: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, or other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or SSPC-SP 8, "Pickling."

a. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

2. Factory-Primed Finish: Apply shop primer immediately after cleaning and pretreating.

D. Drywall Beads: Edge trim formed from 0.0299-inch zinc-coated steel sheet formed to receive joint compound and in size to suit thickness of gypsum board.

2.2 STAINLESS-STEEL MATERIALS

A. Rolled-Stainless-Steel Floor Plate: ASTM A 793, manufacturer's standard finish.

B. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 316. Remove tool and die marks and stretch lines or blend into finish.

1. Finish: Directional Satin Finish, No. 4.

2.3 ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS

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. Acudor Products, Inc.
2. Babcock-Davis.
3. Dur-Red Products.
4. JL Industries (a division of Activar Construction Products Group).
5. Karp Associates, Inc.
6. Larsen's Manufacturing Company.
7. Milcor Inc.
8. Nystrom, Inc.

B. Flush Access Doors and Trimless Frames: Fabricated from steel sheet at typical areas and from stainless-steel sheet at toilet and wet areas.

1. Locations: Wall and ceiling surfaces.
2. Door: Minimum 0.060-inch-thick sheet metal, set flush with surrounding finish surfaces.
3. Frame: Minimum 0.060-inch-thick sheet metal with drywall bead flange.
4. Hinges: Continuous piano.
5. Lock: Cylinder.

a. Lock Preparation: Prepare door panel to accept cylinder specified in Section 087100, DOOR HARDWARE.

C. Recessed Access Doors and Trimless Frames: Fabricated from steel sheet at typical areas and from stainless-steel sheet at toilet and wet areas.

1. Locations: Wall and ceiling surfaces.
2. Door: Minimum 0.060-inch-thick sheet metal in the form of a pan recessed 5/8 inch for gypsum board infill.
3. Frame: Minimum 0.060-inch-thick sheet metal with drywall bead for gypsum board surfaces.
4. Hinges: Concealed pivoting rod hinge.
5. Lock: Cylinder.

a. Lock Preparation: Prepare door panel to accept cylinder specified in Section 087100, DOOR HARDWARE.

D. Fire Rated, Uninsulated, Flush Access Doors and Frames with Exposed Trim: Fabricated from steel at typical areas and from stainless-steel sheet at toilets and wet areas.

1. Locations: Wall surfaces.
2. Fire-Resistance Rating: Not less than that of adjacent construction.
3. Door: Minimum 0.060-inch-thick sheet metal, flush construction.
4. Frame: Minimum 0.060-inch-thick sheet metal with 1-inch-wide, surface-mounted trim.
5. Hinges: Continuous piano.
6. Automatic Closer: Spring type.
7. Lock: Self-latching device with cylinder lock.

a. Lock Preparation: Prepare door panel to accept cylinder specified in Section 087100, DOOR HARDWARE

2.4 FABRICATION

A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.

B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access panels to types of supports indicated.

1. For trimless frames with drywall bead, provide edge trim for gypsum board and gypsum base securely attached to perimeter of frames.
2. For trimless frames with plaster bead for full-bed plaster applications, provide zinc-coated expanded metal lath and exposed casing bead welded to perimeter of frames.
3. Provide mounting holes in frames for attachment of units to metal or wood framing.
4. Provide mounting holes in frame for attachment of masonry anchors.

D. Recessed Access Doors: Form face of panel to provide recess for application of applied finish. Reinforce panel as required to prevent buckling.

1. For recessed doors with plaster infill, provide self-furring expanded metal lath attached to door panel.

E. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.

1. For cylinder lock, furnish two keys per lock and key all locks alike.
2. For recessed panel doors, provide access sleeves for each locking device. Furnish plastic grommets and install in holes cut through finish.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with manufacturer's written instructions for installing access doors and frames.

B. Set frames accurately in position and attach securely to supports with plane of face panels aligned with adjacent finish surfaces.

C. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

3.2 ADJUSTING AND CLEANING

A. Adjust doors and hardware after installation for proper operation.

B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF SECTION

SECTION 083310

OVERHEAD COILING DOORS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Manually-operated and electric-motor-operated overhead coiling doors of the following types:
   a. Insulated service doors.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 055000 - METAL FABRICATIONS for miscellaneous steel supports.
2. Section 087100 - DOOR HARDWARE for lock cylinders and keying.
3. Division 26 - ELECTRICAL for electrical service and connections for powered operators and accessories.

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide overhead coiling doors capable of withstanding the effects of gravity loads and the following loads and stresses without evidencing permanent deformation of door components:

1. Wind Load: Uniform pressure (velocity pressure) required by Code but not less than 20 lbf/sq. ft. acting inward and outward.

B. Operation-Cycle Requirements: Provide overhead coiling door components and operators capable of operating for not less than 20,000 cycles and for 10 cycles per day.

1.4 SUBMITTALS

A. Product Data: For each type and size of overhead coiling door and accessory. Include the following:

1. Summary of forces and loads on walls and jambs.
2. Fire-Rated Doors: Include description of fire-release system including testing and resetting instructions.

B. Shop Drawings: For special components and installations not dimensioned or detailed in manufacturer's product data.

C. Qualification Data: For Installer.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for both installation and maintenance of units required for this Project.

B. Source Limitations: Obtain overhead coiling doors through one source from a single manufacturer.

1. Obtain operators and controls from overhead coiling door manufacturer.

C. Fire-Test-Response Characteristics: Provide assemblies complying with NFPA 80 that are identical to door and frame assemblies tested for fire-test-response characteristics per UL 10b and NFPA 252, and that are listed and labeled for fire ratings indicated by UL, FMG, ITS, or another testing and inspecting agency acceptable to authorities having jurisdiction.

D. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a testing agency acceptable to authorities having jurisdiction that doors comply with all standard construction requirements of tested and labeled fire-rated door assemblies except for size.

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. CornellCookson Inc.
2. McKEON Door Company.
3. Overhead Door Corp.
4. Raynor Garage Door Co.
5. Wayne-Dalton Corp.

2.2 DOOR CURTAIN MATERIALS AND CONSTRUCTION

A. Door Curtains: Fabricate overhead coiling door curtain of interlocking slats, designed to withstand wind loading indicated, in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:

1. Steel Door Curtain Slats: Zinc-coated (galvanized), cold-rolled structural steel (SS) sheet; complying with ASTM A 653/A 653M, G90 (Z275) coating designation.

a. Minimum Base-Metal (Uncoated) Thickness: 0.0209 inch.
b. Flat profile slats.

2. Insulation: Fill slat with manufacturer's standard rigid cellular polystyrene or polyurethane-foam-type thermal insulation complying with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to ASTM E 84. Enclose insulation completely within metal slat faces.
3. Inside Curtain Slat Face: To match material of outside metal curtain slat.

B. Endlocks and Windlocks for Service Doors: Malleable-iron casings galvanized after fabrication, secured to curtain slats with galvanized rivets or high-strength nylon. Provide locks on not less than alternate curtain slats for curtain alignment and resistance against lateral movement.

C. Endlocks for Counter Doors: Manufacturer's standard locks on not less than alternate curtain slats for curtain alignment and resistance against lateral movement.

D. Bottom Bar for Service Doors: Consisting of 2 angles, each not less than 1-1/2 by 1-1/2 by 1/8 inch thick; galvanized, stainless-steel, or aluminum extrusions to suit type of curtain slats.

E. Bottom Bar for Counter Doors: Manufacturer's standard continuous channel or tubular shape, either stainless steel or aluminum extrusions to suit type of curtain slats.

F. Curtain Jamb Guides for Service Doors: Fabricate curtain jamb guides of steel angles or channels and angles, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Build up units with not less than 3/16-inch-thick galvanized steel sections complying with ASTM A 36/A 36M and ASTM A 123/A 123M. Slot boltholes for guide adjustment. Provide removable stops on guides to prevent overtravel of curtain, and a continuous bar for holding windlocks.

G. Curtain Jamb Guides for Counter Doors: Fabricate curtain jamb guides of material and finish to match curtain slats, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Provide continuous integral wear strips to prevent metal-to-metal contact and to minimize operational noise; with removable stops on guides to prevent overtravel of curtain.

2.3 HOODS AND ACCESSORIES

A. Hood: Form to act as weatherseal and entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Provide closed ends for surface-mounted hoods and provide fascia for any portion of between-jamb mounting projecting beyond wall face. Provide intermediate support brackets as required to prevent sagging.

1. Fabricate hoods for steel doors of minimum 0.028-inch-thick, hot-dip galvanized steel sheet with G90 zinc coating, complying with ASTM A 653/A 653M.
2. Include automatic drop baffle to guard against passage of smoke or flame.

B. Weatherseals: Provide replaceable, adjustable, continuous, compressible weather-stripping gaskets fitted to bottom and top of exterior doors, unless otherwise indicated. At door head, use 1/8-inch-thick, replaceable, continuous sheet secured to inside of hood.

1. Provide motor-operated doors with combination bottom weatherseal and sensor edge.
2. In addition, provide replaceable, adjustable, continuous, flexible, 1/8-inch- thick seals of flexible vinyl, rubber, or neoprene at doorjambs for a weathertight installation.

C. Fabricate locking device assembly with lock, spring-loaded dead bolt, operating handle, cam plate, and adjustable locking bar to engage through slots in tracks. Lock cylinder is specified in Section 087100 - DOOR HARDWARE.

D. If door unit is power operated, provide safety interlock switch to disengage power supply when door is locked.

E. Automatic-Closing Device for Fire-Rated Doors: Provide automatic-closing device that is inoperative during normal door operations, with governor unit complying with requirements of NFPA 80 and with an easily tested and reset release mechanism, and designed to be activated by building fire alarm and detection system and door-holder-release devices.

2.4 COUNTERBALANCING MECHANISM

A. General: Counterbalance doors by means of adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to door curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.

B. Counterbalance Barrel: Fabricate spring barrel of hot-formed, structural-quality, welded or seamless carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats and to limit barrel deflection to not more than 0.03 in./ft. (2.5 mm/m) of span under full load.

C. Provide spring balance of one or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Provide cast-steel barrel plugs to secure ends of springs to barrel and shaft.

D. Fabricate torsion rod for counterbalance shaft of cold-rolled steel, sized to hold fixed spring ends and carry torsional load.

E. Brackets: Provide mounting brackets of manufacturer's standard design, either cast iron or cold-rolled steel plate.

2.5 MANUAL DOOR OPERATOR

A. General: Equip door with manual door operator by door manufacturer.

B. Chain-Hoist Operator: Provide manual chain-hoist operator consisting of endless steel hand chain, chain pocket wheel and guard, and gear-reduction unit with a maximum 25-lbf (111-N) force for door operation. Provide alloy steel hand chain with chain holder secured to operator guide.

C. Push-up Operation: Design counterbalance mechanism so required lift or pull for door operation does not exceed 25-lbf (111-N).

2.6 ELECTRIC DOOR OPERATORS

A. General: Provide electric door operator assembly of size and capacity recommended and provided by door manufacturer for door specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, remote-control stations, control devices, integral gearing for locking door, and accessories required for proper operation.

B. Comply with NFPA 70.

C. Disconnect Device: Provide hand-operated disconnect or mechanism for automatically engaging chain and sprocket operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount disconnect and operator so they are accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.

D. Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency auxiliary operator.

E. Provide control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6, with NFPA 70 Class 2 control circuit, maximum 24-V, ac or dc.

F. Door-Operator Type: Provide wall-, hood-, or bracket-mounted, jackshaft-type door operator unit consisting of electric motor, drive, and chain and sprocket secondary drive.

G. Electric Motors: Provide high-starting torque, reversible, continuous-duty, Class A insulated, electric motors complying with NEMA MG 1; with overload protection; sized to start, accelerate, and operate door in either direction from any position, at not less than 2/3 fps and not more than 1 fps, without exceeding nameplate ratings or service factor.

1. Type: Polyphase, medium-induction type.
2. Service Factor: According to NEMA MG 1, unless otherwise indicated.
3. Coordinate wiring requirements and electrical characteristics of motors with building electrical system.

H. Remote-Control Station: Provide momentary-contact, three-button control station with push-button controls labeled "Open," "Close," and "Stop."

1. Provide interior units, full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 enclosure.

I. Obstruction Detection Device: Provide each motorized door with indicated external automatic safety sensor capable of protecting full width of door opening. Activation of sensor immediately stops and reverses downward door travel.

J. Limit Switches: Provide adjustable switches, interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.

K. Provide electric operators with ADA-compliant audible alarm and visual indicator lights.

L. Radio Control: Provide radio control system consisting of the following:

1. Three-channel universal coaxial receiver to open, close, and stop door, one per operator.
2. Multifunction remote control.
3. Remote antenna mounting kit.

2.7 FINISHES

A. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations

in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

B. Powder-Coat Finish: Manufacturer's standard powder-coat finish consisting of primer and topcoat according to coating manufacturer's written instructions for cleaning, pretreatment, application, thermosetting, and minimum dry film thickness.

1. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install coiling doors and operating equipment complete with necessary hardware, jamb and head molding strips, anchors, inserts, hangers, and equipment supports.

1. Install fire-rated doors to comply with NFPA 80.

3.2 ADJUSTING

A. Lubricate bearings and sliding parts; adjust doors to operate easily, free of warp, twist, or distortion and with weathertight fit around entire perimeter.

3.3 STARTUP SERVICES

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

a. Test door closing when activated by detector or alarm-connected fire-release system. Reset door-closing mechanism after successful test.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner’s maintenance personnel to adjust, operate, and maintain overhead coiling doors.

END OF SECTION

SECTION 083480

SMOKE CONTAINMENT CURTAIN

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Smoke containment system at elevator hoistway entrances.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 055000 - METAL FABRICATIONS for miscellaneous steel supports.
2. Division 26 - ELECTRICAL for electrical service and connections for powered operators and accessories and tie-in to fire alarm system.

1.3 SUBMITTALS

A. Product Data: For each type and size of smoke containment curtain and accessory. Include the following:

1. Summary of forces and loads on walls and jambs.
2. Include description of fire-release system including testing and resetting instructions.

B. Shop Drawings: For special components and installations not dimensioned or detailed in manufacturer's product data.

C. Qualification Data: For Installer.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Minimum five years experience in producing smoke containment systems of the type specified. Manufacturer shall maintain a quality control program in accordance with ICBO-ES Acceptance Criteria AC 77.

B. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for both installation and maintenance of units required for this Project.

C. Source Limitations: Obtain overhead coiling doors through one source from a single manufacturer.

1. Obtain operators and controls from overhead coiling door manufacturer.

D. Fire-Test-Response Characteristics: Provide assemblies complying with NFPA 80 that are identical to door and frame assemblies tested for fire-test-response characteristics per UL 10b and NFPA 252, and that are listed and labeled for fire ratings indicated by UL, FMG, ITS, or another testing and inspecting agency acceptable to authorities having jurisdiction.

E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100.

F. Testing Laboratory Label:

1. UL Listing.
2. OSHPD Anchorage Pre-Approval No. R-0318.

G. Pre-Installation Meeting:

1. Schedule and convene a pre-installation meeting prior to commencement of field operations with representatives of the following in attendance: Owner, Design Professional, Construction Manager, smoke containment system sub-contractor, painting sub-contractor, and electrical sub-contractor.
2. Review substrate conditions, requirements of related work, installation instructions, storage and handling procedures, and protection measures.
3. Keep minutes of meeting including responsibilities of various parties and deviations from specifications and installation instructions.

1.5 TESTS

A. Fire-Resistance: Where fire-resistance ratings are indicated or required by authorities having jurisdiction, provide curtains which are identical to curtains whose fire-resistance rating has been tested in compliance with ASTM E152 by independent agencies acceptable to the Design Professional and authorities having jurisdiction.

B. ASTM A240 - Standard Specification for Heat Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels.

C. ICBO Evaluation Services: AC77 - Acceptance Criteria for Smoke-Containment Systems Used With Fire-Resistive Elevator Hoistway Doors and Frames.

D. NFPA Codes and Standards:

1. 70 - National Electrical Code.
2. 105 - Recommended Practice for the Installation of Smoke-Control Door Assemblies.
3. 72 – National Fire Alarm Code

E. SBCCI Public Safety and Evaluation Services, Inc., Report No 9710 - Smoke Guard.

F. UL Standards:

1. 268 - Smoke Detectors for Fire Protective Signaling Systems.
2. 508 - Industrial Control Equipment.
3. 864 - Control Units for Fire Protective Signaling Systems.

4. 1784 - Air Leakage Tests for Door Assemblies.

G. Air Leakage: Less than 3 cfm per sq. ft. of door opening at 0.1 in water pressure differential at ambient temperature and 400 degrees F tested per IBC 714.2.3 or per 1997 UBC Vol. 3, Standard 7-2, Part II.

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. Model M400 by Smoke Guard Corporation, Boise, ID 83713.

2.2 CURTAIN MATERIALS AND CONSTRUCTION

A. Curtain:

1. Film: Minimum 1 mil (0.025 mm) thick transparent polyimide film reinforced with 100 denier nomex yarn at .25 in (6.35 mm) each way.
2. Magnetic Strips: Flexible multi-pole strips attached to longitudinal edges of film with low modulus silicone adhesive.

B. Housing: 20 gauge, powder coated, cold rolled or stainless steel container and door with concealed hinges, and latch.

C. Auxiliary Rails:

1. Material: 16 gauge ASTM A 240/240M, Type 430, ferretic stainless steel.
2. Size: As shown on Drawings.

D. Cove Bases (required for hoistway openings wider than 48"): 16 gauge ASTM A 240/240M, Type 430, ferretic stainless steel.

E. Rewind Motor: NFPA 70, 12v DC.

F. Release Mechanism: Comply with UL Standard No. 508 or 864.

G. Control Station: Metal box with battery backup, power disconnect with integral circuit breaker, step down power transformer (120v AC to 12v DC), and controller circuit board.

1. Emergency Power Supply: 12v DC battery with charger.

H. Wall Switch: Include switch to rewind curtain into housing, system status indicators, keyed curtain deployment switch, and keyed to silence function.

2.3 IDENTIFICATION

A. Label each smoke containment system with following information:

1. Manufacturer’s name.

2. Maximum leakage rating at specified pressure and temperature conditions.
3. Label of quality control agency.

2.4 ACCESSORIES

A. Provide automatic-closing device that is inoperative during normal door operations, with governor unit complying with requirements of NFPA 80 and with an easily tested and reset release mechanism, and designed to be activated by building fire alarm and detection system and door-holder-release devices.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install coiling doors and operating equipment complete with necessary hardware, jamb and head molding strips, anchors, inserts, hangers, and equipment supports.

1. Install fire-rated curtain to comply with NFPA 80.

3.2 ADJUSTING

A. Lubricate bearings and sliding parts; adjust doors to operate easily, free of warp, twist, or distortion and with weathertight fit around entire perimeter.

3.3 STARTUP SERVICES

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

a. Test door closing when activated by detector or alarm-connected fire-release system. Reset door-closing mechanism after successful test.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner’s maintenance personnel to adjust, operate, and maintain overhead coiling doors.

END OF SECTION

SECTION 083513

GLAZED FOLDING DOORS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Thermally broken aluminum-framed folding glass wall system.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 055000 - METAL FABRICATIONS for miscellaneous steel supports and framing.
2. Section 087100 - DOOR HARDWARE for lock cylinders and keying.
3. Section 061000 - ROUGH CARPENTRY for blocking and supports.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for folding doors.

B. Shop Drawings: For folding doors. Include plans, elevations, sections, details, attachments to other work, clearances required for operation, and accessory items. Show blocking.

C. Setting Drawings: For anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors that are to be embedded in concrete and masonry, and for cutouts required in other work, including support-beam punching template.

D. Samples for Verification: For each type of folding door indicated and for each type of exposed finish required, in manufacturer's standard sizes.

E. Qualification Data: For qualified Installer.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

1.5 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication

PART 2 - PRODUCTS

PART 3 - PRODUCTS

3.1 THERMALLY BROKEN ALUMINUM-FRAMED FOLDING GLASS WALL SYSTEMS

A. Basis-of-Design: Model SL70 by Nana Wall or equal by Solar Innovations or LaCantina.

1. Swing Panel - Operation / Cycling Performance (AAMA 920): 500,000 cycles.
2. System - Life Cycle Performance (DIN EN 1191/12400): 20,000 cycles.
3. Folding Glass Storefront Units tested to AAMA/WDMA/CSA 101/I.S.2/A440.
4. Forced Entry (AAMA 1304 / ATSM F842): Meets requirements for plus F1.
5. Adjustment: Folding and sliding hardware capable of compensation and adjustment without removing panels from tracks. Width Adjustment: 1/16 inch (1.5 mm) per hinge. Height Adjustment: 1/16 inch (1.5 mm) up and down.
6. Hinges: Stainless steel. Stainless steel security hinge pins and set-screws.
7. Fasteners: Tapered pins or stainless screws for connecting frame components.
8. Aluminum Extrusion: AlMgSi0.5 alloy, 6063-T5. Thickness: 0.078 inch (2.0 mm) nominal. Thermally broken with a 3/4 to 15/16 inch (20 to 24 mm) wide polyamide plastic reinforced with glass fibers.
9. Aluminum Finish Powder Coating: AAMA 2605, PVDF Kynar finish, standard color as selected.
10. Sliding and Folding System:

    a. Manufacturer's combination sliding and folding hardware with top, bottom tracks and threshold.
    b. Running carriages to have sealed, self-lubricating, ball bearing multi-rollers.
    c. Surface mounted hinges and running carriages will not be allowed.
    d. Weight of panels supported by the bottom of the track will not be allowed.

11. Mounting: Upper guide carriage and lower running carriage with four vertical stainless steel wheels and two horizontal polyamide plastic wheels. The vertical wheels to ride on top of sill track and lie above the water run-off level. Carrying capacity of lower running carriage to be 440 lbs (200 kg).
12. Aluminum Thresholds: Thermally broken with polyamide, raised sill. Finish to match panel finish.
13. Glazing: 15/16 inch tempered insulating glass units, low-e coating, spacers to match frame, selected from manufacturer's standard spacer colors. Source from same source as storefront glazing.

PART 4 - EXECUTION

4.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of folding doors.

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

4.2 PREPARATION

A. For folding doors supported by or anchored to permanent construction, advise installers of specific requirements for placement of anchorage devices. Furnish installers of other work with templates and drawings showing locations of anchorage devices and similar items.

4.3 INSTALLATION

A. Install frame in accordance with manufacturer's recommendations and installation instructions. Properly flash and waterproof around the perimeter of the opening.

B. Securely attach anchorage devices to rigidly fit frame in place, level, straight, plumb and square. Install frame in proper elevation, plane and location, and in proper alignment with other work.

C. When lower track is designed to drain, provide connections to allow for drainage.

D. Install panels, handles, lockset and accessories in accordance with manufacturer’s recommendations and instructions.

4.4 ADJUSTING

A. Adjust units as necessary to ensure smooth, quiet operation without warping or binding. Adjust hardware to function smoothly. Confirm that latches engage accurately and securely without forcing or binding.

END OF SECTION

SECTION 084110

ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Exterior and interior aluminum-framed storefronts.
2. Exterior and interior manual-swing aluminum doors.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 079200 - JOINT SEALANTS for installation of joint sealants installed with aluminum-framed systems and for sealants to the extent not specified in this Section.
2. Section 087100 - DOOR HARDWARE for lock cylinders and keying.
3. Section 088000 - GLAZING for glazing requirements to the extent not specified in this Section.
4. Section 089000 - LOUVERS AND VENTS for units installed with aluminum-framed systems.

1.3 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design entrance and storefront system, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. General: Provide aluminum-framed systems, including anchorage, capable of withstanding, without failure, the effects of the following:

1. Structural loads.
2. Thermal movements.
3. Dimensional tolerances of building frame and other adjacent construction.
4. Failure includes the following:

a. Deflection exceeding specified limits.
b. Thermal stresses transferred to building structure.
c. Framing members transferring stresses, including those caused by thermal and structural movements, to glazing.
d. Noise or vibration created by wind and thermal and structural movements.

e. Loosening or weakening of fasteners, attachments, and other components.
f. Sealant failure.
g. Failure of operating units to function properly.

C. Structural Loads: Wind and seismic loads as indicated on the Structural Drawings, but not less than that required by Code.

D. Deflection of Framing Members:

1. Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans up to 13 feet 6 inches (and to 1/240 of clear span plus 1/4 inch for spans greater than 13 feet 6 inches or an amount that restricts edge deflection of individual glazing lites to 3/4 inch, whichever is less.
2. Deflection Parallel to Glazing Plane: Limited to 1/360 of clear span or 1/8 inch, whichever is smaller, amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components directly below to less than 1/8 inch and clearance between members and operable units directly below to less than 1/16 inch.

E. Thermal Movements: Provide aluminum-framed systems that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

F. Air Infiltration: Provide doors and storefront which comply with the following. Test unit in accordance with ASTM E 283.

1. Swinging Entrance Doors, ASHRAE Requirement: 1.0 cfm/sf maximum air leakage at a pressure differential of 1.57 psf.
2. Storefront, ASHRAE Requirement: 0.06 cfm/sf maximum air leakage at a pressure differential of 1.57 psf or higher.

G. Water Leakage Test: Test fixed framing system in accordance with ASTM E 331.

1. Test Pressure: 8 psf.
2. Performance: No leakage as defined in test method at specified test pressure. No uncontrolled water penetrating system or appearing on normally exposed interior surfaces.

H. Solar Heat-Gain Coefficient: Provide units with a whole-unit SHGC maximum as required by Code, determined according to NFRC 200 procedures. Submit proof of compliance with submittals as specified.

I. Thermal Transmittance: Provide window units that have a U-value as required by Code rated in BTU/hour/sq. ft./degrees F at 15-mph exterior wind velocity, when tested in accordance with AAMA 1503.1. Test unit to be 4 ft. x 6 ft. Submit proof of compliance with submittals as specified.

J. Condensation Resistance: Provide aluminum-framed systems with fixed glazing and framing areas having condensation-resistance factor (CRF) of not less than 65 for fixed storefront units and not less than 55 for doors when tested according to AAMA 1503.

1.4 SUBMITTALS

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

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For aluminum-framed systems. Include plans, elevations, sections, details, and attachments to other work.

1. Include structural analysis of story drift and deflection from anticipated live loads, and determination whether head receptors are required.
2. Include details of provisions for system expansion and contraction and for draining moisture occurring within the system to the exterior.
3. For entrances, include hardware schedule and indicate operating hardware types, functions, quantities, and locations.

C. Delegated-Design Submittal: For entrance and storefront systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

D. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

E. Qualification Data: For Installer.

F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for aluminum-framed systems.

G. Performance Reports: Based on systems, components and glazing methods proposed for use on this Project, proof that units as glazed for this Project meet or exceed Code requirements for the following:

1. U-value.
2. Solar heat-gain coefficient.

H. Maintenance Data: For aluminum-framed systems to include in maintenance manuals.

I. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

A. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data by a qualified professional engineer.

B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for

installations of entrance and storefront systems that are similar to those indicated for this Project in material, design, and extent.

C. Installer Qualifications: Capable of assuming engineering responsibility and performing work of this Section and who is acceptable to manufacturer.

D. Accessible Entrances: Comply with authorities having jurisdiction, local state building code and the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)."

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of structural supports for aluminum-framed systems by field measurements before fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating aluminum-framed systems without field measurements. Coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.7 WARRANTY

A. Special Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes fail within specified warranty period. Warranty does not include normal weathering.

1. Warranty Period: 10 years from date of Substantial Completion.

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. Storefront, Thermal Break, 2 inch by 4-1/2 inch profile:
   a. EFCO Corporation, 403X.
   b. Kawneer North America, 451UT.
   c. Oldcastle BuildingEnvelope, 3000XT.
   d. Tubelite Inc., TU24000.
   e. YKK AP America Inc., YES 45 XT.

2. Storefront, 1-3/4 inch by 4-1/2 inch profile:
   a. EFCO Corporation, 401 NT.
   b. Kawneer North America, Trifab 400.
   c. Oldcastle BuildingEnvelope, FG-1000.
   d. Tubelite Inc., INT45.
   e. YKK AP America Inc., YES 40 FS.

3. Doors, Medium Stile:

a. EFCO Corporation, D-300.
b. Kawneer North America, 350.
c. Oldcastle BuildingEnvelope, MS-375.
d. Tubelite Inc., Medium.
e. YKK AP America Inc., 35D.

4. Doors, Medium Stile, Thermally-Broken:
   a. EFCO Corporation, D-302.
   b. Kawneer North America, Insulpour 350T.
   c. Oldcastle BuildingEnvelope, MS-375TC.
   d. Tubelite Inc., Medium Thermal Block.
   e. YKK AP America Inc., 35XT.

2.2 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

1. Sheet and Plate: ASTM B 209.
2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
3. Extruded Structural Pipe and Tubes: ASTM B 429.
4. Structural Profiles: ASTM B 308/B 308M.
5. Welding Rods and Bare Electrodes: AWS A5.10/A5.10M.

B. Steel Reinforcement: With manufacturer's standard corrosion-resistant primer complying with SSPC-PS Guide No. 12.00 applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.

1. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
2. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
3. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

2.3 FRAMING SYSTEMS

A. Framing Members: Manufacturer's standard extruded-aluminum framing members of thickness required and reinforced as required to support imposed loads.

1. Construction: Dual thermal-break.

B. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

C. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

1. Where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration, use self-locking devices.
2. Reinforce members as required to receive fastener threads.
3. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system.

D. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123/A 123M or ASTM A 153/A 153M requirements.

E. Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials. Form exposed flashing from sheet aluminum finished to match framing and of sufficient thickness to maintain a flat appearance without visible deflection.

F. Framing System Gaskets and Sealants: Manufacturer's standard recommended by manufacturer for joint type.

2.4 GLAZING SYSTEMS

A. Glazing: As specified in Section 088000 - GLAZING.

B. Glazing Gaskets: Manufacturer's standard compression types, replaceable, molded or extruded, that maintain uniform pressure and watertight seal.

C. Spacers and Setting Blocks: Manufacturer's standard elastomeric types.

2.5 DOORS

A. Doors: Manufacturer's standard glazed doors, for manual swing operation.

1. Door Construction: Mechanical clip fastening, SIGMA deep penetration plus welds and 1-1/8 inch long fillet welds inside and outside of all four corners. Glazing stops shall be hook-in type and EPDM glazing gaskets reinforced with non-stretchable cord.

2.6 DOOR HARDWARE

A. General: Provide heavy-duty units in sizes and types recommended by entrance system and hardware manufacturers for entrances and uses indicated.

1. Opening-Force Requirements:

a. Egress Doors: Not more than 30 lbf required to set door in motion and not more than 15 lbf required to open door to minimum required width.
b. Accessible Interior Doors: Not more than 5 lbf.

B. Hardware Sets: Provide as specified in Section 087100 - DOOR HARDWARE.

2.7 ACCESSORY MATERIALS

A. Insulating Materials: As specified in Section 072100 - THERMAL INSULATION.

B. Joint Sealants: For installation at perimeter of aluminum-framed systems, as specified in Section 079200 - JOINT SEALANTS.

C. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil thickness per coat.

2.8 FABRICATION

A. Form aluminum shapes before finishing.

B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

C. Framing Members, General: Fabricate components that, when assembled, have the following characteristics:

1. Profiles that are sharp, straight, and free of defects or deformations.
2. Accurately fitted joints with ends coped or mitered.
3. Means to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.
4. Physical and thermal isolation of glazing from framing members.
5. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

D. Mechanically Glazed Framing Members: Fabricate for flush glazing (without projecting stops).

E. Door Frames: Reinforce as required to support loads imposed by door operation and for installing hardware.

1. At exterior doors, provide compression weather stripping at fixed stops.
2. At interior doors, provide silencers at stops to prevent metal-to-metal contact. Install three silencers on strike jamb of single-door frames and two silencers on head of frames for pairs of doors.

F. Doors: Reinforce doors as required for installing hardware.

1. At pairs of exterior doors, provide sliding weather stripping retained in adjustable strip mortised into door edge.
2. At exterior doors, provide weather sweeps applied to door bottoms.

G. Hardware Installation: Factory install hardware to the greatest extent possible. Cut, drill, and tap for factory-installed hardware before applying finishes.

H. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.9 ALUMINUM FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

C. High-Performance Organic Finish (2-Coat Fluoropolymer): AA-C12C40R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: conversion coating; Organic Coating: manufacturer's standard 2-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color coat, with color coat containing not less than 70 percent polyvinylidene fluoride resin by weight). Coatings shall be fluorosurfactant free Kynar 500 by Arkema or fluorosurfactant-compliant Hylar 500 by Solvay; or equal. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 2605 and with coating and resin manufacturers' written instructions.

1. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

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

3.2 INSTALLATION

A. General:

1. Comply with manufacturer's written instructions.
2. Do not install damaged components.
3. Fit joints to produce hairline joints free of burrs and distortion.
4. Rigidly secure nonmovement joints.
5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration.
6. Seal joints watertight, unless otherwise indicated.

B. Metal Protection:

1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape or installing nonconductive spacers as recommended by manufacturer for this purpose.
2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.

D. Set continuous sill members and flashing in full sealant bed as specified in Section 079200 - JOINT SEALANTS and to produce weathertight installation.

E. Install components plumb and true in alignment with established lines and grades, without warp or rack.

F. Install glazing as specified in Section 088000 - GLAZING.

1. Structural-Sealant Glazing:

    a. Prepare surfaces that will contact structural sealant according to sealant manufacturer's written instructions to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.
    b. Install weatherseal sealant according to Section 079200 - JOINT SEALANTS and according to sealant manufacturer's written instructions to produce weatherproof joints. Install joint filler behind sealant as recommended by sealant manufacturer.

G. Entrances: Install to produce smooth operation and tight fit at contact points.

1. Exterior Entrances: Install to produce tight fit at weather stripping and weathertight closure.
2. Field-Installed Hardware: Install surface-mounted hardware according to hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

H. Erection Tolerances: Install aluminum-framed systems to comply with the following maximum tolerances:

1. Location and Plane: Limit variation from true location and plane to 1/8 inch in 12 feet; 1/4 inch over total length.
2. Alignment:

    a. Where surfaces abut in line, limit offset from true alignment to 1/16 inch.
    b. Where surfaces meet at corners, limit offset from true alignment to 1/32 inch.

3. Diagonal Measurements: Limit difference between diagonal measurement to 1/8 inch.

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Testing Services: Testing and inspecting of representative areas to determine compliance of installed systems with specified requirements shall take place as follows and in successive stages as indicated on Drawings. Do not proceed with installation of the next area until test results for previously completed areas show compliance with requirements.

1. Air Infiltration: Areas shall be tested for air leakage of 1.5 times the rate specified for laboratory testing under Part 1 "Performance Requirements" Article, but not more than 0.09 cfm/sq. ft. of fixed wall area when tested according to ASTM E 783 at a minimum static-air-pressure difference of 6.24 lbf/sq. ft.
2. Water Penetration: Areas shall be tested according to ASTM E 1105 at a minimum cyclic static-air-pressure difference of 0.67 times the static-air-pressure difference specified for laboratory testing under Part 1 "Performance Requirements" Article, but not less than 4.18 lbf/sq. ft., and shall not evidence water penetration.
3. Water Spray Test: Before installation of interior finishes has begun, a minimum area of 75 feet by 1 story of aluminum-framed systems designated by Architect shall be tested according to AAMA 501.2 and shall not evidence water penetration.

C. Repair or remove work where test results and inspections indicate that it does not comply with specified requirements.

D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.4 ADJUSTING

A. Entrances: Adjust operating hardware for smooth operation according to hardware manufacturers' written instructions.

1. For doors accessible to people with disabilities, adjust closers to provide a 3-second closer sweep period for doors to move from a 70-degree open position to 3 inches from the latch measured to the leading door edge.

END OF SECTION

SECTION 085110

ALUMINUM WINDOWS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Fixed and operable aluminum-framed windows with factory-installed glass and glazing.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 084110 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS.
2. Section 088000 - GLAZING for requirements for glass and glazing.

1.3 PERFORMANCE REQUIREMENTS

A. General: Provide aluminum windows capable of complying with performance requirements indicated, based on testing manufacturer's windows that are representative of those specified and that are of test size indicated below:

1. Minimum size required by AAMA/NWWDA 101/I.S.2.

B. AAMA/NWWDA Performance Requirements: Provide aluminum windows of the performance class and grade indicated that comply with AAMA/NWWDA 101/I.S.2.

1. Performance Class: Architectural Grade AW.
2. Performance Grade: Minimum for performance class indicated.
3. Exception to AAMA/NWWDA 101/I.S.2: In addition to requirements for performance class and performance grade, design glass framing system to limit lateral deflections of glass edges to less than 1/175 of glass-edge length or 3/4 inch whichever is less, at design pressure based on the following:

C. Structural Performance: Provide aluminum windows capable of withstanding the following, including wind loads based on passing AAMA/NWWDA 101/I.S.2, Uniform Load Structural Test, at basic wind speed indicated and as required by Code:

1. Deflection: Design glass framing system to limit lateral deflections of glass edges to less than 1/175 of glass-edge length or 3/4 inch, whichever is less, at design pressure based on structural computations.

2. Wind and Seismic Loads: As indicated on the Structural Drawings, but not less than that required by Code.
3. Movements of supporting structure including, but not limited to, story drift and deflection from uniformly distributed and concentrated live loads as required by Code. Deflection may require special considerations including but not limited to head receptors.

D. Air Infiltration: Maximum rate not more than indicated when tested according to AAMA/NWWDA 101/I.S.2, Air Infiltration Test.

1. Maximum Rate: As required by Code.

E. Water Resistance: No water leakage as defined in AAMA/NWWDA referenced test methods at a water test pressure equaling that indicated, when tested according to AAMA/NWWDA 101/I.S.2, Water Resistance Test.

1. Test Pressure: 15 percent of positive design pressure, but not less than 2.86 lbf/sq. ft. or more than 12 lbf/sq. ft.

F. Condensation-Resistance Factor: Provide aluminum windows tested for thermal performance according to AAMA 1503, showing a CRF of 52 where windows are indicated to be "thermally improved."

G. Thermal Transmittance: Provide aluminum windows with a whole-window U-value maximum indicated at 15-mph exterior wind velocity and winter condition temperatures when tested according to AAMA 1503.

1. U-Value: As required by Code. Submit proof of compliance with submittals as specified.

H. Solar Heat-Gain Coefficient: Provide aluminum windows with a whole-window SHGC maximum as required by Code, determined according to NFRC 200 procedures. Submit proof of compliance with submittals as specified.

I. Thermal Movements: Provide aluminum windows, including anchorage, that accommodate thermal movements of units resulting from the following maximum change (range) in ambient and surface temperatures without buckling, distortion, opening of joints, failure of joint sealants, damaging loads and stresses on glazing and connections, and other detrimental effects. Base engineering calculation on actual surface temperatures of materials due to solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F material surfaces.

1.4 SUBMITTALS

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

1. Include construction details, material descriptions, fabrication methods, dimensions of individual components and profiles, hardware, finishes, and operating instructions.

B. Shop Drawings: Include plans, elevations, sections, details, hardware, attachments to other Work, operational clearances, and the following:

1. Mullion details, including reinforcement and stiffeners.

2. Joinery details.
3. Expansion provisions.
4. Flashing and drainage details.
5. Weather-stripping details.
6. Thermal-break details.
7. Glazing details.
8. Window cleaning provisions.
9. Window System Operators: Show locations, mounting, and details for installing operator components and controls.
10. 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 and used to determine the following:

    a. Structural test pressures and design pressures from basic wind speeds indicated.
    b. Deflection limitations of glass framing systems.

C. Samples for Verification: Full-size operable window of each type of window.

D. Qualification Data: For Installer, professional engineer and testing agency.

E. Field Quality-Control Test Reports: From a qualified testing and inspecting agency engaged by Contractor.

F. Product Test Reports: Based on evaluation of comprehensive tests performed within the last four years by a qualified testing agency, for each type, grade, and size of aluminum window. Test results based on use of downsized test units will not be accepted.

G. Performance Reports: Based on systems, components and glazing methods proposed for use on this Project, proof that windows as glazed for this Project meet or exceed Code requirements for the following:

1. U-value.
2. Solar heat-gain coefficient.

H. Maintenance Data: For operable window sash, operating hardware, weather stripping, and finishes to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An installer acceptable to aluminum window manufacturer for installation of units required for this Project.

B. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data by a qualified professional engineer.

C. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the state the project is located, and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of windows that are similar to those indicated for this Project in material, design, and extent.

D. Source Limitations: Obtain aluminum windows through one source from a single manufacturer.

E. Product Options: Information on Drawings and in Specifications establishes requirements for aluminum windows' aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance.

F. Fenestration Standard: Comply with AAMA/NWWDA 101/I.S.2, "Voluntary Specifications for Aluminum, Vinyl (PVC) and Wood Windows and Glass Doors," for minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.

1. Provide AAMA certified aluminum windows with an attached label.

G. Glazing Publications: Comply with published recommendations of glass manufacturers and GANA's "Glazing Manual" unless more stringent requirements are indicated.

H. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockup for types of windows indicated, in locations shown on Drawings.

I. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01. Review methods and procedures related to aluminum windows including, but not limited to, the following:

1. Inspect and discuss condition of substrate and other preparatory work performed by other trades.
2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
3. Review required testing and inspecting procedures.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify aluminum window openings 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 opening dimensions and proceed with fabricating aluminum windows without field measurements. Coordinate wall construction to ensure that actual opening dimensions correspond to established dimensions.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace aluminum windows that fail in materials or workmanship within specified warranty period. Failures include, but are not limited to, the following:

1. Failure to meet performance requirements.
2. Structural failures including excessive deflection.
3. Water leakage, air infiltration, or condensation.
4. Faulty operation of movable sash and hardware.

5. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
6. Insulating glass failure.

B. Warranty Period: Ten years from date of Substantial Completion.

C. Warranty Period for Metal Finishes: Ten years from date of Substantial Completion.

D. Warranty Period for Glass: Ten years from date of Substantial Completion.

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. EFCO, a Pella Company.
2. Graham Architectural Products Corp.
3. Kawneer North America.
4. Peerless Products, Inc.
5. Wausau Window and Wall Systems.

2.2 MATERIALS

A. Aluminum Extrusions: Alloy and temper recommended by aluminum window manufacturer for strength, corrosion resistance, and application of required finish, but not less than 22,000-psi (150-MPa) ultimate tensile strength, not less than 16,000-psi (110-MPa) minimum yield strength, and not less than 0.062-inch (1.6-mm) thickness at any location for the main frame and sash members.

B. Fasteners: Aluminum, nonmagnetic stainless steel, epoxy adhesive, or other materials warranted by manufacturer to be noncorrosive and compatible with aluminum window members, trim, hardware, anchors, and other components.

1. Reinforcement: Where fasteners screw anchor into aluminum less than 0.125 inch (3.2 mm) thick, reinforce interior with aluminum or nonmagnetic stainless steel to receive screw threads, or provide standard, noncorrosive, pressed-in, splined grommet nuts.
2. Exposed Fasteners: Unless unavoidable for applying hardware, do not use exposed fasteners. For application of hardware, use fasteners that match finish of member or hardware being fastened, as appropriate.

C. Anchors, Clips, and Accessories: Aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated.

D. Reinforcing Members: Aluminum, nonmagnetic stainless steel, or nickel/chrome-plated steel complying with ASTM B 456 for Type SC 3 severe service conditions, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated.

E. Compression-Type Weather Stripping, typical: Provide compressible weather stripping designed for permanently resilient sealing under bumper or wiper action and for complete concealment when aluminum window is closed.

F. Sliding-Type Weather Stripping for Double-Hung and Horizontal-Sliding Windows: Provide woven-pile weather stripping of wool, polypropylene, or nylon pile and resin-impregnated backing fabric. Comply with AAMA 701/702.

1. Weather Seals: Provide weather stripping with integral barrier fin or fins of semirigid, polypropylene sheet or polypropylene-coated material. Comply with AAMA 701/702.

G. Replaceable Weather Seals: Comply with AAMA 701/702.

H. Sealant: For sealants required within fabricated windows, provide window manufacturer's standard, permanently elastic, nonshrinking, and nonmigrating type recommended by sealant manufacturer for joint size and movement.

2.3 GLAZING

A. Insulating-Glass Units for Vertical Glazing: 1 inch thick (25.0 mm) insulating glass consisting of two lites of 1/4 inch (6 mm) glass, low e coating on the No. 2 surface and argon gas filled. Provide one of the following or equal:

1. Guardian Industries; SN-68.

a. Visible Light Transmittance: 68 percent.
b. Reflectance Visible Light: 10 percent.
c. U Value (Winter): 0.29.
d. Shading Coefficient: 0.43.
e. Solar Heat Gain Coefficient: 0.37.

2. Viracon; VE1-2M.

a. Visible Light Transmittance: 70 percent.
b. Reflectance Visible Light: 11 percent.
c. U Value (Winter): 0.25.
d. Shading Coefficient: 0.43.
e. Solar Heat Gain Coefficient: 0.37.

3. Vitro Architectural Glass (formerly PPG Industries); Solarban 60.

a. Visible Light Transmittance: 70 percent.
b. Reflectance Visible Light: 11 percent.
c. U Value (Winter): 0.29.
d. Shading Coefficient: 0.44.
e. Solar Heat Gain Coefficient: 0.38.

B. Glazing System: Manufacturer's standard factory-glazing system that produces weathertight seal.

2.4 HARDWARE

A. Hardware Requirements: Provide hardware that complies with AAMA/NWWDA 101/I.S.2.

1. Hardware Finishes: To be selected by Architect from manufacturer’s full range.

2.5 INSECT SCREENS

A. General: Design windows and hardware to accommodate screens in a tight-fitting, removable arrangement, with a minimum of exposed fasteners and latches. Provide for each operable exterior sash or ventilator.

B. Aluminum Insect Screen Frames: Manufacturer's standard aluminum alloy complying with SMA 1004. Fabricate frames with mitered or coped joints, concealed fasteners, and removable PVC spline/anchor concealing edge of frame.

1. Aluminum Tubular Framing Sections and Cross Braces: Roll formed from aluminum sheet with minimum wall thickness as required for class indicated.
2. Finish: Match aluminum window members.

C. Stainless-Steel Wire Fabric: 18-by-16 mesh of 0.009-inch-diameter, nonmagnetic stainless-steel wire, Type 304 or 316, complying with FS RR-W-365, Type VI.

D. Wickets: Not permitted.

2.6 ACCESSORIES

A. Window Cleaner Anchor Bolts: Provide window cleaner anchor bolts of standard design, complying with requirements of authorities having jurisdiction. Fabricate bolts of nonmagnetic stainless steel.

1. Reinforce window units or mullions to receive bolts and provide additional anchorage of units at bolt locations.

2.7 FABRICATION

A. General: Fabricate aluminum windows, in sizes indicated, that comply with AAMA/NWWDA 101/I.S.2 for performance class and performance grade indicated. Include a complete system for assembling components and anchoring windows.

B. Thermally Improved Construction: Fabricate aluminum windows with an integral, concealed, low-conductance thermal barrier; located between exterior materials and window members exposed on interior side; in a manner that eliminates direct metal-to-metal contact.

C. Weather Stripping: Provide full-perimeter weather stripping for each operable sash and ventilator.

D. Weep Holes: Provide concealed weep holes and internal passages to conduct infiltrating water to exterior.

E. Mullions: Provide mullions and cover plates as shown, matching window units, complete with anchors for support to structure and installation of window units. Allow for erection tolerances

and provide for movement of window units due to thermal expansion and building deflections, as indicated. Provide mullions and cover plates capable of withstanding design loads of window units.

F. Factory-Glazed Fabrication: Glaze aluminum windows in the factory where practical and possible for applications indicated. Comply with AAMA/NWWDA 101/I.S.2.

2.8 FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

C. High-Performance Organic Finish (2-Coat Fluoropolymer): AA-C12C40R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: conversion coating; Organic Coating: manufacturer's standard 2-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color coat, with color coat containing not less than 70 percent polyvinylidene fluoride resin by weight). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 2605 and with coating and resin manufacturers' written instructions.

1. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances; rough opening dimensions; levelness of sill plate; coordination with wall flashings, vapor retarders, and other built-in components; operational clearances; and other conditions affecting performance of work.

1. Masonry Surfaces: Visibly dry and free of excess mortar, sand, and other construction debris.
2. Metal Surfaces: Dry; clean; free of grease, oil, dirt, rust, corrosion, and welding slag; without sharp edges or offsets at joints.

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

3.2 INSTALLATION

A. General: Comply with manufacturer's written instructions for installing windows, hardware, accessories, and other components; Drawings; and Shop Drawings.

B. Install windows level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction.

C. Set sill members in bed of sealant or with gaskets, as indicated, for weathertight construction.

D. Install windows and components to drain condensation, water penetrating joints, and moisture migrating within windows to the exterior.

E. Metal Protection: Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials by complying with requirements specified in "Dissimilar Materials" Paragraph in Appendix B in AAMA/NWWDA 101/I.S.2.

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and to prepare test reports.

B. Testing Services: Testing and inspecting of installed windows shall take place as follows:

1. Testing Methodology: Testing of windows for air infiltration and water resistance shall be performed according to AAMA 502.
2. Air-Infiltration Testing:

    a. Test Pressure: That required to determine compliance with AAMA/WDMA/CSA 101/I.S.2/A440 performance class indicated.
    b. Allowable Air-Leakage Rate: 1.5 times the applicable AAMA/WDMA/CSA 101/I.S.2/A440 rate for product type and performance class rounded down to one decimal place.

3. Water-Resistance Testing:

    a. Test Pressure: Two-thirds times test pressure required to determine compliance with AAMA/WDMA/CSA 101/I.S.2/A440 performance grade indicated.
    b. Allowable Water Infiltration: No water penetration.

4. Testing Extent: Three windows of each type as selected by Architect and a qualified independent testing and inspecting agency. Windows shall be tested after perimeter sealants have cured.
5. Test Reports: Prepared according to AAMA 502.

C. Remove and replace windows where test results indicate that they do not comply with specified requirements.

D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.4 ADJUSTING

A. Adjust operating sashes and ventilators, screens, hardware, operators, and accessories for a tight fit at contact points and weather stripping for smooth operation and weathertight closure. Lubricate hardware and moving parts.

3.5 PROTECTION AND CLEANING

A. Protect window surfaces from contact with contaminating substances resulting from construction operations. In addition, monitor window surfaces adjacent to and below exterior concrete and masonry surfaces during construction for presence of dirt, scum, alkaline deposits,

stains, or other contaminants. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written recommendations.

B. Clean aluminum surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.

C. Clean factory-glazed glass immediately after installing windows. Comply with manufacturer's written recommendations for final cleaning and maintenance. Remove nonpermanent labels and clean surfaces.

D. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

END OF SECTION

SECTION 085115

ALUMINUM WINDOW WALL

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Fixed and operable aluminum-framed window wall systems with factory-installed glass and glazing.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 088000 - GLAZING for requirements for glass and glazing.

1.3 PERFORMANCE REQUIREMENTS

A. General: Provide aluminum windows capable of complying with performance requirements indicated, based on testing manufacturer's windows that are representative of those specified and that are of test size indicated below:

1. Minimum size required by AAMA/NWWDA 101/I.S.2.

B. AAMA/NWWDA Performance Requirements: Provide aluminum windows of the performance class and grade indicated that comply with AAMA/NWWDA 101/I.S.2.

1. Performance Class: Architectural Grade AW.
2. Performance Grade: Minimum for performance class indicated.
3. Exception to AAMA/NWWDA 101/I.S.2: In addition to requirements for performance class and performance grade, design glass framing system to limit lateral deflections of glass edges to less than 1/175 of glass-edge length or 3/4 inch whichever is less, at design pressure based on the following:

C. Structural Performance: Provide aluminum windows capable of withstanding the following, including wind loads based on passing AAMA/NWWDA 101/I.S.2, Uniform Load Structural Test, at basic wind speed indicated and as required by Code:

1. Deflection: Design glass framing system to limit lateral deflections of glass edges to less than 1/175 of glass-edge length or 3/4 inch, whichever is less, at design pressure based on structural computations.

2. Wind and Seismic Loads: As indicated on the Structural Drawings, but not less than that required by Code.
3. Movements of supporting structure including, but not limited to, story drift and deflection from uniformly distributed and concentrated live loads as required by Code. Deflection may require special considerations including but not limited to head receptors.

D. Air Infiltration: Maximum rate not more than indicated when tested according to AAMA/NWWDA 101/I.S.2, Air Infiltration Test.

1. Maximum Rate: As required by Code.

E. Water Resistance: No water leakage as defined in AAMA/NWWDA referenced test methods at a water test pressure equaling that indicated, when tested according to AAMA/NWWDA 101/I.S.2, Water Resistance Test.

1. Test Pressure: 15 percent of positive design pressure, but not less than 2.86 lbf/sq. ft. or more than 12 lbf/sq. ft.

F. Condensation-Resistance Factor: Provide aluminum windows tested for thermal performance according to AAMA 1503, showing a CRF of 52 where windows are indicated to be "thermally improved."

G. Thermal Transmittance: Provide aluminum windows with a whole-window U-value maximum indicated at 15-mph exterior wind velocity and winter condition temperatures when tested according to AAMA 1503.

1. U-Value: As required by Code. Submit proof of compliance with submittals as specified.

H. Solar Heat-Gain Coefficient: Provide aluminum windows with a whole-window SHGC maximum as required by Code, determined according to NFRC 200 procedures. Submit proof of compliance with submittals as specified.

I. Thermal Movements: Provide aluminum windows, including anchorage, that accommodate thermal movements of units resulting from the following maximum change (range) in ambient and surface temperatures without buckling, distortion, opening of joints, failure of joint sealants, damaging loads and stresses on glazing and connections, and other detrimental effects. Base engineering calculation on actual surface temperatures of materials due to solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F material surfaces.

1.4 SUBMITTALS

A. Product Data: Include construction details, material descriptions, fabrication methods, dimensions of individual components and profiles, hardware, finishes, and operating instructions for each type of aluminum window indicated.

B. Shop Drawings: Include plans, elevations, sections, details, hardware, attachments to other Work, operational clearances, and the following:

1. Mullion details, including reinforcement and stiffeners.
2. Joinery details.

3. Expansion provisions.
4. Flashing and drainage details.
5. Weather-stripping details.
6. Thermal-break details.
7. Glazing details.
8. Window cleaning provisions.
9. Window System Operators: Show locations, mounting, and details for installing operator components and controls.
10. 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 and used to determine the following:

    a. Structural test pressures and design pressures from basic wind speeds indicated.
    b. Deflection limitations of glass framing systems.

C. Samples for Verification: Full-size operable window of each type of window.

D. Qualification Data: For Installer, professional engineer and testing agency.

E. Field Quality-Control Test Reports: From a qualified testing and inspecting agency engaged by Contractor.

F. Product Test Reports: Based on evaluation of comprehensive tests performed within the last four years by a qualified testing agency, for each type, grade, and size of aluminum window. Test results based on use of downsized test units will not be accepted.

G. Performance Reports: Based on systems, components and glazing methods proposed for use on this Project, proof that windows as glazed for this Project meet or exceed Code requirements for the following:

1. U-value.
2. Solar heat-gain coefficient.

H. Maintenance Data: For operable window sash, operating hardware, weather stripping, and finishes to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An installer acceptable to aluminum window manufacturer for installation of units required for this Project.

B. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data by a qualified professional engineer.

C. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the state the project is located, and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of windows that are similar to those indicated for this Project in material, design, and extent.

D. Source Limitations: Obtain aluminum windows, storefronts, and window walls through one source from a single manufacturer.

E. Product Options: Information on Drawings and in Specifications establishes requirements for aluminum windows' aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance.

F. Fenestration Standard: Comply with AAMA/NWWDA 101/I.S.2, "Voluntary Specifications for Aluminum, Vinyl (PVC) and Wood Windows and Glass Doors," for minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.

1. Provide AAMA certified aluminum windows with an attached label.

G. Glazing Publications: Comply with published recommendations of glass manufacturers and GANA's "Glazing Manual" unless more stringent requirements are indicated.

H. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockup for types of windows indicated, in locations shown on Drawings.

I. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01. Review methods and procedures related to aluminum windows including, but not limited to, the following:

1. Inspect and discuss condition of substrate and other preparatory work performed by other trades.
2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
3. Review required testing and inspecting procedures.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify aluminum window openings 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 opening dimensions and proceed with fabricating aluminum windows without field measurements. Coordinate wall construction to ensure that actual opening dimensions correspond to established dimensions.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace aluminum windows that fail in materials or workmanship within specified warranty period. Failures include, but are not limited to, the following:

1. Failure to meet performance requirements.
2. Structural failures including excessive deflection.
3. Water leakage, air infiltration, or condensation.
4. Faulty operation of movable sash and hardware.

5. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
6. Insulting glass failure.

B. Warranty Period: Ten years from date of Substantial Completion.

C. Warranty Period for Metal Finishes: Ten years from date of Substantial Completion.

D. Warranty Period for Glass: Ten years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Provide products to match existing of one of the following, that meet or exceed requirements:

1. Wausau Window and Wall Systems.
2. Kawneer North America.
3. Oldcastle BuildingEnvelope.

2.2 MATERIALS

A. Aluminum Extrusions: Alloy and temper recommended by aluminum window manufacturer for strength, corrosion resistance, and application of required finish, but not less than 22,000-psi (150-MPa) ultimate tensile strength, not less than 16,000-psi (110-MPa) minimum yield strength, and not less than 0.062-inch (1.6-mm) thickness at any location for the main frame and sash members.

B. Fasteners: Aluminum, nonmagnetic stainless steel, epoxy adhesive, or other materials warranted by manufacturer to be noncorrosive and compatible with aluminum window members, trim, hardware, anchors, and other components.

1. Reinforcement: Where fasteners screw anchor into aluminum less than 0.125 inch (3.2 mm) thick, reinforce interior with aluminum or nonmagnetic stainless steel to receive screw threads, or provide standard, noncorrosive, pressed-in, splined grommet nuts.
2. Exposed Fasteners: Unless unavoidable for applying hardware, do not use exposed fasteners. For application of hardware, use fasteners that match finish of member or hardware being fastened, as appropriate.

C. Anchors, Clips, and Accessories: Aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated.

D. Reinforcing Members: Aluminum, nonmagnetic stainless steel, or nickel/chrome-plated steel complying with ASTM B 456 for Type SC 3 severe service conditions, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated.

E. Compression-Type Weather Stripping, typical: Provide compressible weather stripping designed for permanently resilient sealing under bumper or wiper action and for complete concealment when aluminum window is closed.

F. Replaceable Weather Seals: Comply with AAMA 701/702.

G. Sealant: For sealants required within fabricated windows, provide window manufacturer's standard, permanently elastic, nonshrinking, and nonmigrating type recommended by sealant manufacturer for joint size and movement.

2.3 GLAZING

A. Insulating-Glass Units for Vertical Glazing: Provide insulating glass unit in accordance with Section 088000 – GLAZING.

B. Glazing System: Manufacturer's standard factory-glazing system that produces weathertight seal.

2.4 HARDWARE

A. Hardware Requirements: Provide hardware that complies with AAMA/NWWDA 101/I.S.2, and in accordance with Section 087100 – DOOR HARDWARE.

2.5 INSECT SCREENS

A. General: Design windows and hardware to accommodate screens in a tight-fitting, removable arrangement, with a minimum of exposed fasteners and latches. Provide for each operable exterior sash or ventilator.

B. Aluminum Insect Screen Frames: Manufacturer's standard aluminum alloy complying with SMA 1004. Fabricate frames with mitered or coped joints, concealed fasteners, and removable PVC spline/anchor concealing edge of frame.

1. Aluminum Tubular Framing Sections and Cross Braces: Roll formed from aluminum sheet with minimum wall thickness as required for class indicated.
2. Finish: Match aluminum window members.

C. Stainless-Steel Wire Fabric: 18-by-16 mesh of 0.009-inch-diameter, nonmagnetic stainless-steel wire, Type 304 or 316, complying with FS RR-W-365, Type VI.

2.6 FABRICATION

A. General: Fabricate aluminum windows, in sizes indicated, that comply with AAMA/NWWDA 101/I.S.2 for performance class and performance grade indicated. Include a complete system for assembling components and anchoring windows.

B. Thermally Improved Construction: Fabricate aluminum windows with an integral, concealed, low-conductance thermal barrier; located between exterior materials and window members exposed on interior side; in a manner that eliminates direct metal-to-metal contact.

C. Weather Stripping: Provide full-perimeter weather stripping for each operable sash and ventilator.

D. Weep Holes: Provide concealed weep holes and internal passages to conduct infiltrating water to exterior.

E. Mullions: Provide mullions and cover plates as shown, matching window units, complete with anchors for support to structure and installation of window units. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections, as indicated. Provide mullions and cover plates capable of withstanding design loads of window units.

F. Factory-Glazed Fabrication: Glaze aluminum windows in the factory where practical and possible for applications indicated. Comply with AAMA/NWWDA 101/I.S.2.

2.7 FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

C. High-Performance Organic Finish (2-Coat Fluoropolymer): AA-C12C40R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: conversion coating; Organic Coating: manufacturer's standard 2-coat, thermocured system consisting of specially formulated inhibitive primer, fluoropolymer color coat, with both coat containing not less than 70 percent polyvinylidene fluoride resin by weight). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 2605 and with coating and resin manufacturers' written instructions.

1. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances; rough opening dimensions; levelness of sill plate; coordination with wall flashings, vapor retarders, and other built-in components; operational clearances; and other conditions affecting performance of work.

1. Masonry Surfaces: Visibly dry and free of excess mortar, sand, and other construction debris.
2. Metal Surfaces: Dry; clean; free of grease, oil, dirt, rust, corrosion, and welding slag; without sharp edges or offsets at joints.

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

3.2 INSTALLATION

A. General: Comply with manufacturer's written instructions for installing windows, hardware, accessories, and other components; Drawings; and Shop Drawings.

B. Install windows level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction.

C. Set sill members in bed of sealant or with gaskets, as indicated, for weathertight construction.

D. Install windows and components to drain condensation, water penetrating joints, and moisture migrating within windows to the exterior.

E. Metal Protection: Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials by complying with requirements specified in "Dissimilar Materials" Paragraph in Appendix B in AAMA/NWWDA 101/I.S.2.

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified independent testing and inspecting agency to perform field tests and inspections and to prepare test reports.

B. Testing Services: Testing and inspecting of installed windows shall take place as follows:

1. Testing Methodology: Testing of windows for air infiltration and water resistance shall be performed according to AAMA 502, Test Method A, by applying same test pressures required to determine compliance with AAMA/NWWDA 101/I.S.2 in Part 1 "Performance Requirements" Article.
2. Testing Extent: Three windows as selected by Architect and a qualified independent testing and inspecting agency. Windows shall be tested immediately after installation.
3. Test Reports: Shall be prepared according to AAMA 502.

C. Remove and replace windows where test results indicate that they do not comply with specified requirements.

D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.4 ADJUSTING

A. Adjust operating sashes and ventilators, screens, hardware, operators, and accessories for a tight fit at contact points and weather stripping for smooth operation and weathertight closure. Lubricate hardware and moving parts.

3.5 PROTECTION AND CLEANING

A. Protect window surfaces from contact with contaminating substances resulting from construction operations. In addition, monitor window surfaces adjacent to and below exterior concrete and masonry surfaces during construction for presence of dirt, scum, alkaline deposits, stains, or other contaminants. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written recommendations.

B. Clean aluminum surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.

C. Clean factory-glazed glass immediately after installing windows. Comply with manufacturer's written recommendations for final cleaning and maintenance. Remove nonpermanent labels and clean surfaces.

D. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

END OF SECTION

SECTION 085200

WOOD WINDOWS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Fixed and operable aluminum-clad wood-framed windows with factory-installed glass and glazing, and with primed wood interior finish.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 088000 - GLAZING for glazing requirements for wood windows, except those specified to be factory glazed.

1.3 PERFORMANCE REQUIREMENTS

A. General: Provide wood windows capable of complying with performance requirements indicated, based on testing manufacturer's windows that are representative of those specified and that are of test size indicated below:

1. Minimum size required by AAMA/NWWDA 101/I.S.2.

B. AAMA/NWWDA Performance Requirements: Provide wood windows of the performance class and grade indicated that comply with AAMA/NWWDA 101/I.S.2.

1. Performance Class: C - Commercial.
2. Performance Grade: Minimum for performance class indicated.
3. Exception to AAMA/NWWDA 101/I.S.2: In addition to requirements for performance class and performance grade, design glass framing system to limit lateral deflections of glass edges to less than 1/175 of glass-edge length or 3/4 inch, whichever is less, at design pressure based on Code requirements.

C. Structural Performance: Provide wood windows capable of withstanding the following, including wind loads based on passing AAMA/NWWDA 101/I.S.2, Uniform Load Structural Test, at basic wind speed indicated:

1. Deflection: Based on passing AAMA/NWWDA 101/I.S.2, Uniform Load Deflection Test.

2. Deflection: Design glass framing system to limit lateral deflections of glass edges to less than 1/175 of glass-edge length or 3/4 inch , whichever is less, at design pressure based on structural computations.
3. Wind Speed: As required by Code.

D. Air Infiltration: Maximum rate not more than indicated when tested according to AAMA/NWWDA 101/I.S.2, Air Infiltration Test.

1. Maximum Rate: As required by Code.

E. Water Resistance: No water leakage as defined in AAMA/NWWDA referenced test methods at a water test pressure equaling that indicated, when tested according to AAMA/NWWDA 101/I.S.2, Water Resistance Test.

1. Test Pressure: 15 percent of positive design pressure, but not less than 2.86 lbf/sq. ft. or more than 12 lbf/sq. ft..

F. Thermal Transmittance: Provide wood windows with a whole-window U-value maximum indicated at 15-mph exterior wind velocity and winter condition temperatures when tested according to AAMA 1503.

1. U-Value: As required by Code.

G. Solar Heat-Gain Coefficient: Provide wood windows with a whole-window SHGC maximum as required by Code determined according to NFRC 200 procedures. Submit proof of compliance with submittals as specified.

1.4 SUBMITTALS

A. Product Data: Include construction details, material descriptions, fabrication methods, dimensions of individual components and profiles, hardware, finishes, and operating instructions for each type of wood window indicated.

B. Shop Drawings: Include plans, elevations, sections, details, hardware, attachments to other Work, operational clearances, and the following:

1. Mullion details, including reinforcement and stiffeners.
2. Joinery details.
3. Expansion provisions.
4. Flashing and drainage details.
5. Weather-stripping details.
6. Glazing details.
7. Window cleaning provisions.
8. 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 and used to determine the following:

a. Structural test pressures and design pressures from basic wind speeds indicated.
b. Deflection limitations of glass framing systems.

C. Samples for Verification: For wood window components required, prepared on Samples of size indicated below.

1. Main Framing Member: 12-inch-long, full-size sections of extrusions with factory-applied color finish.
2. Hardware: Full-size units with factory-applied finish.
3. Weather Stripping: 12-inch-long sections.

D. Qualification Data: For Installer and professional engineer.

E. Product Test Reports: Based on evaluation of comprehensive tests performed within the last four years by a qualified testing agency, for each type, grade, and size of wood window. Test results based on use of downsized test units will not be accepted.

F. Maintenance Data: For operable window sash, operating hardware, weather-stripping and finishes to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An installer acceptable to wood window manufacturer for installation of units required for this Project.

B. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548.

C. Source Limitations: Obtain wood windows through one source from a single manufacturer.

D. Product Options: Information on Drawings and in Specifications establishes requirements for wood windows' aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance.

E. Fenestration Standard: Comply with AAMA/NWWDA 101/I.S.2, "Voluntary Specifications for Aluminum, Vinyl (PVC) and Wood Windows and Glass Doors," for minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.

1. Provide AAMA-certified wood windows with an attached label.

F. Glazing Publications: Comply with published recommendations of glass manufacturers and GANA's "Glazing Manual" unless more stringent requirements are indicated.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify wood window openings 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 opening dimensions and proceed with fabricating wood windows without field measurements. Coordinate wall construction to ensure that actual opening dimensions correspond to established dimensions.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace wood windows that fail in materials or workmanship within specified warranty period. Failures include, but are not limited to, the following:

1. Failure to meet performance requirements.
2. Structural failures including excessive deflection.
3. Water leakage, air infiltration, or condensation.
4. Faulty operation of movable sash and hardware.
5. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
6. Insulting glass failure.

B. Warranty Period: Two years from date of Substantial Completion.

C. Warranty Period for Metal Finishes: Ten years from date of Substantial Completion.

D. Warranty Period for Glass: Ten years from date of Substantial Completion.

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. Aluminum-Clad Wood Windows:
   a. Eagle Window & Door, Inc.
   b. Kolbe & Kolbe Millwork Co., Inc.
   c. Marvin Windows and Doors.

2.2 MATERIALS

A. Wood: Clear ponderosa pine or another suitable fine-grained lumber; kiln dried to a moisture content of 6 to 12 percent at time of fabrication; free of visible finger joints, blue stain, knots, pitch pockets, and surface checks larger than 1/32 inch deep by 2 inches wide; water-repellent preservative treated.

B. Aluminum Extrusions and Rolled Aluminum for Cladding: Manufacturer's standard formed sheet or extruded-aluminum cladding, mechanically bonded to exterior exposed wood members. Provide aluminum alloy and temper recommended by wood window manufacturer for strength, corrosion resistance, and application of required finish, but not less than 22,000-psi ultimate tensile strength, and not less than 16,000-psi minimum yield strength.

1. Aluminum Finish: Manufacturer's standard fluoropolymer two-coat system with fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight and complying with AAMA 2605.
   a. Color and Gloss: As selected by Architect from manufacturer's full range.

C. Wood Trim and Glazing Stops: Material and finish to match frame members.

D. Fasteners: Aluminum, nonmagnetic stainless steel, epoxy adhesive, or other materials warranted by manufacturer to be noncorrosive and compatible with wood window members, cladding, trim, hardware, anchors, and other components.

1. Exposed Fasteners: Unless unavoidable for applying hardware, do not use exposed fasteners. For application of hardware, use fasteners that match finish of member or hardware being fastened, as appropriate.

E. Anchors, Clips, and Accessories: Aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated.

F. Reinforcing Members: Aluminum, or nonmagnetic stainless steel, or nickel/chrome-plated steel complying with ASTM B 456 for Type SC 3 severe service conditions, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated.

G. Compression-Type Weather Stripping: Provide compressible weather stripping designed for permanently resilient sealing under bumper or wiper action and for complete concealment when wood window is closed.

1. Weather-Stripping Material: Elastomeric cellular preformed gaskets complying with ASTM C 509.

H. Sliding-Type Weather Stripping: Provide woven-pile weather stripping of wool, polypropylene, or nylon pile and resin-impregnated backing fabric. Comply with AAMA 701/702.

1. Weather Seals: Provide weather stripping with integral barrier fin or fins of semirigid, polypropylene sheet or polypropylene-coated material. Comply with AAMA 701/702.

I. Replaceable Weather Seals: Comply with AAMA 701/702.

2.3 GLAZING

A. Insulating-Glass Units for Vertical Glazing: Minimum 3/4 inch thick insulating glass consisting of two equal lites with low-e coating on No. 2 surface and argon gas filled. Thickness sufficient to maintain DP rating on the window for each window size on the project.

B. General: Comply with AAMA/NWWDA 101/I.S. 2.

2.4 INSECT SCREENS

A. General: Design windows and hardware to accommodate screens in a tight-fitting, removable arrangement, with a minimum of exposed fasteners and latches. Provide for each operable exterior sash or ventilator.

B. Aluminum Insect Screen Frames: Manufacturer's standard aluminum alloy complying with SMA 1004. Fabricate frames with mitered or coped joints, concealed fasteners, and removable PVC spline/anchor concealing edge of frame.

1. Aluminum Tubular Framing Sections and Cross Braces: Roll-formed from aluminum sheet with minimum wall thickness as required for class indicated.

2. Finish: Baked-on organic coating in color selected by Designer from manufacturer's full range.

C. Glass-Fiber Mesh Fabric: Manufacturer's standard mesh of PVC-coated, glass-fiber threads; woven and fused to form a fabric mesh resistant to corrosion, shrinkage, stretch, impact damage, and weather deterioration in the following color. Comply with ASTM D 3656.

D. Wickets: Not allowed.

2.5 ACCESSORIES

A. Grids: Removable grids and simulated divided lites as indicated on the Drawings. Color as selected by Architect.

2.6 FABRICATION

A. General: Fabricate wood windows, in sizes indicated, that comply with AAMA/NWWDA 101/I.S.2 for performance class and performance grade indicated. Include a complete system for assembling components and anchoring windows.

B. Exterior Cladding: Minimum thickness 0.050 inch.

C. Reglazing: Fabricate wood windows that are reglazable without dismantling sash or ventilator framing.

D. Weather Stripping: Provide full-perimeter weather stripping for each operable sash and ventilator, unless otherwise indicated.

1. Double-Hung Windows: Provide weather stripping only at horizontal rails of operable sash.

E. Factory machine windows for openings and hardware that is not surface applied.

F. Mullions: Provide mullions and cover plates as shown, matching window units, complete with anchors for support to structure and installation of window units. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections, as indicated. Provide mullions and cover plates capable of withstanding design loads of window units.

G. Factory-Glazed Fabrication: Except for light sizes in excess of 100 united inches, glaze wood windows in the factory where practical and possible for applications indicated. Comply with AAMA/NWWDA 101/I.S.2.

H. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation. Allow for scribing, trimming, and fitting at Project site.

2.7 WOOD FINISHES

A. Factory-Finished Windows: Provide fabricator's standard factory finish consisting of prime coat applied to interior wood surfaces.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances; rough opening dimensions; levelness of sill plate; coordination with wall flashings, vapor retarders, and other built-in components; and other conditions affecting performance of work.

1. Masonry Surfaces: Visibly dry and free of excess mortar, sand, and other construction debris.
2. Metal Surfaces: Dry; clean; free of grease, oil, dirt, rust, corrosion, and welding slag; without sharp edges or offsets at joints.

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

3.2 INSTALLATION

A. General: Comply with manufacturer's written instructions for installing windows, hardware, accessories, and other components; Drawings; and Shop Drawings.

B. Install windows level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction.

C. Set sill members in bed of sealant or with gaskets, as indicated, for weathertight construction.

D. Metal Protection: Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials by complying with requirements specified in "Dissimilar Materials" Paragraph in Appendix B in AAMA/NWWDA 101/I.S.2.

3.3 ADJUSTING

A. Adjust operating sashes and ventilators, screens, hardware, and accessories for a tight fit at contact points and weather stripping for smooth operation and weathertight closure. Lubricate hardware and moving parts.

3.4 PROTECTION AND CLEANING

A. Protect window surfaces from contact with contaminating substances resulting from construction operations. In addition, monitor window surfaces adjacent to and below exterior concrete and masonry surfaces during construction for presence of dirt, scum, alkaline deposits, stains, or other contaminants. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written recommendations.

B. Clean exposed surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.

C. Clean factory-glazed glass immediately after installing windows. Comply with manufacturer's written recommendations for final cleaning and maintenance. Remove nonpermanent labels and clean surfaces.

D. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

END OF SECTION

SECTION 088000

GLAZING

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Glass and glazing for the following products and applications:

a. Steel doors, frames and sidelights specified in Section 081110 - HOLLOW METAL DOORS AND FRAMES.
b. Glazed entrances and storefronts specified in Section 084110 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS.
c. Interior lites.
d. Unframed mirrors.
e. Glazing film.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 081400 - FLUSH WOOD DOORS for factory glazing.
2. Section 085110 - ALUMINUM WINDOWS for factory glazing.

1.3 DEFINITIONS

A. Manufacturers of Glass Products: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.

C. Interspace: Space between lites of an insulating-glass unit that contains dehydrated air or a specified gas.

D. Deterioration of Coated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in metallic coating.

E. Deterioration of Insulating Glass: Failure of hermetic seal under normal use that is attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

F. Deterioration of Laminated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.

1.4 PERFORMANCE REQUIREMENTS

A. General: Provide glazing systems capable of withstanding normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Glass Design: Glass thickness designations indicated are minimums and are for detailing only. Confirm glass thicknesses by analyzing Project loads and in-service conditions. Provide glass lites in the thickness designations indicated for various size openings, but not less than thicknesses and in strengths (annealed or heat treated) required to meet or exceed the following criteria:

1. Glass Thicknesses: Select minimum glass thicknesses to comply with ASTM E 1300, according to the following requirements:

a. Specified Design Wind Loads: As required by Code.
b. Specified Design Snow Loads for Sloped Glazing: As required by Code.
c. Probability of Breakage for Vertical Glazing: 8 lites per 1000 for lites set vertically or not more than 15 degrees off vertical and under wind action.

1) Load Duration: 60 seconds or less.

d. Probability of Breakage for Sloped Glazing: 1 lite per 1000 for lites set more than 15 degrees off vertical and under wind and snow action.

1) Load Duration: 30 days.

e. Maximum Lateral Deflection: For the following types of glass supported on all 4 edges, provide thickness required that limits center deflection at design wind pressure to 1/50 times the short side length or 1 inch, whichever is less.

1) For monolithic-glass lites heat-treated to resist wind loads.
2) For insulating glass.
3) For laminated-glass lites.

f. Minimum Glass Thickness for Exterior Lites: Not less than 6 mm.

C. Thermal Movements: Provide glazing that allows for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures acting on glass framing members and glazing components. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

D. Thermal and Optical Performance Properties: Provide glass with performance properties specified based on manufacturer's published test data, as determined according to procedures indicated below:

1. For monolithic-glass lites, properties are based on units with lites 6.0 mm thick.
2. For laminated-glass lites, properties are based on products of construction indicated.
3. For insulating-glass units, properties are based on units with lites 6.0 mm thick and a nominal 1/2-inch-wide interspace.
4. Center-of-Glass Values: Based on using LBL-44789 WINDOW 6.3 computer program for the following methodologies:

a. U-Factors: NFRC 100 expressed as Btu/ sq. ft. x h x deg F.
b. Solar Heat Gain Coefficient: NFRC 200.
c. Solar Optical Properties: NFRC 300.

1.5 SUBMITTALS

A. Product Data: For each glass product and glazing material indicated.

B. Samples: 12-inch- square Samples for each type of glass and glass assembly, glazing sealants.

C. Glazing Schedule: Use same designations indicated on Drawings for glazed openings in preparing a schedule listing glass types and thicknesses for each size opening and location.

D. Product Certificates: Signed by manufacturers of glass and glazing products certifying that products furnished comply with requirements.

1. For solar-control low-e-coated glass, provide documentation demonstrating that manufacturer of coated glass is certified by coating manufacturer.

E. Qualification Data: For installers.

F. Preconstruction Adhesion and Compatibility Test Report: From glazing sealant manufacturer indicating glazing sealants were tested for adhesion to glass and glazing channel substrates and for compatibility with glass and other glazing materials.

G. Product Test Reports: For each type of glazing products:

H. Warranties: Special warranties specified in this Section.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed glazing similar in material, design, and extent to that indicated for this Project; whose work has resulted in glass installations with a record of successful in-service performance..

B. Source Limitations for Glass: Obtain the following through one source from a single manufacturer for each glass type: clear float glass, laminated glass and insulating glass.

C. Source Limitations for Glass Sputter-Coated with Solar-Control Low-E Coatings: Where solar-control low-e coatings of a primary glass manufacturer that has established a certified fabricator program is specified, obtain sputter-coated solar-control low-e-coated glass in fabricated units from a manufacturer that is certified by coated-glass manufacturer.

D. Source Limitations for Glazing Accessories: Obtain glazing accessories through one source from a single manufacturer for each product and installation method indicated.

E. Elastomeric Glazing Sealant Product Testing: Obtain sealant test results for product test reports in "Submittals" Article from a qualified testing agency based on testing current sealant formulations within a 36-month period.

1. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.
2. Test elastomeric glazing sealants for compliance with requirements specified by reference to ASTM C 920, and where applicable, to other standard test methods.

F. Preconstruction Adhesion and Compatibility Testing: Submit to elastomeric glazing sealant manufacturers, for testing indicated below, samples of each glazing material type, tape sealant, gasket, glazing accessory, and glass-framing member that will contact or affect elastomeric glazing sealants:

1. Use ASTM C 1087 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of glazing sealants to glass, tape sealants, gaskets, and glazing channel substrates.
2. Submit not fewer than eight pieces of each type of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.
3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
4. For materials failing tests, obtain sealant manufacturer's written instructions for corrective measures, including the use of specially formulated primers.
5. Testing will not be required if elastomeric glazing sealant manufacturers submit data based on previous testing of current sealant products for adhesion to, and compatibility with, glazing materials matching those submitted.

G. Fire-Protection-Rated Glazing: Listed and labeled by a testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on positive-pressure testing according to NFPA 257 or UL 9, including the hose-stream test, and shall comply with NFPA 80.

1. Fire-protection-rated glazing required to have a fire-protection rating of 20 minutes shall be exempt from the hose-stream test, unless required by authorities having jurisdiction.

H. Safety Glazing Products: Comply with testing requirements in 16 CFR 1201.

1. Subject to compliance with requirements, obtain safety glazing products permanently marked with certification label of the Safety Glazing Certification Council or another certification agency] acceptable to authorities having jurisdiction.
2. Where glazing units, including Kind FT glass and laminated glass, are specified in Part 2 articles for glazing lites more than 9 sq. ft. in exposed surface area of one side, provide glazing products that comply with Category II materials, for lites 9 sq. ft. or less in

exposed surface area of one side, provide glazing products that comply with Category I or II materials, except for hazardous locations where Category II materials are required by 16 CFR 1201 and regulations of authorities having jurisdiction.

I. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. GANA Publications: GANA Laminated Division's "Laminated Glass Design Guide" and GANA's "Glazing Manual."
2. AAMA Publications: AAMA GDSG-1, "Glass Design for Sloped Glazing," and AAMA TIR-A7, "Sloped Glazing Guidelines."
3. IGMA Publication for Sloped Glazing: IGMA TB-3001, "Sloped Glazing Guidelines."
4. IGMA Publication for Insulating Glass: SIGMA TM-3000, "Glazing Guidelines for Sealed Insulating Glass Units."

J. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the following testing and inspecting agency:

1. Insulating Glass Certification Council.

K. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockup for types of windows indicated, in locations shown on Drawings.

L. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to manufacturer's written instructions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. For insulating-glass units that will be exposed to substantial altitude changes, comply with insulating-glass manufacturer's written recommendations for venting and sealing to avoid hermetic seal ruptures.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

1. Do not install liquid glazing sealants when ambient and substrate temperature conditions are outside limits permitted by glazing sealant manufacturer or below 40 deg F.

1.9 WARRANTY

A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer's standard form, made out to the Owner and signed by coated-glass manufacturer agreeing to replace coated-glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.

1. Warranty Period: Ten years from date of Substantial Completion.

B. Manufacturer's Special Warranty on Laminated Glass: Manufacturer's standard form, made out to the Owner and signed by laminated-glass manufacturer agreeing to replace laminated-glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.

1. Warranty Period: Five years from date of Substantial Completion.

C. Manufacturer's Special Warranty on Insulating Glass: Manufacturer's standard form, made out to the Owner and signed by insulating-glass manufacturer agreeing to replace insulating-glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.

1. Warranty Period: Ten years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 INSULATING-GLASS UNITS

A. Insulating-Glass Units for Vertical Glazing: 1 inch thick (25.0 mm) insulating glass consisting of two lites of 1/4 inch (6 mm) glass, low e coating on the No. 2 surface and argon gas filled. Provide one of the following or equal:

1. Guardian Industries; SN-68.

a. Visible Light Transmittance: 68 percent.
b. Reflectance Visible Light: 10 percent.
c. U Value (Winter): 0.29.
d. Shading Coefficient: 0.43.
e. Solar Heat Gain Coefficient: 0.37.

2. Viracon; VE1-2M.

a. Visible Light Transmittance: 70 percent.
b. Reflectance Visible Light: 11 percent.
c. U Value (Winter): 0.25.
d. Shading Coefficient: 0.43.
e. Solar Heat Gain Coefficient: 0.37.

3. Vitro Architectural Glass (formerly PPG Industries); Solarban 60.

a. Visible Light Transmittance: 70 percent.
b. Reflectance Visible Light: 11 percent.

c. U Value (Winter): 0.29.
d. Shading Coefficient: 0.44.
e. Solar Heat Gain Coefficient: 0.38.

B. Insulating-Glass Units for Sloped Glazing (Skylights):

1. Basis-of-Design Product: Viracon, Vitro, Guardian or equal.
2. Outdoor Lite: 1/4 inch (6 mm), clear heat-strengthened glass with low-e coating on No. 2 surface.
3. Indoor Lite: 5/16 inch (8.0 mm), clear laminated glass with minimum 0.060 inch (1.52 mm) interlayer, as required to comply as a Type II safety glass material.
4. Overall Unit Thickness: 1-1/16 inch (26.5 mm).
5. Interspace Content: Argon.

2.2 GLASS PRODUCTS

A. Float Glass: ASTM C 1036, Type I, Quality-Q3, Class I (clear) unless otherwise indicated.

B. Low-Iron, Ultraclear Float Glass: ASTM C 1036, Type I, Quality-Q3, Class I, complying with other requirements specified and with visible light transmission not less than 91 percent and solar heat gain coefficient not less than 0.87.

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

a. AGC Glass; Krystal Klear.
b. Guardian Industries Corp.; Ultrawhite.
c. Pilkington North America; Optiwhite.
d. Vitro Architectural Glass (formerly PPG Industries); Starphire.

C. Heat-Treated Float Glass: ASTM C 1048; Type I; Quality-Q3; Class I (clear) unless otherwise indicated; of kind and condition indicated.

1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
2. For uncoated glass, comply with requirements for Condition A.
3. For coated vision glass, comply with requirements for Condition C (other coated glass).

D. Coated Float Glass: Pyrolytic and vacuum deposited coatings on glass in conformance with ASTM C 1376.

E. Uncoated Tinted Float Glass: Class 2, complying with other requirements specified.

1. Tint Color: As selected by the Architect.
2. Visible Light Transmittance: As standard with manufacturer.

F. Tempered Float Glass: ASTM C 1048; Type I (transparent flat glass); Quality-Q3; Kind FT; 1/4 inch thick unless indicated otherwise.

G. Patterned Glass: ASTM C 1036, Type II (patterned and wired flat glass), Class 1 (clear), Form 3 (patterned); and of quality, finish, and pattern specified.

H. Laminated Glass: ASTM C 1172, and complying with testing requirements in 16 CFR 1201 for Category II materials, and with other requirements specified. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.

1. Construction for Framed Units: Laminate glass with polyvinyl butyral interlayer to comply with interlayer manufacturer's written recommendations.
2. Construction for Units with Exposed Edges: Laminate glass with cast-in-place and cured-transparent-resin interlayer to comply with interlayer manufacturer's written recommendations.
3. Interlayer Thickness: 0.030 inch (0.76 mm) thick for vertical glazing, 0.060 inch (1.52 mm) thick for sloped glazing.
4. Interlayer Color: Clear unless otherwise indicated.

I. Fire-Rated Monolithic Ceramic Glazing Material (Not for Doors or Locations Requiring Safety Glazing): Proprietary product in the form of clear flat sheets of 3/16-inch nominal (5.0 mm) thickness weighing 2.5 lb/sq. ft. and as follows:

1. Fire-Protection Rating: As indicated for the fire window in which glazing material is installed, and permanently labeled by a testing and inspecting agency acceptable to authorities having jurisdiction.
2. Products: Subject to compliance with requirements, provide the following:

    a. Technical Glass Products (TGP); FireLite Premium, polished both sides.

J. Fire-Rated Laminated Ceramic Glazing Material (for Doors and Locations Requiring Safety Glazing): Category II safety glazing product in the form of 2 lites of clear ceramic glazing material laminated together to produce a laminated lite of 5/16-inch nominal (8.0 mm) thickness; polished on both surfaces; weighing 4 lb/sq. ft. and as follows:

1. Fire-Protection Rating: As indicated for the assembly in which glazing material is installed, and permanently labeled by a testing and inspecting agency acceptable to authorities having jurisdiction.
2. Polished on both surfaces, transparent.
3. Products: Subject to compliance with requirements, provide one of the following:

    a. Technical Glass Products (TGP); FireLite Plus.
    b. Safti First; Pyran Platinum L, (for maximum 90 minute-rated openings).
    c. Vetrotech Saint-Gobain; SGG Keralite FR-L.

K. Laminated Glass with Intumescent Interlayers (Temperature-Rise-Rated Doors): Laminated glass made from multiple plies of uncoated, clear float glass; with intumescent interlayers; complying with testing requirements in 16 CFR 1201 for Category II materials.

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

    a. InterEdge, Inc., a subsidiary of AGC Glass; Pyrobel.
    b. Pilkington Group Limited (distributed by Technical Glass Products); PyroStop.
    c. Vetrotech Saint-Gobain; SGG Contraflam N2 or SGG Swissflam N2.

L. Insulating-Glass Units, General: Factory-assembled units consisting of sealed lites of glass separated by an argon-filled interspace, and complying with ASTM E2190 and with requirements specified in this Section.

1. Provide Kind HS (heat-strengthened) float glass in place of annealed glass where needed to resist thermal stresses induced by differential shading of individual glass lites and to comply with glass design requirements specified in Part 1 “Performance Requirements” paragraph.
2. Provide Kind FT (fully tempered) glass lites where safety glass is indicated.
3. Overall Unit Thickness and Thickness of Each Lite: Dimensions indicated for insulating-glass units are nominal and the overall thicknesses of units are measured perpendicularly from outer surfaces of glass lites at unit’s edge.
4. Sealing System: Dual seal, with primary and secondary sealants as follows:

    a. Manufacturer’s Standard Sealants. Butyl primary and silicone secondary sealants. Secondary sealant shall cover entire spacer bar at IGU perimeter.

5. Spacer Specifications: Manufacturer’s standard spacer material. Spacer corners shall be bent, soldered, or welded. Keyed spacer corners will not be accepted. Spacer may have a mid-span spacer key located at the midpoint of the insulating glass unit head. Where a mid-span spacer key is used, the key must be fully embedded (all sides) in butyl sealant.

M. Ceramic-Coated Spandrel Glass: ASTM C 1048, Condition B, Type I, Quality-Q3, and complying with other requirements specified.

1. Glass: Clear float.
2. Ceramic Coating Color: Custom color as selected by the Architect.

N. Ceramic-Coated Vision Glass: Float glass with ceramic enamel applied by silk-screened process and complying with ASTM C 1048, Condition C (other coated glass), Type I (transparent flat glass), Quality-Q3, Specification No. 95-1-31 in GANA Tempering Division's "Engineering Standards Manual," and other requirements specified.

1. Ceramic Frit Pattern: Custom pattern as selected by the Architect.
2. Ceramic Coating Color: Custom color as selected by the Architect.

O. Silicone-Coated Spandrel Glass: ASTM C 1048, Condition C, Type I, Quality-Q3, and complying with other requirements specified.

1. Products: Subject to compliance with requirements, provide ICD High Performance Coatings, Opaci-Coat 300; color as selected by Architect from manufacturer’s full range.

P. Glass Mirrors, General: ASTM C 1503; manufactured using copper-free, low-lead mirror coating process.

1. Mirror Edge Treatment: Flat polished edge.

Q. Glazing Film: Translucent, dimensionally stable, cast PVC film, 2-mil-minimum thickness, with pressure-sensitive, clear adhesive back for adhering to glass and releasable protective backing.

1. Manufacturers: Subject to compliance with requirements, available manufacturer’s that may be incorporated into the Work include, but are not limited to, the following:

a. Avery Dennison, Graphics.
b. FDC Graphic Films, Inc.
c. Madico, Inc.
d. 3M Scotchcal.

2. Comply with requirements for safety glazing.
3. Use: Suitable for exterior and interior applications.
4. Patterns: As selected by Architect from manufacturer's full range.

2.3 GLAZING SEALANTS

A. General: Provide products of type indicated, complying with the following requirements:

1. Compatibility: Verify glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, interlayer of laminated glass, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
3. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.
4. VOC Content:

a. Structural Glazing Adhesives: 100 g/L.
b. Architectural Sealants: 250 g/L.

5. Methylene chloride and perchloroethylene may not be intentionally added to sealants.

B. Elastomeric Glazing 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.

1. Single-Component Neutral- and Basic-Curing Silicone Glazing Sealants:

a. Dow Corning Corporation; 790.
b. GE Silicones; SilPruf LM SCS2700.
c. Tremco Inc.; Spectrem 1.

C. Glazing Sealants for Fire-Resistive Glazing Products: Identical to products used in test assemblies to obtain fire-protection rating.

2.4 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based elastomeric tape with a solids content of 100 percent; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; packaged on rolls with a release paper backing; and complying with ASTM C 1281 and AAMA 800 for project conditions.

B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; packaged on rolls with release liner protecting adhesive; and complying with AAMA 800 for the following types:

1. Type 1, for glazing applications in which tape acts as the primary sealant.
2. Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.5 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

D. Spacers: Elastomeric blocks or continuous extrusions with a Shore, Type A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

F. Perimeter Insulation for Fire-Resistive Glazing: Identical to product used in test assembly to obtain fire-resistance rating.

G. Mirror Mastic: An adhesive setting compound, asbestos-free, produced specifically for setting mirrors and certified by both mirror manufacturer and mastic manufacturer as compatible with glass coating and substrates on which mirrors will be installed.

1. VOC Content: 250 g/L or less.
2. Methylene chloride and perchloroethylene may not be intentionally added to adhesives.
3. Do not use adhesives that contain urea formaldehyde.

H. Mirror Hardware, Top and Bottom Aluminum J-Channels: Aluminum extrusions with a return deep enough to produce a glazing channel to accommodate mirrors of thickness indicated and in lengths required to cover bottom and top edges of each mirror in a single piece.

2.6 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites in a manner that produces square edges with slight kerfs at junctions with outdoor and indoor faces.

C. Grind smooth and polish exposed glass edges and corners.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing glazing, with Installer present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
2. Presence and functioning of weep system.
3. Minimum required face or edge clearances.
4. Effective sealing between joints of glass-framing members.

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

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

3.3 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Glazing channel dimensions, as indicated on Drawings, provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.

C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.

E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

G. Provide spacers for glass lites where length plus width is larger than 50 inches as follows:

1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

J. Wall-Mounted Mirrors: Install mirrors with mastic and mirror hardware. Attach mirror hardware securely to mounting surfaces with mechanical fasteners installed with anchors or inserts as applicable. Install fasteners so heads do not impose point loads on backs of mirrors.

K. Glazing Film: Apply squarely aligned to glass edges, uniformly smooth, and free from tears, air bubbles, wrinkles, and rough edges, in single sheet completely overlaying the back face of clean glass, according to manufacturer's written instructions, including surface preparation and application temperature limitations.

3.4 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Do not remove release paper from tape until just before each glazing unit is installed.

F. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

3.5 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.6 CLEANING AND PROTECTION

A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations, including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended by glass manufacturer.

C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.

D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.

END OF SECTION

SECTION 089000

LOUVERS AND VENTS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Fixed extruded-aluminum louvers and frames.
2. Elevator vents.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 079200 - JOINT SEALANTS for sealants installed in perimeter joints between louver frames and adjoining construction.
2. Division 23 - HEATING, VENTILATING AND AIR CONDITIONING for louvers that are a part of mechanical equipment.

1.3 DEFINITIONS

A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section unless otherwise defined in this Section or in referenced standards.

B. Drainable-Blade Louver: Louver with blades having gutters that collect water and drain it to channels in jambs and mullions, which carry it to bottom of unit and away from opening.

1.4 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide louvers capable of withstanding the effects of gravity loads and wind loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act on vertical projection of louvers. Loads as required by Code.

B. Seismic Performance: Provide louvers capable of withstanding the effects of earthquake motions as required by code.

C. Thermal Movements: Provide louvers that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other

detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F ambient; 180 deg F material surfaces.

1.5 SUBMITTALS

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

B. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other Work. Show blade profiles, angles, and spacing.

1. For installed louvers 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 Verification: For each type of metal finish required.

D. Qualification Data: For professional engineer.

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 each type of louver.

1.6 QUALITY ASSURANCE

A. Source Limitations: Obtain louvers and vents through one source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.

B. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.2, "Structural Welding Code--Aluminum."

C. SMACNA Standard: Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify louver openings 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 opening dimensions and proceed with fabricating louvers without field measurements. Coordinate construction to ensure that actual opening dimensions correspond to established dimensions.

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. Airolite Company, LLC.
2. American Warming and Ventilating.
3. Construction Specialties, Inc.
4. Greenheck.
5. Industrial Louvers, Inc.
6. McDermott Metal Works Corporation
7. Nystrom Building Products.

2.2 MATERIALS

A. Aluminum Extrusions: ASTM B 221, alloy 6063-T5 or T-52.

B. Aluminum Sheet: ASTM B 209, alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer for required finish.

C. Fasteners: Of same basic metal and alloy as fastened metal or 300 Series stainless steel, unless otherwise indicated. Do not use metals that are incompatible with joined materials.

D. Postinstalled Fasteners for Concrete and Masonry: Torque-controlled expansion anchors, made from stainless-steel components, with capability to sustain, without failure, a load equal to 4 times the loads imposed, for concrete, or 6 times the load imposed, for masonry, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.

E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.3 FABRICATION, GENERAL

A. Assemble louvers in factory to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

B. Maintain equal louver blade spacing, including separation between blades and frames at head and sill, to produce uniform appearance.

C. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.

D. Include supports, anchorages, and accessories required for complete assembly.

E. Provide vertical mullions of type and at spacings indicated, but not more than recommended by manufacturer, or 72 inches o.c., whichever is less.

1. Fully Recessed Mullions: Provide mullions fully recessed behind louver blades. Where length of louver exceeds fabrication and handling limitations, fabricate with close-fitting blade splices designed to permit expansion and contraction.

F. Join frame members to each other and to fixed louver blades with fillet welds concealed from view, unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

2.4 ELEVATOR VENTS

A. Elevator Vents: Factory-fabricated horizontal or through-wall dampered elevator vents as detailed on the Drawings meeting local state building code requirements.

2.5 FIXED, EXTRUDED-ALUMINUM LOUVERS

A. Horizontal Storm-Resistant Louvers:

1. Louver Depth: 4 inches.
2. Frame and Blade Nominal Thickness: As required to comply with structural performance requirements, but not less than 0.080 inch.
3. Performance Requirements:

a. Free Area: Comply with requirements indicated on the Drawings.
b. Wind-Driven Rain Performance: Not less than 99 percent effectiveness when subjected to a rain fall rate of 3 inches per hour and a wind speed of 29 mph at a core area intake velocity of 300 fpm.

4. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

2.6 LOUVER SCREENS

A. General: Provide screen at each exterior louver.

1. Screen Location for Fixed Louvers: Interior face.
2. Screening Type: Bird screening.

B. Secure screens to louver frames with stainless-steel machine screws, spaced a maximum of 6 inches from each corner and at 12 inches o.c.

C. Louver Screen Frames: Fabricate with mitered corners to louver sizes indicated.

D. Louver Screening for Aluminum Louvers:

1. Bird Screening: Aluminum, 1/2-inch-square mesh, 0.063-inch wire.

2.7 BLANK-OFF PANELS

A. Insulated, Blank-off Panels: Laminated metal-faced panels consisting of insulating core surfaced on back and front with metal sheets.

1. Thickness: 1 inch.
2. Metal Facing Sheets: Aluminum sheet, not less than 0.032-inch nominal thickness.

3. Insulating Core: Rigid insulation board.
4. Seal perimeter joints between panel faces and louver frames with 1/8-by-1-inch PVC compression gaskets.
5. Panel Finish: Same finish applied to louvers.

2.8 ALUMINUM FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

C. High-Performance Organic Finish (3-Coat Fluoropolymer): AA-C12C40R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: conversion coating; Organic Coating: manufacturer's standard 3-coat, thermocured system consisting of specially formulated inhibitive primer, fluoropolymer color coat, and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 2605 and with coating and resin manufacturers' written instructions.

1. Color and Gloss: As selected by Architect from manufacturer's full range.

D. High-Performance Organic Finish (2-Coat Fluoropolymer): AA-C12C40R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: conversion coating; Organic Coating: manufacturer's standard 2-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color coat, with color coat containing not less than 70 percent polyvinylidene fluoride resin by weight). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 2605 and with coating and resin manufacturers' written instructions.

1. Basis of Design: Sherwin-Williams Coil Coatings; Valspar Fluropon Pure.
2. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and openings, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

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

3.2 PREPARATION

A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.3 INSTALLATION

A. Locate and place louvers and vents level, plumb, and at indicated alignment with adjacent work.

B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.

C. Form closely fitted joints with exposed connections accurately located and secured.

D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

E. Repair finishes damaged by cutting, welding, soldering, and grinding. Restore finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.

F. Protect galvanized and nonferrous-metal surfaces from corrosion or galvanic action by applying a heavy coating of bituminous paint on surfaces that will be in contact with concrete, masonry, or dissimilar metals.

G. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Section 079200 - JOINT SEALANTS for sealants applied during louver installation.

3.4 ADJUSTING AND CLEANING

A. Clean exposed surfaces of louvers and vents that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate until final cleaning.

B. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.

C. Restore louvers and vents damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.

1. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION

SECTION 092110

GYPSUM BOARD ASSEMBLIES

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Interior gypsum wallboard.
2. Tile backing panels.
3. Acoustic insulation (sound attenuation batts) in gypsum wallboard assemblies.
4. Non-load-bearing steel framing.
5. Installation of access panels.
6. Marking and identification for fire- and smoke-partitions.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 054000 - COLD-FORMED METAL FRAMING for load-bearing steel framing.
2. Section 061000 - ROUGH CARPENTRY for plywood backing panels.
3. Section 061600 - SHEATHING for gypsum sheathing at exterior assemblies.
4. Section 083110 - ACCESS DOORS AND FRAMES for installation in gypsum board assemblies.
5. Section 092120 - GYPSUM BOARD SHAFT WALL ASSEMBLIES for framing, gypsum panels, other components of shaft wall assemblies, and finishing gypsum board shaft wall assemblies.
6. Section 093000 - TILING for joint compound at cementitious tile backing panels.

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide fire stop tracks capable of withstanding deflection within limits and under conditions indicated.

1. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure.

B. Marking and Identification for Fire- and Smoke-Partitions: Fire walls, fire barriers, fire partitions, smoke barriers, smoke partitions and other walls required to have protected openings or penetrations shall be effectively and permanently identified with signs or stenciling. Such identification shall:

1. Be located in accessible concealed floor, floor-ceiling or attic spaces; and
2. Locate within 15 feet of end of each wall and repeat at intervals not exceeding 30 feet measured horizontally along the wall or partition; and
3. Include lettering not less than 3 inches in height with a minimum 3/8 inch stroke in contrasting color, incorporating the suggested wording: "FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS," or other wording.
4. Exception: Walls in Group R-2 occupancies that do not have a removable decorative ceiling allowing access to the concealed space.

1.4 SUBMITTALS

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

B. Shop Drawings: If materials and systems other than those specified and those indicated on the Drawings are proposed for use, submit shop drawings signed and sealed by a structural engineer licensed in the jurisdiction of the project certifying proposed systems meet code requirements, project requirements and the following deflection criteria:

1. For gypsum board assemblies without applied rigid finishes L/240; for gypsum board assemblies with applied rigid finishes such as tile, stone, wood paneling L/360. Lateral load 5 psf except at shafts. Lateral load at shafts shall be required based on analysis of equipment and systems using shaft.

C. Samples: Full-size Sample in 12-inch-long length for each trim accessory indicated.

1.5 QUALITY ASSURANCE

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

C. Mockups: Before beginning gypsum board installation, install mockups of at least 100 sq. ft. in surface area to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Install mockups for the following:

   a. Each level of gypsum board finish indicated for use in exposed locations.
   b. Each texture finish indicated.

2. Apply or install final decoration indicated, including painting and wallcoverings, on exposed surfaces for review of mockups.
3. Simulate finished lighting conditions for review of mockups.
4. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 STORAGE AND HANDLING

A. Store materials inside under cover and keep them dry and protected against damage from weather, condensation, direct sunlight, construction traffic, and other causes. Stack panels flat to prevent sagging.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

B. Do not install interior products until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 NON-LOAD-BEARING STEEL FRAMING, GENERAL

A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.

1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal, unless otherwise indicated.
2. Protective Coating: Manufacturer's standard corrosion-resistant zinc coating, unless otherwise indicated.

2.2 SUSPENSION SYSTEM COMPONENTS

A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inch-diameter wire, or double strand of 0.0475-inch-diameter wire.

B. Hanger Attachments to Concrete:

1. Anchors: Fabricated from corrosion-resistant materials with holes or loops for attaching wire hangers and capable of sustaining, without failure, a load equal to 5 times that imposed by construction as determined by testing according to ASTM E 488 by an independent testing agency.

a. Type: Postinstalled, expansion anchor.

C. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.162-inch diameter.

D. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.0538 inch and minimum 1/2-inch-wide flanges with depth as required for span and loading and indicated on Drawings.

E. Furring Channels (Furring Members): 0.0538-inch bare-steel thickness, with minimum 1/2-inch-wide flanges, 3/4 inch deep.

F. Grid Suspension System for Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.

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

a. Armstrong World Industries, Inc.; Drywall Grid Systems.
b. Chicago Metallic Corporation; Drywall Furring System.
c. USG Corporation; Drywall Suspension System.

2. Performance Requirements: Ceiling support system shall support a live load of 6 psf minimum at L/240.

2.3 STEEL FRAMING FOR FRAMED ASSEMBLIES

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. California Expanded Metals Co. (CEMCO).
2. EB Metal U.S.
3. Marino\WARE.
4. Studco Building Systems.

B. Steel Studs and Runners: ASTM C 645.

1. Minimum Base-Metal Thickness: 0.0312 inch (20 gauge).

C. Slip-Type Head Joints: Where indicated, provide one of the following:

1. Single Long-Leg Runner System: ASTM C 645 top runner with 2-inch- deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top runner and with continuous bridging located within 12 inches of the top of studs to provide lateral bracing.
2. Double-Runner System: ASTM C 645 top runners, inside runner with 2-inch-deep flanges in thickness not less than indicated for studs and fastened to studs, and outer runner sized to friction fit inside runner.
3. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.

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

1) Brady Innovations; Sliptrack Systems.
2) California Expanded Metals Co. (CEMCO); CST Slotted Tracks.
3) Clark Dietrich Building Systems; MaxTrak Slotted Deflection Track.
4) Steel Network Inc. (The); VertiTrack VT Series.

D. Fire Stop Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness compatible with studs and in width to accommodate depth of studs.

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

a. California Expanded Metals Co. (CEMCO); SLP-TRK Slotted Tracks.
b. Clark Dietrich Building Systems; BlazeFrame Fire Stop Deflection Track.
c. Fire Trak Corp.; Fire Trak attached to studs with Fire Trak Slip Clip.
d. Metal-Lite, Inc.; The System Slotted Track.

E. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.

1. Minimum Base-Metal Thickness: 0.0312 inch (20 gauge).

F. Cold-Rolled Channel Bridging: 0.0538-inch bare-steel thickness, with minimum 1/2-inch- wide flanges.

1. Depth: 1-1/2 inches.
2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch-thick, galvanized steel.

G. Hat-Shaped, Rigid Furring Channels: ASTM C 645.

1. Minimum Base-Metal Thickness: 0.0312 inch (20 gauge).
2. Depth: 1-1/2 inches.

H. Resilient Furring Channels: 1/2-inch-deep, steel sheet members designed to reduce sound transmission. Strictly comply with manufacturer's installation instruction.

1. Basis-of-Design: ClarkDietrich RC Deluxe, asymmetrical configuration.

I. Resilient Sound Isolation Clips: Provide galvanized steel and resilient material sound-isolation clips, equal to the following:

1. Kinetics Noise Control Co.; IsoMax.
2. PAC International, Inc.; RSIC-1.
3. Pliteq, Inc.; GenieClip.
4. Studco Building Systems; Resilmount A237R.

J. Spring Isolation Hangers: Provide galvanized and coated spring hanger system, equal to the following:

1. Kinetics Noise Control Co.; ICW.
2. PAC International, Inc.; RSIC--SI-CRC Pro Series.

K. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches wall attachment flange of 7/8 inch, minimum bare-metal thickness of 0.0179 inch, and depth required to fit insulation thickness indicated.

L. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

M. Isolation Strip at Exterior Walls: Adhesive-backed, closed-cell foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.

2.4 INTERIOR GYPSUM BOARD

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

1. CertainTeed Gypsum, Inc.
2. National Gypsum Company.
3. United States Gypsum Company (USG).

B. Gypsum Wallboard: ASTM C 1396.

1. Basis of Design: USG; SHEETROCK EcoSmart Panels.
2. Thickness: 1/2 inch.
3. Long Edges: Tapered.

C. Gypsum Wallboard, Fire-Resistant Type X: ASTM C 1396.

1. Basis of Design: USG; SHEETROCK EcoSmart Panels Firecode X.
2. Thickness: 5/8 inch.
3. Long Edges: Tapered.

D. Abuse-Resistant Type: ASTM C 1629. Manufactured to produce greater resistance to surface indentation and through-penetration (impact resistance) than standard, regular-type and Type X gypsum board.

1. Core: 5/8 inch, Type X.
2. Long Edges: Tapered.

E. Moisture- and Mold-Resistant Gypsum Board: ASTM C 1396. With moisture- and mold-resistant core and paper surfaces.

1. Basis of Design: USG; SHEETROCK EcoSmart Mold Tough Firecode X.
2. Core: 5/8 inch, Type X.
3. Long Edges: Tapered.
4. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.5 TILE BACKING PANELS

A. Cementitious Tile Backing Units: ANSI A118.9 and ASTM C 1288 or 1325, with manufacturer's standard edges.

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

a. Custom Building Products; Wonderboard and Wonderboard Lite.
b. FinPan, Inc.; Util-A-Crete Concrete Backer Board.

c. National Gypsum Company; Permabase Cement Board.
d. USG Corporation; DUROCK Cement Board.

2. Thickness: 5/8 inch.
3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.6 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.

1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
2. Shapes:

a. Cornerbead.
b. Bullnose bead.
c. LC-Bead: J-shaped; exposed long flange receives joint compound.
d. Expansion (control) joint.
e. Curved-Edge Cornerbead: With notched or flexible flanges.

B. Aluminum Trim: Extruded accessories of profiles and dimensions indicated.

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. Fry Reglet Corp.
b. Gordon, Inc.
c. Pittcon Industries.

2. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221, Alloy 6063-T5.
3. Finish: Corrosion-resistant primer compatible with joint compound and finish materials specified.

2.7 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M.

B. Joint Tape:

1. Interior Gypsum Wallboard: Paper.
2. Tile Backing Panels: As recommended by panel manufacturer.

C. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
3. Fill Coat: For second coat, use setting-type, sandable topping compound.
4. Finish Coat: For third coat, use setting-type, sandable topping compound.

5. Skim Coat: For final coat of Level 5 finish, use setting-type, sandable topping compound.

D. Joint Compound for Tile Backing Panels:

1. Cementitious Backing Units: Thinset, nonsag mortar, as recommended by backing unit manufacturer. Refer to Section 093000 - TILING.
2. Water-Resistant Gypsum Backing Board: Use setting-type taping compound and setting-type, sandable topping compound.

2.8 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.

1. Basis of Design: Henkel; OSI F38 Drywall and Panel Adhesive.
2. VOC Content: 50 g/L or less.
3. Methylene chloride and perchloroethylene may not be intentionally added to adhesives.
4. Do not use adhesives that contain urea formaldehyde.

C. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.

1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
2. For fastening cementitious tile backing units, use screws of type and size recommended by panel manufacturer.

D. Acoustic Insulation, Sound Attenuation (Batts) Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

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

a. Knauf Insulation; EcoBatt.
b. Owens Corning; EcoTouch SA
c. Owens Corning; Thermafiber SAFB FF.
d. Rockwool (formerly Roxul); AFB evo.

2. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.

E. Acoustical Sealant: Manufacturer's standard nondrying, nonhardening, nonskinning, nonstaining, gunnable, joint sealant, recommended for sealing interior concealed joints to reduce airborne sound transmission.

1. Available Products, for Concealed and Exposed Joints: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Pecora Corp.; AC-20 FTR Acoustical and Insulation Sealant.
b. Specified Technologies, Inc.; Smoke N Sound Acoustical Sealant.
c. USG; SHEETROCK Acoustical Sealant.

2. Available Products, for Concealed Joints Only: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. OSI (a division of Henkel); Pro-Series SC-175.
b. Pecora Corp.; BA-98.
c. Tremco, Inc.; Tremco Acoustical/Curtainwall Sealant.

3. VOC Content, Architectural Sealants: 250 g/L or less.
4. Methylene chloride and perchloroethylene may not be intentionally added to sealants.

2.9 IDENTIFICATION LABELS FOR FIRE- AND SMOKE-PARTITIONS

A. Identification Labels: Self-adhesive signs, to comply with applicable local Code.

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. Fire Wall Signs, Inc.
b. Marking & Identification Tape (mnitape.com).
c. My Safety Sign.
d. Safety Supply Warehouse.

2. Text: "FIRE AND SMOKE BARRIER - PROTECT ALL OPENINGS".

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames and framing, for compliance with requirements and other conditions affecting performance.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

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

3.2 PREPARATION

A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.

1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

B. Coordination with Sprayed Fire-Resistive Materials:

1. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling runners (tracks) to surfaces indicated to receive sprayed fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches o.c.
2. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of non-load-bearing steel framing. Do not reduce thickness of fire-resistive materials below that required for fire-resistance ratings indicated. Protect adjacent fire-resistive materials from damage.

3.3 INSTALLATION, GENERAL

A. Installation Standard: ASTM C 754. Also comply with requirements in ASTM C 840 that apply to framing installation.

B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

C. Install bracing at terminations in assemblies.

D. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.4 INSTALLING SUSPENSION SYSTEMS

A. Install suspension system components in sizes and spacings indicated on Drawings, but not less than those required by referenced installation standards for assembly types and other assembly components indicated.

B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.

C. Suspend hangers from building structure as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.

    a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.

2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.

    a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.

3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.

4. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
5. Do not attach hangers to steel roof deck.
6. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
7. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
8. Do not connect or suspend steel framing from ducts, pipes, or conduit.

D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.

E. Seismic Bracing: Sway-brace suspension systems with hangers used for support.

F. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

G. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

3.5 INSTALLING FRAMED ASSEMBLIES

A. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

B. Install studs so flanges within framing system point in same direction.

C. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.

1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on doorframes; install runner track section (for cripple studs) at head and secure to jamb studs.

    a. Install two studs at each jamb, unless otherwise indicated.
    b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
    c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.

3. Other Framed Openings: Frame openings other than door openings the same as required for door openings, unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.

4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.

    a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.

5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
6. Curved Partitions:

    a. Bend track to uniform curve and locate straight lengths so they are tangent to arcs.
    b. Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of not less than 2 studs at ends of arcs, place studs 6 inches o.c.

D. Direct Furring: Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.

E. Z-Furring Members:

1. Erect insulation vertically and hold in place with Z-furring members spaced 24 inches o.c.
2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches from corner and cut insulation to fit.

3.6 APPLYING AND FINISHING PANELS, GENERAL

A. Comply with ASTM C 840.

B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.

D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

E. Form control and expansion joints with space between edges of adjoining gypsum panels.

F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.

1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.

2. Fit gypsum panels around ducts, pipes, and conduits.
3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- wide joints to install sealant.

G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- wide spaces at these locations, and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

3.7 APPLYING INTERIOR GYPSUM BOARD

A. Single-Layer Application:

1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing, unless otherwise indicated.
2. On partitions/walls, apply gypsum panels to minimize end joints.
3. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

B. Multilayer Application:

1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints 1 framing member, 16 inches minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
3. On Z-furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
4. Fastening Methods: Fasten base layers and face layers separately to supports with screws.

C. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written recommendations and temporarily brace or fasten gypsum panels until fastening adhesive has set.

D. Curved Surfaces:

1. Install panels horizontally (perpendicular to supports) and unbroken, to extent possible, across curved surface plus 12-inch-long straight sections at ends of curves and tangent to them.
2. For double-layer construction, fasten base layer to studs with screws 16 inches o.c. Center gypsum board face layer over joints in base layer, and fasten to studs with screws spaced 12 inches o.c.

3.8 APPLYING TILE BACKING PANELS

A. Cementitious Tile Backing Units: ANSI A108.1, at locations indicated to receive tile, with joints treated to comply with ANSI A108.11.

B. Water-Resistant Backing Board: Install at areas not subject to wetting and elsewhere as indicated with 1/4-inch gap where panels abut other construction or penetrations.

C. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.9 INSTALLING TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.

C. Interior Trim: Install in the following locations:

1. Cornerbead: Use at outside corners, unless otherwise indicated.
2. LC-Bead: Use at exposed panel edges.
3. Curved-Edge Cornerbead: Use at curved openings.

D. Aluminum Trim: Install in locations indicated on Drawings.

3.10 FINISHING GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints, rounded or beveled edges, and damaged surface areas.

C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below:

1. Level 1: Ceiling plenum areas and concealed areas not exposed to view.
2. Level 2: Panels that are substrate for tile.
3. Level 3: Not Used.
4. Level 4: Panel surfaces that will be exposed to view (typical panels).

5. Level 5: Where indicated on Drawings.

E. Cementitious Tile Backing Units: Finish according to manufacturer's written instructions.

3.11 INSTALLING IDENTIFICATION FOR FIRE- AND SMOKE-PARTITIONS

A. Marking and Identification for Fire- and Smoke-Partitions: Permanently install as required by Code.

3.12 PROTECTION

A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

B. Remove and replace panels that are wet, moisture damaged, or exhibit mold growth. Repair of damaged panels in place is not acceptable.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION

SECTION 092120

GYPSUM BOARD SHAFT WALL ASSEMBLIES

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Gypsum board shaft wall assemblies.
2. Marking and identification for fire- and smoke-partitions.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 083110 - ACCESS DOORS AND FRAMES for installation in gypsum board assemblies.
2. Section 092110 - GYPSUM BOARD ASSEMBLIES for non-shaft-wall gypsum board assemblies.
3. Section 092110 - GYPSUM BOARD ASSEMBLIES for applying and finishing panels in gypsum board assemblies.

1.3 DEFINITIONS

A. Gypsum Board Construction Terminology: Refer to ASTM C 11 for definitions of terms for gypsum board construction not defined in this Section or in other referenced standards.

1.4 PERFORMANCE REQUIREMENTS

A. Structural Performance:

1. Provide gypsum board shaft wall assemblies capable of withstanding the full air-pressure loads indicated for maximum heights of partitions without failing and while maintaining an airtight and smoke-tight seal. Evidence of failure includes deflections exceeding limits indicated, bending stresses causing studs to break or to distort, and end-reaction shear causing track (runners) to bend or to shear and studs to become crippled.
2. Provide gypsum board shaft wall assemblies for horizontal duct enclosures capable of spanning distances indicated within deflection limits indicated.

B. Marking and Identification for Fire- and Smoke-Partitions: Fire walls, fire barriers, fire partitions, smoke barriers, smoke partitions and other walls required to have protected openings or

penetrations shall be effectively and permanently identified with signs or stenciling. Such identification shall:

1. Be located in accessible concealed floor, floor-ceiling or attic spaces; and
2. Locate within 15 feet of end of each wall and repeat at intervals not exceeding 30 feet measured horizontally along the wall or partition; and
3. Include lettering not less than 3 inches in height with a minimum 3/8 inch stroke in contrasting color, incorporating the suggested wording: "FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS," or other wording.
4. Exception: Walls in Group R-2 occupancies that do not have a removable decorative ceiling allowing access to the concealed space.

1.5 SUBMITTALS

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

B. Fire-Test-Response Reports: From a qualified independent testing and inspecting agency substantiating each gypsum board shaft wall assembly's required fire-resistance rating.

1. Include data substantiating that elevator entrances and other items that penetrate each gypsum board shaft wall assembly do not negate fire-resistance rating.

1.6 QUALITY ASSURANCE

A. Fire-Resistance-Rated Assemblies: Provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.

1. Fire-Resistance-Rated Assemblies: Indicated by design designations from FM's "Approval Guide, Building Products," UL's "Fire Resistance Directory," or ITS's "Directory of Listed Products."

B. STC-Rated Assemblies: For gypsum board shaft wall assemblies indicated to have STC ratings, provide assembly materials and construction complying with requirements of assemblies whose STC ratings were determined according to ASTM E 90 and classified according to ASTM E 413 by a qualified independent testing agency.

C. Preinstallation Conference: Conduct conference at Project site to comply with requirements of Division 01. Review methods and procedures for installing work related to gypsum board shaft wall assemblies including, but not limited to, the following:

1. Fasteners proposed for anchoring steel framing to building structure.
2. Sprayed fire-resistive materials applied to structural framing.
3. Elevator equipment, including hoistway doors, elevator call buttons, and elevator floor indicators.
4. Wiring devices in shaft wall assemblies.
5. Doors and other items penetrating shaft wall assemblies.
6. Items supported by shaft wall-assembly framing.
7. Mechanical work enclosed within shaft wall assemblies.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages, containers, and bundles bearing brand name and identification of manufacturer or supplier.

B. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes. Stack gypsum panels flat on leveled supports off the ground to prevent sagging.

1.8 PROJECT CONDITIONS

A. Comply with requirements for environmental conditions, room temperatures, and ventilation specified in Section 092110 - GYPSUM BOARD ASSEMBLIES.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. CertainTeed Gypsum, Inc.
2. National Gypsum Company.
3. United States Gypsum Company (USG).

2.2 ASSEMBLY MATERIALS

A. General: Provide materials and components complying with requirements of fire-resistance-rated assemblies indicated.

1. Provide panels in maximum lengths available to eliminate or minimize end-to-end butt joints.
2. Provide auxiliary materials complying with gypsum board shaft wall assembly manufacturer's written recommendations.

B. Steel Framing: ASTM C 645.

1. Protective Coating: ASTM A 653/A 653M, G40, hot-dip galvanized coating.

C. Gypsum Liner Panels: Manufacturer's proprietary liner panels in 1-inch thickness and with moisture-resistant paper faces.

D. Gypsum Wallboard: ASTM C 1396, core type as required by fire-resistance-rated assembly indicated.

E. Accessories: Cornerbead, edge trim, and control joints of material and shapes specified in Section 092110 - GYPSUM BOARD ASSEMBLIES comply with gypsum board shaft wall assembly manufacturer's written recommendations for application indicated.

F. Gypsum Wallboard Joint-Treatment Materials: ASTM C 475 and as specified in Section 092110 - GYPSUM BOARD ASSEMBLIES.

G. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.

H. Track (Runner) Fasteners: Power-driven fasteners of size and material required to withstand loading conditions imposed on shaft wall assemblies without exceeding allowable design stress of track, fasteners, or structural substrates in which anchors are embedded.

1. Powder-Actuated Fasteners: Provide powder-actuated fasteners with capability to sustain, without failure, a load equal to 10 times that imposed by shaft wall assemblies, as determined by testing conducted by a qualified independent testing agency according to ASTM E 1190.
2. Postinstalled Expansion Anchors: Where indicated, provide expansion anchors with capability to sustain, without failure, a load equal to 5 times that imposed by shaft wall assemblies, as determined by testing conducted by a qualified independent testing agency according to ASTM E 488.

I. Laminating Adhesive: Comply with requirements of Section 092110 - GYPSUM BOARD ASSEMBLIES.

J. Acoustic Insulation, Sound Attenuation (Batts) Blankets: Comply with requirements of Section 092110 - GYPSUM BOARD ASSEMBLIES.

K. Acoustical Sealant: Comply with requirements of Section 092110 - GYPSUM BOARD ASSEMBLIES.

2.3 GYPSUM BOARD SHAFT WALL

A. Basis-of-Design Product: As indicated on Drawings by design designation of a qualified testing and inspecting agency.

B. Sustained Air-Pressure Loads: 5 lbf/sq. ft.

C. Deflection Limit: L/240.

D. Studs: Manufacturer's standard profile for repetitive members and corner and end members and for fire-resistance-rated assembly indicated.

1. Depth: As indicated.
2. Minimum Base Metal Thickness: Manufacturer's standard thicknesses that comply with structural performance requirements for stud depth indicated.

E. Track (Runner): Manufacturer's standard J-profile track with long-leg length as standard with manufacturer, but at least 2 inches in depth matching studs.

1. Minimum Base Metal Thickness: Manufacturer's standard thicknesses that comply with structural performance requirements for stud depth indicated.

F. Jamb Struts: Manufacturer's standard J-profile strut with long-leg length of 3 inches, in depth matching studs, and not less than 0.0341 inch thick.

G. Room-Side and Shaft-Side Finish: As indicated.

H. STC Rating: As indicated.

I. Cavity Insulation: Sound attenuation blankets.

2.4 IDENTIFICATION LABELS FOR FIRE- AND SMOKE-PARTITIONS

A. Identification Labels: Self-adhesive signs, to comply with applicable local Code.

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. Fire Wall Signs, Inc.
b. Marking & Identification Tape (mnitape.com).
c. My Safety Sign.
d. Safety Supply Warehouse.

2. Text: "FIRE AND SMOKE BARRIER-PROTECT ALL OPENINGS"

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates to which gypsum board shaft wall assemblies attach or abut, with Installer present, including hollow-metal frames, elevator hoistway doorframes, cast-in anchors, and structural framing. Examine for compliance with requirements for installation tolerances and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Sprayed Fire-Resistive Materials: Coordinate with gypsum shaft wall assemblies so both elements of Work remain complete and undamaged. Patch or replace sprayed fire-resistive materials removed or damaged during installation of shaft wall assemblies to comply with requirements specified in Section 078100 - APPLIED FIREPROOFING.

1. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling runners (tracks) to surfaces indicated to receive sprayed fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches o.c.
2. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of gypsum board assemblies and without reducing the fire-resistive material thickness below that which is required to obtain fire-resistance rating indicated. Protect remaining fire-resistive materials from damage.

3.3 INSTALLATION

A. General: Install gypsum board shaft wall assemblies to comply with requirements of fire-resistance-rated assemblies indicated, manufacturer's written installation instructions, and the following:

1. ASTM C 754 for installing steel framing and gypsum shaft wallboard.

B. Do not bridge building expansion joints with shaft wall assemblies; frame both sides of joints with furring and other support.

C. Install supplementary framing in gypsum board shaft wall assemblies around openings and as required for blocking, bracing, and support of gravity and pullout loads of fixtures, equipment, services, heavy trim, furnishings, and similar items that cannot be supported directly by shaft wall assembly framing.

1. At elevator hoistway doorframes, provide jamb struts on each side of doorframe.
2. Where handrails directly attach to gypsum board shaft wall assemblies, provide galvanized steel reinforcing strip with 0.0312-inch minimum thickness of base (uncoated) metal, accurately positioned and secured behind at least 1 face-layer panel.

D. Integrate stair hanger rods with gypsum board shaft wall assemblies by locating cavity of assemblies where required to enclose rods.

E. At penetrations in shaft wall, maintain fire-resistance rating of shaft wall assembly by installing supplementary steel framing around perimeter of penetration and fire protection behind boxes containing wiring devices, elevator call buttons, elevator floor indicators, and similar items.

F. Isolate gypsum finish panels from building structure to prevent cracking of finish panels while maintaining continuity of fire-rated construction.

G. Install control joints to maintain fire-resistance rating of assemblies.

H. Seal gypsum board shaft walls with acoustical sealant at perimeter of each assembly where it abuts other work and at joints and penetrations within each assembly. Install acoustical sealant to withstand dislocation by air-pressure differential between shaft and external spaces; maintain an airtight and smoke-tight seal; and comply with manufacturer's written instructions or ASTM C 919, whichever is more stringent.

I. In elevator shafts where gypsum board shaft wall assemblies cannot be positioned within 2 inches of the shaft face of structural beams, floor edges, and similar projections into shaft, install 1/2- or 5/8-inch- thick, gypsum board cants covering tops of projections.

1. Slope cant panels at least 75 degrees from horizontal. Set base edge of panels in adhesive and secure top edges to shaft walls at 24 inches o.c. with screws fastened to shaft wall framing.
2. Where steel framing is required to support gypsum board cants, install framing at 24 inches o.c. and extend studs from the projection to the shaft wall framing.

3.4 FINISHING GYPSUM BOARD SHAFT WALL ASSEMBLIES

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints, rounded or beveled edges, and damaged surface areas.

C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below:

1. Level 1: Ceiling plenum areas and concealed areas not exposed to view.
2. Level 2: Panels that are substrate for tile.
3. Level 4: Panel surfaces that will be exposed to view (typical panels).
4. Level 5: Where indicated on Drawings.

3.5 INSTALLING IDENTIFICATION FOR FIRE- AND SMOKE-PARTITIONS

A. Marking and Identification for Fire- and Smoke-Partitions: Permanently install as required by Code.

3.6 PROTECTION

A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

B. Remove and replace panels that are wet, moisture damaged, or exhibit mold growth. Repair of damaged panels in place is not acceptable.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION

SECTION 093000

TILING

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Floor, wall, and base tiles.
2. Setting materials and accessories.
3. Surface preparation.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 033000 - CAST-IN-PLACE CONCRETE for monolithic slab finishes specified for tile substrates.
2. Section 079200 - JOINT SEALANTS for sealing of joints between dissimilar materials.
3. Section 083110 - ACCESS DOORS AND FRAMES for installation in tile.
4. Section 092110 - GYPSUM BOARD ASSEMBLIES for tile backer units.
5. Section 096340 - STONE FLOORING for stone flooring.

1.3 DEFINITIONS

A. Module Size: Actual tile size plus joint width indicated.

B. Face Size: Actual tile size, excluding spacer lugs.

1.4 PERFORMANCE REQUIREMENTS

A. Wet Dynamic Coefficient of Friction: For flooring exposed as a walking surface, provide products with the following values as determined by testing identical products per ANSI/ NFSI B101.3 - 2012 Test Method for Measuring Wet DCOF of Common Hard-Surface Floor Materials, or ANSI 326.3 - American National Standard Test Method for Measuring Dynamic Coefficient of Friction of Hard Surface Materials - 2017. Testing by other methods or earlier editions of the specified test method is not acceptable.

1. Wet Dynamic Coefficient of Friction: Not less than 0.43.

1.5 SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.

1. For feature spaces including lobbies, reception areas, corridors, food service areas and similar spaces provide layout drawings based on measured as-building conditions.

C. Samples for Verification:

1. Assembled samples with grouted joints for each type and composition of tile and for each color and finish required, at least 12 inches square and mounted on rigid panel. Use grout of type and in color or colors approved for completed work.
2. Full-size units of each type of trim and accessory for each color and finish required.
3. Stone Thresholds: 6-inch lengths.
4. Metal Edge Strips: 6-inch lengths.

D. Qualification Data: For Installer.

E. Material Test Reports: For each tile setting product.

1.6 QUALITY ASSURANCE

A. Source Limitations for Tile: Obtain tile of same type and color or finish from one source or producer.

1. Obtain tile from same production run and of consistent quality in appearance and physical properties for each contiguous area.

B. Source Limitations for Setting Materials: Obtain ingredients of a uniform quality for each membrane, mortar, adhesive, and grout component from a single manufacturer and each aggregate from one source or producer.

C. Source Limitations for Other Products: Obtain each of the following products specified in this Section through one source from a single manufacturer for each product:

1. Stone thresholds.
2. Metal edge strips.

D. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirement in ANSI A137.1 for labeling sealed tile packages.

B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.

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

D. Store liquid additives in unopened containers and protected from freezing.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

1.9 WARRANTY

A. Tiling Contractor’s Warranty: The tiling subcontractor shall supply Owner with a minimum two-year workmanship warranty for each tile area. In the event any work related to the tiling and setting materials is found to be defective within two years of substantial completion, the tiling contractor shall remove and replace such at no additional cost to the Owner. The tiling subcontractor’s warranty obligation shall run directly to the Owner, and a copy the tiling signed warranty shall be sent to the tiling system’s manufacturer.

1. The duration of the tiling subcontractor’s two-year warranty shall run concurrent with the tiling system’s manufacturer’s 25-year warranty.

B. Tiling Systems Manufacturer’s Warranty: The tiling systems manufacturer shall guarantee installed tile areas to be in a fully bonded, uncracked, flat, and watertight condition, for a period of 25 years, from the date of final acceptance of the tiling system. The warranty shall be a 25-year no dollar limit (NDL), non-prorated total system labor and material warranty. Total system warranty shall include tiling materials, related components and accessories including, but not limited to the substrate board, waterproofing and crack suppression membranes, mortars, grouts, adhesives, transition materials, and floor drain assemblies.

PART 2 - PRODUCTS

2.1 PRODUCTS, GENERAL

A. ANSI Ceramic Tile Standard: Provide Standard-grade tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.

1. For facial dimensions of tile, comply with requirements relating to tile sizes specified in Part 1 "Definitions" Article.
2. Large Format Tiles are defined as more than 12 inches in any nominal dimension.

B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.

2.2 TILE PRODUCTS

A. Tile Types: Refer to Finish Schedule.

B. Factory Blending: For tile exhibiting color variations within ranges selected during Sample submittals, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.

C. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer, unless otherwise indicated.

D. Tile Trim Units: Matching characteristics of adjoining flat tile and coordinated with sizes and coursing of adjoining flat tile where applicable. Provide shapes selected from manufacturer's standard shapes.

2.3 THRESHOLDS AND EDGE STRIPS

A. Thresholds: Fabricate to sizes and profiles indicated or required to provide transition between adjacent floor finishes.

1. Bevel edges at 1:2 slope, with lower edge of bevel aligned with or up to 1/16 inch above adjacent floor surface. Finish bevel to match top surface of threshold. Limit height of threshold to 1/2 inch or less above adjacent floor surface.

B. Marble Thresholds: ASTM C 503/C 503M, with a minimum abrasion resistance of 10 according to ASTM C 1353 or ASTM C 241/C 241M and with honed finish.

1. Description: Uniform, fine- to medium-grained white stone with gray veining.

C. Metal Edge Strips: Angle or L-shape, height to match tile and setting-bed thickness, metallic or combination of metal and resilient base, designed specifically for flooring applications.

1. Basis of Design: Schluter Systems.
2. Material: ASTM B 221, extruded aluminum, with clear anodized satin finish.
3. Material: ASTM A 666, stainless steel, 300 series, with No. 4 satin finish.

2.4 SETTING MATERIALS

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

1. Custom Building Products.
2. Laticrete International, Inc.
3. MAPEI Corporation.

B. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.

1. Basis of Design: MAPEI; Mapecem Quickpatch.

C. Waterproof Membrane: Manufacturer's standard product, that complies with ANSI A118.10 and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.

D. Fabric-Reinforced, Fluid-Applied Waterproofing and Crack Suppression Membrane: System consisting of liquid-latex rubber or elastomeric polymer and continuous fabric reinforcement.

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

a. Custom Building Products; 9240 Waterproofing and Anti-Fracture Membrane.
b. Laticrete; Hydro Ban.
c. MAPEI; Mapelastic AquaDefense.

E. Portland Cement Mortar (Thickset) Installation Materials: ANSI A108.02.

1. Cleavage Membrane: Asphalt felt, ASTM D 226, Type I (No. 15); or polyethylene sheeting, ASTM D 4397, 4.0 mils thick.

F. Latex-Portland Cement Mortar (Thin Set): ANSI A118.4.

1. Provide prepackaged, dry-mortar mix combined with liquid-latex additive at Project site.
2. For wall applications, provide nonsagging mortar.

a. For glass tile wall applications, provide white color mortar.

G. Tile Grout, Cementitious Type: ANSI A118.7, liquid-latex form for addition to prepackaged dry-grout mix.

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

a. Custom Building Products; Polyblend.
b. Laticrete; Permacolor Select.
c. MAPEI; Keracolor.

2. Cementitious Grout Types:

a. Unsanded grout mixture for joints 1/8 inch and narrower.
b. Sanded grout mixture for joints 1/8 inch and wider.

3. Color: To be selected by Architect from manufacturer’s full range.

H. Tile Grout, Epoxy Type: ANSI A118.3, chemical resistant, water cleanable, tile grouting epoxy.

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

a. Custom Building Products; CEG-IG.
b. Laticrete; SpectraLock Pro.
c. MAPEI; Kerapoxy.

2. Color: To be selected by Architect from manufacturer’s full range.

I. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

J. Grout Sealer: Manufacturer's standard silicone product for sealing grout joints that does not change color or appearance of grout.

2.5 ELASTOMERIC SEALANTS

A. Joint Sealants: Refer to Section 079200 - JOINT SEALANTS.

B. Colors: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints, unless otherwise indicated.

2.6 MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.

B. Add materials, water, and additives in accurate proportions.

C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.

1. Verify that substrates for setting tile are firm; dry; clean; free of oil, waxy films, and curing compounds; and within flatness tolerances required by referenced ANSI A108 Series of tile installation standards for installations indicated.
2. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed before installing tile.
3. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.

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

3.2 PREPARATION

A. Remove coatings, including curing compounds and other substances that contain soap, wax, oil, or silicone, that are incompatible with tile-setting materials.

B. Provide concrete substrates for tile floors that comply with flatness tolerances specified in referenced ANSI A108 Series of tile installation standards.

1. Fill cracks, holes, and depressions with trowelable leveling and patching compound according to tile-setting material manufacturer's written instructions. Use product specifically recommended by tile-setting material manufacturer.
2. Remove protrusions, bumps, and ridges by sanding or grinding.

C. Where indicated, prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot toward drains.

D. Blending: For tile exhibiting color variations within ranges selected during Sample submittals, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

3.3 TILING INSTALLATION, GENERAL

A. ANSI Tile Installation Standards: Comply with parts of ANSI A108 Series "Specifications for Installation of Ceramic Tile" that apply to types of setting and grouting materials and to methods indicated in ceramic tile installation schedules.

B. Comply with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 series "Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.

C. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions, unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

D. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

E. Jointing Pattern: Lay tile in grid pattern, unless otherwise indicated. Align joints when adjoining tiles on floor, base, walls, and trim are same size. Lay out tile work and center tile fields in both directions in each space or on each wall area. Adjust to minimize tile cutting. Provide uniform joint widths, unless otherwise indicated.

1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.

F. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.

G. Expansion Joints: Locate expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.

1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
2. Prepare joints and apply sealants to comply with requirements in Section 079200 - JOINT SEALANTS.

H. Stone Thresholds: Install stone thresholds at locations indicated; set in same type of setting bed as abutting field tile, unless otherwise indicated.

1. At locations where mortar bed (thickset) would otherwise be exposed above adjacent floor finishes, set thresholds in mortar (thinset).
2. Do not extend membranes under thresholds set in mortar. Fill joints between such thresholds and adjoining tile set on membrane with elastomeric sealant.

I. Metal Edge Strips: Install at locations indicated or where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with top of tile.

J. Floor Sealer: Apply floor sealer to grout joints according to floor-sealer manufacturer's written instructions. As soon as floor sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

3.4 MEMBRANE INSTALLATION

A. Install waterproofing to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness bonded securely to substrate.

B. Install crack-suppression membrane to comply ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness bonded securely to substrate.

C. Do not install tile over membrane until membrane has cured and been tested to determine that it is watertight.

3.5 CLEANING AND PROTECTING

A. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.

1. Remove grout residue from tile as soon as possible.
2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions, but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.
3. Remove temporary protective coating by method recommended by coating manufacturer that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent it from clogging drains.

B. When recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear.

C. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed. After seven days, cover areas subject to construction traffic with heavy cardboard.

D. Before final inspection, remove protective coverings and rinse neutral cleaner from tile surfaces.

3.6 TILE INSTALLATION SCHEDULE

A. This schedule refers to Tile Installation Methods specified in the TCNA Manual.

B. Floor Tile Over Concrete, Typical: TCNA F113 and ANSI A108.5.

1. Tile Type: Refer to Finish Schedule.
2. Mortar: Thinset.
3. Grout: Polymer-modified unsanded grout.
4. Joint Width: 1/16 inch.

C. Floor Tile Over Concrete, at Commercial Kitchen and Servery Areas: TCNA F115 and ANSI A108.5.

1. Tile Type: Refer to Finish Schedule.
2. Mortar: Thinset.
3. Grout: Epoxy.
4. Joint Width: 1/8 inch.

D. Floor Tile Over Waterproof Membrane and Concrete, at Toilet Rooms: TCNA F122 and ANSI A108.5.

1. Tile Type: Refer to Finish Schedule.
2. Mortar: Thinset.
3. Grout: Polymer-modified unsanded grout.
4. Joint Width: 1/16 inch.

E. Wall Tile, Typical Over Cementitious Backer-Board: TCNA W244C and ANSI A108.5.

1. Tile Type: Refer to Finish Schedule.
2. Mortar: Thinset.
3. Grout: Polymer-modified unsanded grout.
4. Joint Width: 1/16 inch.

F. Wall Tile Over Waterproof Membrane and Cementitious Backer-Board, at Bathtubs and Showers: TCNA B420 and ANSI A108.5.

1. Tile Type: Refer to Finish Schedule.
2. Mortar: Thinset.
3. Grout: Polymer-modified unsanded grout.
4. Joint Width: 1/16 inch.

END OF SECTION

SECTION 095100

ACOUSTICAL CEILINGS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Acoustical ceiling tiles and panels.
2. Suspension systems, grid systems and ceiling hangers.
3. Acoustical sealant at edge moldings at acoustical ceilings.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 092110 - GYPSUM BOARD ASSEMBLIES for gypsum board ceilings and soffits.
2. Division 21 - FIRE SUPPRESSION for fire-suppression components located in ceilings.
3. Division 23 - HEATING, VENTILATING AND AIR CONDITIONING for air handling and distribution components located in ceilings.
4. Division 26 - ELECTRICAL for light fixture and alarm system components located in ceilings.

1.3 SUBMITTALS

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

B. Coordination Drawings: Reflected ceiling plans drawn to scale and coordinating penetrations and ceiling-mounted items. Show the following:

1. Ceiling suspension members.
2. Method of attaching hangers to building structure. Furnish layouts for cast-in-place anchors, clips, and other ceiling attachment devices whose installation is specified in other Sections.
3. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
4. Minimum Drawing Scale: 1/4 inch = 1 foot.

C. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.

1. Acoustical Panel: Set of 6 inch square Samples of each type, color, pattern, and texture.

2. Exposed Suspension System Members, Moldings, and Trim: Set of 12 inch long Samples of each type, finish, and color.

D. Asbestos Certification: Manufacturer's written certification that acoustical ceiling products contain no asbestos (0.0000%). Product labels indicating that it is the user's responsibility to test the products for asbestos are unacceptable and sufficient cause for rejection of the product on site.

E. Maintenance Data: For finishes to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Source Limitations:

1. Acoustical Ceiling Panels: Obtain each type through one source from a single manufacturer.
2. Suspension Systems: Obtain each type through one source from a single manufacturer.

B. Seismic Performance: Acoustical ceiling shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

C. Fire-Test-Response Characteristics: Provide acoustical panel ceilings that comply with the following requirements:

1. Fire-Resistance Characteristics: Where indicated, provide acoustical panel ceilings identical to those of assemblies tested for fire resistance per ASTM E 119 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.

a. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another testing and inspecting agency.
b. Identify materials with appropriate markings of applicable testing and inspecting agency.

2. Surface-Burning Characteristics: Provide acoustical panels complying with ASTM E 1264 for Class A materials as determined by testing identical products per ASTM E 84.

D. Mockups: Build mockups to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution.

1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

E. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels, suspension system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1.7 COORDINATION

A. Coordinate layout and installation of acoustical panels and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.1 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. Armstrong Ceilings.
2. CertainTeed Ceilings.
3. USG.

2.2 ACOUSTICAL PANELS, GENERAL

A. Products: Subject to compliance with specified requirements, provide as indicated on the Finish Schedule and as approved by the Architect.

2.3 METAL SUSPENSION SYSTEMS

A. Metal Suspension System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635.

1. Structural Classification: Intermediate-duty system.
2. End Condition of Cross Runners: Override (stepped) or butt-edge type.
3. Face Design: Flat, flush.
4. Cap Material: Steel or aluminum cold-rolled sheet.
5. Color: White, prefinished.
6. Grid Face Width: As specified with ACT type.

B. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated.

1. Anchors in Concrete: Anchors with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing per ASTM E 488 or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency; zinc-plated for Class SC1 service.
2. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated, and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing per ASTM E 1190, conducted by a qualified testing and inspecting agency.

C. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:

1. Zinc-Coated Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
2. Size: Select wire diameter so its stress at three times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106 diameter wire.

D. Hold-Down Clips: At vestibules and areas subject to wind uplift, provide manufacturer's standard hold-down clips spaced 24 inches on all cross tees.

2.4 METAL EDGE MOLDINGS AND TRIM

A. Roll-Formed Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that fit acoustical panel edge details and suspension systems indicated; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension system runners.

1. For lay-in panels with reveal edge details, provide stepped edge molding that forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member.
2. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.
3. For narrow-face suspension systems, provide suspension system and manufacturer's standard edge moldings that match width and configuration of exposed runners.

B. Suspension Trim: Subject to compliance with requirements, provide one of the following:

1. Armstrong World Industries, Inc.; Axiom.
2. CertainTeed Ceilings; Approved equal.
3. USG Interiors, Inc.; Compasso.

2.5 ACOUSTICAL SEALANT

A. Acoustical Sealant, for Concealed Joints: Manufacturer's standard nondrying, nonhardening, nonskinning, nonstaining, gunnable, joint sealant, recommended for sealing interior concealed joints to reduce airborne sound transmission.

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

a. OSI (a division of Henkel); Pro-Series SC-175.
b. Pecora Corp.; AC-20 FTR Acoustical and Insulation Sealant.
c. Pecora Corp.; BA-98.
d. Specified Technologies, Inc. (STI); Smoke N Sound Acoustical Sealant.
e. USG; SHEETROCK Acoustical Sealant.

2. VOC Content, Architectural Sealants: 250 g/L or less.
3. Methylene chloride and perchloroethylene may not be intentionally added to sealants.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.

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

3.2 PREPARATION

A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

3.3 INSTALLATION

A. General: Install acoustical panel ceilings to comply with ASTM C 636 per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."

B. Suspend ceiling hangers from building's structural members and as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
4. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
5. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
6. Do not attach hangers to steel deck tabs.

7. Space hangers not more than 48 o.c. along each member supported directly from hangers, unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.

C. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.

1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
2. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.
3. Do not use exposed fasteners, including pop rivets, on moldings and trim.

D. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

E. Install acoustical panels with undamaged edges and fit accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.

1. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.
2. Install hold-down clips in areas indicated, in areas required by authorities having jurisdiction, and for fire-resistance ratings; space as recommended by panel manufacturer's written instructions, unless otherwise indicated.

3.4 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION

SECTION 096340

STONE FLOORING

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Interior dimension stone flooring.
2. Interior stone stair treads.
3. Interior stone thresholds.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 055100 - METAL STAIRS AND RAILINGS for stair fabrication.
2. Section 079200 - JOINT SEALANTS for sealing control and expansion joints in stone paving and flooring with elastomeric sealants.

1.3 PERFORMANCE REQUIREMENTS

A. Wet Dynamic Coefficient of Friction: For flooring exposed as a walking surface, provide products with the following values as determined by testing identical products per ANSI/ NFSI B101.3 - 2012 Test Method for Measuring Wet DCOF of Common Hard-Surface Floor Materials, or ANSI 326.3 - American National Standard Test Method for Measuring Dynamic Coefficient of Friction of Hard Surface Materials - 2017. Testing by other methods or earlier editions of the specified test method is not acceptable.

1. Wet Dynamic Coefficient of Friction: Not less than 0.43.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Each variety of stone. Include data on physical properties required by referenced ASTM standards.
2. Stone accessories and other manufactured products.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other Work.

C. Samples for Verification:

1. For each stone type indicated, in sets of Samples not less than 12 inches square. Include two or more Samples in each set and show the full range of variations in appearance characteristics expected in completed Work.
2. For each color of grout required.

D. Qualification Data: For Installer.

E. Maintenance Data: For stone paving and flooring to include in maintenance manuals. Include Product Data for stone-care products used or recommended by Installer and names, addresses, and telephone numbers of local sources for products.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An installer who employs experienced mechanics and stone fitters who are skilled in installing stone paving and flooring similar in material, design, and extent to those indicated for this Project and whose projects have a record of successful in-service performance.

B. Fabricator Qualifications: Shop that employs skilled workers who fabricate stone paving and flooring similar to those indicated for this Project and whose products have a record of successful in-service performance.

C. Source Limitations for Stone: Obtain each variety of stone, regardless of finish, from a single quarry with resources to provide materials of consistent quality in appearance and physical properties.

1. Obtain each variety of stone from a single quarry, whether specified in this Section or in another Section of the Specifications.

D. Source Limitations for Other Materials: Obtain each type of cementitious material, grout, admixture, stone accessory, sealant, and other material from a single manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Lift stone with wide-belt slings; do not use wire rope or ropes that might cause staining. Move stone, if required, using dollies with cushioned wood supports.

B. Store stone on pallets with nonstaining separators and nonstaining, waterproof covers. Ventilate under covers to prevent condensation.

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

1.7 PROJECT CONDITIONS

A. Do not set stone when air or material temperature is below 50 deg F.

B. Maintain minimum ambient temperatures of 50 deg F during installation and for 7 days after completion unless higher temperatures are required by fabricator's or supplier's instructions.

PART 2 - PRODUCTS

2.1 STONE, GENERAL

A. Varieties and Sources: Subject to compliance with requirements, provide one of the stone varieties specified for each stone type in Part 2 "Stone Types" Article.

B. Match Architect's samples for variety, color, finish, and other stone characteristics relating to aesthetic effects.

C. Provide stone that is free of cracks, seams, and starts impairing structural integrity or function.

D. Provide stone from a single quarry for each variety of stone required.

E. Quarry stone in a manner to ensure that as-quarried block orientations yield finished stone with required characteristics.

F. Make stone slabs available for Architect to examine for appearance characteristics.

1. Architect will select aesthetically acceptable slabs and will indicate aesthetically unacceptable slabs and portions of slabs.
2. Segregate slabs selected for use on Project and mark backs indicating approval.
3. Mark and photograph aesthetically unacceptable portions of slabs as directed by Architect.

2.2 STONE TYPES

A. Granite: Provide granite complying with ASTM C 615 and NBGQA's "Specifications for Architectural Granite" and as follows:

1. Varieties, Cut and Finish: As selected by Architect.

B. Limestone: Provide limestone complying with ASTM C 568 and ILI's "Indiana Limestone Handbook" and as follows:

1. Varieties, Cut and Finish: As selected by Architect.

C. Slate: Provide slate complying with ASTM C 629, with a fine, even grain and unfading color, from clear, sound stock and as follows:

1. Varieties, Cut and Finish: As selected by Architect.

2.3 MORTAR MATERIALS

A. Portland Cement: ASTM C 150, Type I or II. Provide natural color or white cement as required to produce mortar color indicated.

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

C. Aggregate: ASTM C 144 and as follows:

1. For pointing mortar, use aggregate graded with 100 percent passing No. 16 sieve.

2. Colored Aggregates: Natural-colored sand or ground granite, or other sound stone; of color necessary to produce required mortar color.

D. Mortar Pigments: Natural or synthetic iron oxides, compounded for use in mortar mixes and with a record of satisfactory performance in stone mortars.

E. Latex additive (water emulsion) described below, serving as replacement for part of or all gaging water, of type specifically recommended by latex-additive manufacturer for use with job-mixed portland cement mortar and not containing a retarder.

F. Water: Potable.

2.4 GROUT

A. Grout Colors: As selected by Architect from manufacturer's full range.

B. Latex-Portland Cement Grout: ANSI A118.6, for materials described in Paragraph H-2.4, composed as follows:

1. Factory-Prepared, Dry-Grout Mixture: Factory-prepared mixture of portland cement; dry, redispersible, ethylene vinyl acetate additive; and other ingredients to produce the following: Unsanded grout mixture for joints 1/8 inch and narrower.

a. VOC Content, Ceramic Tile Adhesives: 65 g/L or less.

C. Water-Cleanable Epoxy Grout: ANSI A118.3.

1. VOC Content, Ceramic Tile Adhesives: 65 g/L or less.

2.5 ACCESSORIES

A. Water-Cleanable Epoxy Adhesive: ANSI A118.3.

1. VOC Content, Epoxy Adhesives: 100 g/L or less.

B. Cleavage Membrane: Polyethylene sheeting, ASTM D 4397, 4.0 mils thick.

C. Reinforcing Wire Fabric: Galvanized, welded wire fabric, 2 by 2 inches by 0.062-inch diameter; comply with ASTM A 185 and ASTM A 82 except for minimum wire size.

D. Abrasive Inserts for Stair Treads: Abrasive strips consisting of aluminum oxide, silicon carbide, or a combination of both, in an epoxy-resin binder, fabricated for installing in routed grooves of stair treads to provide slip resistance. Provide epoxy-resin installation adhesive compatible with inserts.

E. Divider Strips and Edging: Metal or combination of metal and PVC or neoprene base, designed specifically for flooring applications, in longest lengths available, and as follows:

1. Exposed-Edge Material: White zinc alloy.
2. Width: 1/8 inch.
3. Control-Joint Filler: Neoprene, in color selected by Architect from manufacturer's full range.

F. Cork Joint Filler: Preformed strips complying with ASTM D 1752, Type II.

G. Cleaner: Stone cleaner specifically formulated for stone types, finishes, and applications indicated, as recommended by stone producer and, if a sealer is specified, by sealer manufacturer. Do not use cleaning compounds containing acids, caustics, harsh fillers, or abrasives.

H. Floor Sealer: Colorless, slip- and stain-resistant sealer that does not affect color or physical properties of stone surfaces, as recommended by stone producer for application indicated.

1. VOC Content, Floor Coating: 100 g/L or less.

2.6 STONE FABRICATION

A. General: Fabricate stone paving and flooring in sizes and shapes necessary to comply with requirements indicated, including details on Drawings and Shop Drawings.

1. For granite, comply with recommendations in NBGQA's "Specifications for Architectural Granite."
2. For limestone, comply with recommendations in ILI's "Indiana Limestone Handbook."
3. Fabricate stone thresholds in sizes and profiles as indicated or required to provide transition between adjacent floor finishes.

B. Cut stone to produce pieces of thickness, size, and shape indicated and to comply with fabrication and construction tolerances recommended by applicable stone association.

1. Pattern: As indicated on the Drawings.
2. Stone Edges: Square.
3. Cut stone to produce uniform joints, 1/16 wide, in locations indicated.
4. Clean sawed backs of stones to remove rust stains and iron particles.

C. Pattern Arrangement: Fabricate and arrange stone units with veining and other natural markings to comply with the following requirements:

1. Cut stone from one block or contiguous, matched blocks in which natural markings occur.
2. Arrange units with veining as indicated on Drawings.

D. Carefully inspect finished stone units at fabrication plant for compliance with requirements for appearance, material, and fabrication. Replace defective units.

1. Grade and mark stone for overall uniform appearance when assembled in place. Natural variations in appearance are acceptable if installed stone units match range of colors and other appearance characteristics represented in approved samples and mockups.

2.7 MORTAR AND GROUT MIXES

A. Mortar: Comply with referenced standards and with manufacturers' written instructions for mix proportions, mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures needed to produce mortar of uniform quality and with optimum performance characteristics.

1. Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated. Do not use calcium chloride.
2. Combine and thoroughly mix cementitious materials, water, and aggregates in a mechanical batch mixer, unless otherwise indicated. Discard mortar when it has reached initial set.

B. Mortar Bed Bond Coat: Mix neat cement and latex additive to a creamy consistency.

C. Latex-Modified Portland Cement Bond Coat: Proportion and mix portland cement, aggregate, and latex additive to comply with latex-additive manufacturer's written instructions.

D. Joint Grout: Comply with mixing requirements of referenced ANSI standards and manufacturer's written instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces indicated to receive stone paving and flooring, with Installer present, for compliance with requirements for maximum moisture content, installation tolerances, and other conditions affecting performance.

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

3.2 PREPARATION

A. Vacuum clean concrete substrates to remove dirt, dust, debris, and loose particles.

B. Remove substances from concrete substrates that could impair mortar bond, including curing and sealing compounds, form oil, and laitance.

C. Clean dirty or stained stone surfaces by removing soil, stains, and foreign materials before setting. Clean stone by thoroughly scrubbing with fiber brushes and then drenching with clear water. Use only mild cleaning compounds that contain no caustic or harsh materials or abrasives.

3.3 INSTALLATION, GENERAL

A. Do necessary field cutting as stone is set. Use power saws with diamond blades to cut stone. Cut lines straight and true, with edges eased slightly to prevent snipping.

B. Set stone to comply with Drawings and Shop Drawings.

C. Scribe and field-cut stone as necessary to fit at obstructions. Produce tight and neat joints.

D. Stone over Waterproofing: Carefully place stone and setting materials over waterproofing so protection materials are not displaced and waterproofing is not punctured or otherwise damaged. Replace protection materials that become displaced and arrange for repair of damaged waterproofing before covering with stone.

1. Provide cork joint filler, where indicated, at waterproofing that is turned up on vertical surfaces or, if not indicated, provide temporary filler or protection until stone paving installation is complete.

E. Expansion- and Control-Joint Installation: Locate and install according to Drawings and Shop Drawings. Joint-sealant materials and installation are specified in Section 079200 - JOINT SEALANTS.

3.4 INSTALLATION TOLERANCES

A. Variation in Line: For positions shown in plan for edges of paving, flooring, ramps, steps, changes in color or finish, and continuous joint lines, do not exceed 1/8 inch in 96 inches, 1/4 inch in 20 feet or 3/8 inch maximum.

B. Variation in Joint Width: Do not vary joint thickness more than 1/16 inch or 1/4 of nominal joint width, whichever is less.

C. Variation in Surface Plane of Paving and Flooring: Do not exceed 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 3/8 inch maximum from level or slope indicated.

D. Variation in Plane between Adjacent Units (Lipping): Do not exceed 1/32-inch difference between planes of adjacent units.

3.5 INSTALLATION OF STONE DIRECTLY OVER CONCRETE

A. Saturate concrete with clean water several hours before placing setting bed. Remove surface water about one hour before placing setting bed.

B. Apply mortar bed bond coat to damp concrete and broom to provide an even coating that completely covers the concrete. Do not exceed 1/16-inch thickness. Limit area of mortar bed bond coat to avoid its drying out before placing setting bed.

C. Apply mortar bed immediately after applying mortar-bed bond coat. Spread, tamp, and screed to uniform thickness at elevations required for setting stone to finished elevations indicated.

D. Mix and place only that amount of mortar bed that can be covered with stone before initial set. Cut back, bevel edge, and discard material that has reached initial set before stone can be placed.

E. Place stone before initial set of mortar occurs. Immediately before placing stone on setting bed, apply uniform 1/16-inch-thick bond coat to bed or to back of each stone unit.

F. Tamp and beat stone with a wooden block or rubber mallet to obtain full contact with setting bed and to bring finished surfaces within indicated tolerances. Set each unit in a single operation before initial set of mortar; do not return to areas already set and disturb stone for purposes of realigning finished surfaces or adjusting joints.

G. Rake out joints to depth required to receive grout as units are set.

3.6 INSTALLATION OF STONE OVER CLEAVAGE MEMBRANE OR WATERPROOFING

A. Place cleavage membrane over substrates indicated to receive stone, lapped at least 4 inches at joints.

B. Place reinforcing wire fabric over membrane, lapped at least one full mesh at joints and supported so mesh becomes embedded in middle of setting bed. Hold edges back from vertical surfaces approximately 1/2 inch.

C. Place mortar bed over membrane with reinforcing wire fabric fully embedded in middle of mortar bed. Spread, tamp, and screed to uniform thickness at elevations required for setting stone to finished elevations indicated.

D. Mix and place only that amount of mortar bed that can be covered with stone before initial set. Cut back, bevel edge, and discard material that has reached initial set before stone can be placed.

E. Place stone before initial set of mortar occurs. Immediately before placing stone on setting bed, apply uniform 1/16-inch- thick bond coat to bed or to back of each stone unit.

F. Tamp and beat stone with a wooden block or rubber mallet to obtain full contact with setting bed and to bring finished surfaces within indicated tolerances. Set each unit in a single operation before initial set of mortar; do not return to areas already set and disturb stone for purposes of realigning finished surfaces or adjusting joints.

G. Rake out joints to depth required to receive grout as units are set.

3.7 STONE THRESHOLD INSTALLATION

A. At locations adjacent to stone paving and flooring, install stone thresholds in same type of setting bed as abutting stone paving and flooring, unless otherwise indicated.

1. Set thresholds in thin-set, latex-portland cement mortar to comply with ANSI A108.5 at locations where mortar bed would otherwise be exposed above other adjacent paving and flooring.

B. At locations not adjacent to stone paving and flooring, install stone thresholds in full bed of water-cleanable epoxy adhesive to comply with ANSI A108.4.

3.8 STONE STAIR TREAD AND RISER INSTALLATION

A. Install stone stair treads and risers to comply with "Installation of Stone Directly over Concrete" Article.

B. Install stone stair treads and risers in a full bed of water-cleanable epoxy adhesive to comply with ANSI A108.4.

3.9 GROUTING OF STONE PAVING AND FLOORING

A. Grout stone joints to comply with ANSI A108.10 and manufacturer's written instructions.

1. Do not use sanded grout for polished stone.

B. Grout joints as soon as possible after initial set of setting bed. Force grout into joints, taking care not to smear grout on adjoining stone and other surfaces. After initial set of grout, finish joints by tooling to produce a slightly concave polished joint, free of drying cracks.

C. Cure grout by maintaining in a damp condition for seven days except as otherwise recommended by latex-additive manufacturer.

3.10 ADJUSTING AND CLEANING

A. Remove and replace stone paving and flooring of the following description:

1. Broken, chipped, stained, or otherwise damaged stone. Stone may be repaired if methods and results are approved by Architect.
2. Defective joints.
3. Stone paving, flooring, and joints not matching approved samples and mockups.
4. Stone paving and flooring not complying with other requirements indicated.

B. Replace in a manner that results in stone paving and flooring matching approved samples and mockups, complying with other requirements, and showing no evidence of replacement.

C. In-Progress Cleaning: Clean stone paving and flooring as work progresses. Remove mortar fins and smears before tooling joints.

D. Clean stone paving and flooring after setting and grouting are complete. Use procedures recommended by stone fabricator for types of application.

E. Apply sealer to cleaned stone flooring according to sealer manufacturer's written instructions.

3.11 PROTECTION

A. Prohibit traffic from installed stone for a minimum of 72 hours.

B. Protect stone paving and flooring during construction with nonstaining kraft paper. Where adjoining areas require construction work access, cover stone paving and flooring with a minimum of 3/4-inch untreated plywood over nonstaining kraft paper.

END OF SECTION

SECTION 096341

SITE STONE PAVING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes materials, labor, apparatus, tools, equipment, temporary construction, transportation, and services necessary for and incidental to performing the proper completion of Work as required to make a complete Site Stone Pavement installations, as shown on the Contract Drawings, and as specified herein this Section.

B. Work under this Section consists of, but is not necessarily limited to, furnishing and installing the following:

1. Granite Paving mortared to concrete pavement.
2. Granite Cobble mortared to concrete pavement.
3. Granite Cobble set atop a sand setting bed.
4. Stone Sealers

C. Related Documents: The following Documents contain requirements that relate to Work in this Section:

1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
2. Section 040513 "Site Masonry Mortaring and Grouting".
3. Section 055013 “Site Miscellaneous Metal Fabrication”.
4. Section 321313 "Landscape Architectural Cement Concrete Paving".
5. Section 321316 “Decorative Cement Concrete Paving”.

1.2 PERFORMANCE REQUIREMENTS

A. Stone Abrasion Resistance: Minimum abrasive-hardness value of 12, as determined per ASTM C 241.

B. Static Coefficient of Friction: ASTM C 1028, values as follows:

1. Level Surfaces: A minimum of 0.6.
2. Step Treads: A minimum of 0.6.
3. Ramp Surfaces: A minimum of 0.8.

1.3 SUBMITTALS

A. General: Refer to Division 01 for project submittal requirements and timelines. If provided in hardcopy submittal booklets submit each item in this Article in required copies with four (4) copies for review by Landscape Architect. Three (3) copies shall be returned (One for Client, one for Owner and one for Contractor) and one copy maintained by Landscape Architect. Provide one (1) sets of Material Samples for review by the Landscape Architect unless requested otherwise.

B. Submittal Booklets: Each Submittal Booklet under this Section shall be tabbed into specific sections, containing clearly identified (through yellow highlighter or other specific identification methods) and legible information on the following information indicated in this Article.

C. Electronic Submittals: Electronic Submittal shall be provided in a single bound file, PDF format preferred, unless otherwise noted in Division 01.

D. Product Data: For each variety of stone, stone accessory, and other manufactured products specified.

1. For stone varieties proposed for use on Project, include data on physical properties required by referenced ASTM standards.

E. Shop Drawings: Show details of fabrication and installation of stone paving and flooring, including dimensions and profiles of stone units; arrangement and details of jointing; and details showing relationship with, attachment to, and reception of related work.

1. Include large-scale details of decorative surfaces and inscriptions.

F. Grout Samples for Initial Selection: Manufacturer's standard samples of actual products showing the full range of colors available.

G. Stone Samples for Verification: Sets for each color, grade, finish, and variety of stone required; not less than 12 inches square. Include two (2) or more samples in each set showing the full range of variations in appearance characteristics expected in completed Work.

H. Grout Samples for Verification: For each color required, showing the full range of exposed color and texture expected in completed Work.

I. Qualification Data: For firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

J. Maintenance Data: For stone paving and flooring to include in the maintenance manuals specified in Division 1. Include Product Data for stone-care products used or recommended by Installer and the names, addresses, and telephone numbers of local sources for products.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer who has completed stone paving and flooring similar in material, design, and extent to that indicated for Project that has resulted in construction with a record of successful in-service performance.

B. Source Limitations for Stone: Obtain each variety of stone, regardless of finish, from a single quarry with resources to provide materials of consistent quality in appearance and physical properties and to cut and finish material without delaying the Work.

1. Obtain each variety of stone from a single quarry, whether specified in this Section or in another Section of the Specifications.

C. Source Limitations for Other Materials: Obtain each type of cementitious material, grout, admixture,

D. Mockups: Refer to Contract Drawings for Mock-up requirements or provide at minimum as noted below. Before installing stone paving construct 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 completed Work.

1. Locate mockups in the location indicated or, if not indicated, as directed by Landscape Architect.
2. Build mockups as follows:

    a. Approximately 4’-0” by 4’-0” by full depth covering scope / scale of work to be preformed.

3. Notify Architect 7 days in advance of the dates and times when mockups will be constructed.
4. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.

    a. Approval of mockups does not constitute approval of deviations from Contract Documents contained in mockups, unless such deviations are specifically approved by Architect in writing.
    b. Approved mockups in an undisturbed condition at the time of Substantial Completion may become part of the completed Work.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in undamaged condition.

B. Store and handle stone and related materials to prevent deterioration or damage due to moisture, temperature changes, contaminants, corrosion, breaking, chipping, or other causes.

1. Store stone on wood skids or pallets with nonstaining, waterproof covers. Arrange to distribute weight evenly and to prevent damage to stone. Ventilate under covers to prevent condensation.
2. Store cementitious materials off ground, under cover, and in dry location.
3. Store aggregate materials covered and in dry location.

1.6 PROJECT CONDITIONS

A. Do not set stone flooring when air temperature or material temperature is below 50 deg F.

B. Maintain minimum ambient temperatures of 50 deg F during installation of stone flooring and for 7 days after completion, unless higher temperatures are required by fabricator's or supplier's instructions.

C. Weather Limitations for Stone Paving: Comply with the following requirements:

1. Cold-Weather Requirements: Protect stone paving against freezing when atmospheric temperature is 40 deg F and falling. Heat materials to provide mortar and grout temperatures between 40 and 120 deg F. Provide the following protection for completed portions of work for 24 hours after installation when the mean daily air temperature is as indicated: below 40 deg F, cover with weather-resistant membrane; below 25 deg F, cover with insulating blankets; below 20 deg F, provide enclosure and temporary heat to maintain temperature above 32 deg F.

2. Hot-Weather Requirements: Protect stone paving when temperature and humidity conditions produce excessive evaporation of setting beds and grout. Provide artificial shade and windbreaks and use cooled materials as required. Do not apply mortar to substrates with temperatures of 100 deg F and above.

PART 2 - PRODUCTS

2.1 STONE SOURCES

A. Varieties and Sources: Subject to compliance with requirements, provide one of the stone varieties indicated in the Stone Schedule for each stone type.

1. Where 2 or more stone types listed in the Materials Schedule are identical except for finish, provide the same variety from the same source for each type.

B. Varieties and Sources: Subject to compliance with requirements, provide stone varieties from sources indicated in the Finish Schedule on the contract drawings.

2.2 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. Portland Cement-Lime Mix:

a. Glen-Gery Corporation.
b. Lafarge Corporation.
c. Lehigh Portland Cement Co.
d. Riverton Corporation (The).

2. Mortar Pigments:

a. Davis Colors.
b. Lafarge Corporation.
c. Solomon Grind-Chem Services, Inc.

3. Water-Cleanable Epoxy Adhesives:

a. American Olean Tile Co., Inc.
b. Bonsal: W. R. Bonsal Co.
c. C-Cure Chemical Co., Inc.
d. Custom Building Products.
e. Dal-Tile Corp.
f. Laticrete International, Inc.
g. Mapei Corporation.
h. Summitville Tiles, Inc.

4. Latex-Portland Cement Grouts:

a. American Olean Tile Co., Inc.
b. Boiardi Products Corp.

c. Bonsal: W. R. Bonsal Co.
d. Bostik.
e. C-Cure Chemical Co., Inc.
f. Custom Building Products.
g. Dal-Tile Corp.
h. DAP Inc.
i. Fuller: H. B. Fuller Co.; TEC Inc.
j. Laticrete International, Inc.
k. Mapei Corporation.
l. Summitville Tiles, Inc.

2.3 STONE:GENERAL

A. Reference contract drawings for stone finish and material schedules.

B. Provide stone that is free of cracks, seams, and starts impairing structural integrity or function.

C. Provide stone from a single quarry for each variety of stone required.

1. Provide matched blocks extracted from contiguous locations in a single bed of quarry stratum unless stone from blocks randomly selected for aesthetic effect is approved by Architect.

D. Quarry stone in a manner to ensure as-quarried block orientations yield finished stone with required characteristics.

2.4 MORTAR MATERIALS

A. Portland Cement: ASTM C 150, Type I or II; natural color, white, or a blend to produce mortar color indicated.

1. Low-Alkali Cement: Not more than 0.60 percent total alkali when tested according to ASTM C 114.

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

C. Portland Cement-Lime Mix: Packaged blend of portland cement complying with ASTM C 150, Type I or Type III, and hydrated lime complying with ASTM C 207.

1. For pigmented mortars, use colored portland cement-lime mix of formulation required to produce color indicated or, if not indicated, as selected from manufacturer's standard formulations. Pigments shall not exceed 10 percent of portland cement by weight for mineral oxides nor 2 percent for carbon black.

D. Aggregate: ASTM C 144 and as indicated below:

1. For joints narrower than 1/4 inch, use aggregate graded with 100 percent passing No. 16 sieve.
2. For pointing mortar, use aggregate graded with 100 percent passing No. 16 sieve.

E. Latex-Portland Cement Mortar: ANSI A118.4, composition as follows:

1. Factory-Packaged Dry Mortar: Mix with either polyvinyl acetate or ethylene vinyl acetate dry-polymer additive.

F. Water: Potable.

2.5 GROUT

A. Grout Colors: Provide colors to comply with the following requirements:

1. Provide Landscape Architect's selection from manufacturer's full range of colors.

B. Sand-Portland Cement Grout: ANSI A108.10.

C. Commercial Portland Cement Grout (Sanded): ANSI A118.6, for materials described in H-2.1, for joints 1/8 inch and wider.

2.6 ACCESSORIES

A. Water-Cleanable Epoxy Adhesive: ANSI A118.3.

B. Setting Shims: Resilient plastic shims, nonstaining to stone, sized to suit joint thicknesses.

C. Cleavage Membrane: Asphalt felt, ASTM D 226, Type I (No. 15); or polyethylene sheeting, ASTM D 4397, 4 mils thick.

D. Cleavage Membrane: Polyethylene sheeting, ASTM D 4397, 4 mils thick.

E. Reinforcing Wire Fabric: Galvanized, welded-wire fabric, 2 by 2 inches by 0.062-inch- diameter wire, complying with ASTM A 185 and ASTM A 82, except for minimum wire size.

F. Divider Strips and Edging: Metallic or combination of metal and PVC or neoprene base, designed specifically for flooring applications consisting of the following:

1. Angle or L-Shape: Height to match stone thickness.
2. Straight Shape: Height equal to stone thickness plus depth of setting bed.
3. Length: Longest available as provided by manufacturer.
4. Control-Joint Filler: Neoprene, in color selected by Architect from manufacturer's full range of colors.

G. Cleaner: Provide stone cleaners specifically formulated for stone types, finishes, and applications indicated as recommended by stone producer and, if a sealer is specified, by sealer manufacturer. Do not use cleaning compounds containing acids, caustics, harsh fillers, or abrasives.

2.7 STONE FABRICATION

A. General: Fabricate stone paving and flooring in sizes and shapes required to comply with requirements indicated, including details on Drawings and Shop Drawings.

2.8 MORTAR AND GROUT MIXES

A. General: Comply with referenced standards and with manufacturers' written instructions for mix proportions, mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures needed to produce mortar and grout of uniform quality and with optimum performance characteristics.

1. Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated. Do not use calcium chloride.
2. Mixing: Combine and thoroughly mix cementitious materials, water, and aggregates in a mechanical batch mixer, unless otherwise indicated. Discard mortar and grout when they have reached initial set.

B. Portland Cement-Lime Setting Mortar: Comply with ASTM C 270, Proportion Specification for cement-lime mortar indicated below:

1. Type: Type S.

C. Cement-Paste Slush Coat: Mix slush coat to a consistency similar to that of thick cream and consisting of either neat cement and water or cement, sand, and water.

D. Joint Grout: Comply with mixing requirements of referenced ANSI standards and manufacturer's written instructions.

2.9 STONE SEALANT

A. Penetrating Sealant:

1. General: Penetrating Sealant shall be an invisible, water-based Penetrating Sealant, used to protect exterior Unit Paving installations. Sealant shall be a clear, non-flammable, UV-stabilized, non-yellowing solution which cures to reduce staining, soiling, discoloration, efflorescence, and acts as a invisible water-repellant coating, formulated to impart water repellence and dirt reduction to Unit Paving surfaces with no change in the surface appearance. Sealant shall react with carbon dioxide, and atmospheric moisture to form a penetrating water, dirt and mildew repellent barrier within 24 hours. Moisture absorption rate shall be low to reduce visible surface changes for up to ten (10) years.
2. Products & Manufacturers: Subject to compliance with requirements, provide products by one (1) of the following:

a. SLX100, Prosoco, Inc.
b. or equal, as approved by the Landscape Architect.

3. Provide sealer mock-up for final sealer approval on all colors of selected stone prior to installation.

PART 3 - EXECUTION

3.1 EXAMINATION

A. NO WORK UNDER THIS SECTION SHALL COMMENCE UNTIL SUBMITTALS UNDER THIS SECTION HAVE BEEN REVIEWED ACCORDINGLY BY THE LANDSCAPE ARCHITECT.

B. Prior to commencing Work under this Section, Contractor shall examine previously installed Work from other trades and verify that such Work is complete and to the point where Work herein may commence properly. Do not proceed with Work until unsatisfactory conditions have been corrected.

C. Contractor shall notify the Landscape Architect, in writing, on the anticipated commencement date and length of duration of the Work installation herein this section.

D. Examine surfaces to receive stone paving and flooring and conditions under which stone will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of stone paving and flooring.

1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of stone paving and flooring.
2. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Vacuum clean concrete substrates to remove dirt, dust, debris, and loose particles.

B. Remove substances from concrete substrates that could impair mortar bond, including curing and sealing compounds, form oil, and laitance.

C. Clean stone surfaces that have become dirty or stained by removing soil, stains, and foreign materials before setting. Clean stone by thoroughly scrubbing with fiber brushes and then drenching with clear water. Use only mild cleaning compounds that contain no caustic or harsh materials or abrasives.

3.3 INSTALLATION: GENERAL

A. Execute stone paving installation by skilled mechanics and employ skilled stone fitters at the site to do necessary field cutting as stone is set.

1. Use power saws to cut stone. Produce lines cut straight and true, with edges eased slightly to prevent snipping.

B. Scribe and field-cut stone as necessary to fit at obstructions. Produce tight and neat joints.

C. Expansion and Control Joint Installation: Locate and install according to Drawings and Shop Drawings. Joint-sealant materials and installation are specified in Division 7 Section "Joint Sealants."

3.4 INSTALLATION TOLERANCES

A. Variation in Line: For position shown in plan for edges of paving and ramps, steps, changes in color or finish, and continuous joint lines, do not exceed 1/8 inch in 96 inches, 1/4 inch in 20 feet, or 3/8 inch maximum.

B. Variation in Surface Plane of Flooring: Do not exceed 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 3/8 inch maximum from level or slope indicated.

C. Variation in Joint Width: Do not vary joint thickness more than 1/8 inch or one-fourth of the nominal joint width, whichever is less.

D. Variation in Plane between Adjacent Units (Lipping): Do not exceed 1/16-inch difference between planes of adjacent units.

3.5 INSTALLING STONE DIRECTLY OVER CONCRETE

A. Saturate concrete with clean water several hours before placing setting bed. Remove surface water about one hour before placing setting bed.

B. Apply cement-paste slush coat over surface of concrete about 15 minutes before placing setting bed. Limit area of slush coat to avoid its drying out before placing setting bed. Do not exceed 1/16-inch thickness for cement-paste slush coat.

C. Apply mortar setting bed over cement-paste slush coat immediately after slush coat has been applied. Spread and screed setting bed to uniform thickness at subgrade elevations required for accurate setting of stone to finished grades indicated.

D. Mix and place only as much mortar setting bed as can be covered with stone before initial set. Cut back, bevel edge, remove, and discard setting-bed material that has reached initial set before placing stone.

E. Place stone before initial set of cement occurs. Immediately before placing stone on setting bed, apply uniform 1/16-inch thick, slurry bond coat to bed or to back of each stone unit with a flat trowel.

F. Tamp and beat stone with a wooden block or rubber mallet to obtain full contact with setting bed and to bring finished surfaces within indicated tolerances. Set each unit in a single operation before initial set of mortar; do not return to areas already set and disturb stone for purposes of realigning finished surfaces or adjusting joints.

3.6 INSTALLING STONE DIRECTLY OVER SAND SETTING BED

A. Provide sand setting bed per details in contract drawings at noted depths and elevations. Rake and screed smooth for setting purposes.

B. Dampen sand setting bed with clean water several hours before placing stone.

C. Place stone in pattern noted on contract drawings.

D. Tamp and beat stone with a wooden block or rubber mallet to obtain full contact with sand setting bed, to remove air pockets and to bring finished surfaces within indicated tolerances. Set each unit in a single operation; do not return to areas already set and disturb stone for purposes of realigning finished surfaces or adjusting joints.

3.7 INSTALLING STONE OVER CLEAVAGE MEMBRANE OR WATERPROOFING

A. Place cleavage membrane over subfloor surfaces indicated to receive stone flooring, lapped at least 4 inches at joints.

B. Place reinforcing wire fabric, lapped at joints by at least one full mesh and supported so mesh becomes embedded in middle of setting bed. Do not butt edges against vertical surfaces.

C. Place mortar setting bed with reinforcing wire fabric fully embedded in middle of setting bed. Spread and screed setting bed to uniform thickness at elevations required for accurate setting of stone to finished grades indicated.

D. Mix and place only as much mortar setting bed as can be covered with stone before initial set. Cut back, bevel edge, and discard setting-bed material that has reached initial set before placing stone.

E. Place stone before initial set of mortar occurs. Immediately before placing stone on setting bed, apply uniform 1/16-inch thick, slurry bond coat to bed or to back of each stone unit with a flat trowel.

F. Tamp and beat stone with a wooden block or rubber mallet to obtain full contact with setting bed and to bring finished surfaces within indicated tolerances. Set each unit in a single operation before initial set of mortar; do not return to areas already set and disturb stone for purposes of realigning finished surfaces or adjusting joints.

3.8 GROUTING STONE PAVING

A. Grout stone joints to comply with ANSI A108.10 and manufacturer's written instructions.

B. Grout joints as soon as possible after initial set of setting bed. Force grout into joints, taking care not to smear grout on adjoining stone and other surfaces. After initial set of grout, finish joints by tooling to produce a slightly concave polished joint, free from drying cracks.

C. Cure grout by maintaining in a damp condition for 7 days, except as otherwise recommended by latex additive manufacturer.

3.9 ADJUSTING AND CLEANING

A. Remove and replace stone paving and flooring of the following description:

1. Broken, chipped, stained, or otherwise damaged stone. Stone may be repaired if methods and results are approved by Architect.
2. Defective joints.
3. Stone paving, flooring, and joints not matching approved samples and mockups.
4. Stone paving and flooring not complying with other requirements indicated.

B. Replace in a manner that results in stone paving and flooring's matching approved samples and mockups, complying with other requirements, and showing no evidence of replacement.

C. In-Progress Cleaning: Clean stone paving and flooring as work progresses. Remove mortar fins and smears before tooling joints.

D. Clean stone paving and flooring after setting and grouting are complete. Use procedures recommended by stone fabricator for types of application.

3.10 PROTECTION

A. Prohibit traffic from installed stone for a minimum of 72 hours.

B. Protect stone paving and flooring during construction with nonstaining kraft paper. Where adjoining areas require construction work access, cover stone paving and flooring with a minimum of 3/4-inch untreated plywood over nonstaining kraft paper.

END OF SECTION

SECTION 096400

WOOD FLOORING

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Field-finished wood flooring.
2. Factory-finished wood flooring.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 033000 - CAST-IN-PLACE CONCRETE for substrate.
2. Section 064020 - INTERIOR ARCHITECTURAL WOODWORK for wood base.

1.3 PERFORMANCE REQUIREMENTS

A. Wet Dynamic Coefficient of Friction: For flooring exposed as a walking surface, provide products with the following values as determined by testing identical products per ANSI/ NFSI B101.3 - 2012 Test Method for Measuring Wet DCOF of Common Hard-Surface Floor Materials, or ANSI 326.3 - American National Standard Test Method for Measuring Dynamic Coefficient of Friction of Hard Surface Materials - 2017. Testing by other methods or earlier editions of the specified test method is not acceptable.

1. Wet Dynamic Coefficient of Friction: Not less than 0.43.

1.4 SUBMITTALS

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

B. Shop Drawings: Show installation details including location and layout of each type of wood flooring and accessory.

C. Samples for Verification: For each type of wood flooring and accessory, with stain color and finish required, approximately 12 inches long and of same thickness and material indicated for the Work and showing the full range of normal color and texture variations expected.

1.5 QUALITY ASSURANCE

A. Source Limitations: For field-finished wood flooring, obtain each species, grade, and cut of wood from one source with resources to provide materials and products of consistent quality in appearance and physical properties.

B. Comply with applicable National Wood Flooring Association (NWFA, formerly NOFMA) grading rules for species, grade, and cut.

C. Mockups: Install mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. To set quality standards for installation, install mockup of floor area as shown on Drawings.
2. To set quality standards for sanding and application of field finishes, prepare finish mockup of floor area as shown on Drawings.
3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver wood flooring materials in unopened cartons or bundles.

B. Protect wood flooring from exposure to moisture. Do not deliver wood flooring until after concrete, masonry, plaster, ceramic tile, and similar wet work is complete and dry.

C. Store wood flooring materials in a dry, warm, ventilated, weathertight location.

1.7 PROJECT CONDITIONS

A. Conditioning period begins not less than seven days before wood flooring installation, is continuous through installation, and continues not less than seven days after wood flooring installation.

1. Environmental Conditioning: Maintain an ambient temperature between 65 and 75 deg F and relative humidity planned for building occupants in spaces to receive wood flooring during the conditioning period.
2. Wood Flooring Conditioning: Move wood flooring into spaces where it will be installed, no later than the beginning of the conditioning period.

    a. Do not install flooring until it adjusts to relative humidity of, and is at same temperature as, space where it is to be installed.
    b. Open sealed packages to allow wood flooring to acclimatize immediately on moving flooring into spaces in which it will be installed.

B. After conditioning period, maintain relative humidity and ambient temperature planned for building occupants.

C. Install factory-finished wood flooring after other finishing operations, including painting, have been completed.

1.8 EXTRA MATERIALS (ATTIC STOCK)

A. Furnish extra materials described below, before installation begins, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Wood Flooring: Equal to 2 percent of amount installed for each type of wood flooring indicated.
2. Stair Treads: One tread for each stair width.

PART 2 - PRODUCTS

2.1 FIELD-FINISHED WOOD FLOORING

A. Solid-Wood Flooring: Kiln dried to 6 to 9 percent maximum moisture content, tongue and groove and end matched, and with backs channeled.

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

a. Aacer Flooring, Inc.
b. Carlisle Wide Plank Floors.
c. Harris Tarkett Wood Floors.
d. Kentucky Wood Floors.

2. Basis of Design: Match Architect’s sample.
3. Species: Maple, as selected by the Architect.
4. Grade: Select & Better
5. Cut: Quarter/rift sawn.
6. Thickness: 25/32 inch.
7. Face Width: 2-1/4 in.
8. Length: Random-length strips complying with applicable grading rules.

B. Wood Filler: Compatible with finish system components and recommended by filler and finish manufacturers for use indicated. If required to match approved Samples, provide pigmented filler.

2.2 FACTORY-FINISHED WOOD FLOORING

A. Engineered-Wood Flooring: HPVA EF, except bonding agent contains no urea formaldehyde.

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

a. Anderson Hardwood Floors.
b. Armstrong World Industries, Inc.
c. EcoTimber.
d. Gammapar.
e. Mannington Mills, Inc.
f. Tarkett.

2. Species: Maple.
3. Grade: Grade A.
4. Thickness: 3/8 inch
5. Construction: Three ply.
6. Face Width: 3 inches.
7. Length: Manufacturer's standard.
8. Edge Style: Square.
9. Finish: UV urethane or acrylic impregnated.

    a. Color: As selected by Architect from manufacturer's full range.

2.3 ACCESSORY MATERIALS

A. Wood Subfloor: As specified in Section 061000 - ROUGH CARPENTRY.

B. Vapor Retarder: ASTM D 4397, fluid-applied membrane, to be selected by Architect.

C. Trowelable Leveling and Patching Compound: Latex-modified, hydraulic-cement-based formulation approved by wood flooring manufacturer.

D. Wood Flooring Adhesive: As recommended by flooring and adhesive manufacturers for application indicated.

1. VOC Content: Not more than 100 g/L.
2. Do not use adhesives that contain urea formaldehyde.
3. Methylene chloride and perchloroethylene may not be intentionally added to adhesives.

E. Fasteners: Non-corrosive type, as recommended by manufacturer, but not less than that recommended in NWFA's "Installation Guidelines: Wood Flooring."

F. Cork Expansion Strip: Composition cork strip.

G. Metal Edge Strips: Angle or L-shape, height to match flooring thickness, metallic or combination of metal and PVC or neoprene base, designed specifically for wood flooring applications; extruded aluminum exposed-edge material, with clear anodized satin finish.

1. Available Manufacturer: Schluter Systems.

H. Trim: In same species and grade as wood flooring, unless otherwise indicated.

1. Threshold: Tapered on each side and routed at bottom of one side to accommodate wood flooring.
2. Reducer Strip: 2 inches wide, tapered on 1 side, and in thickness matching wood flooring.

I. Cleaning Materials: Provide low-emitting cleaning solutions as recommended by NOFMA.

2.4 FIELD FINISH MATERIALS

A. Wood Finish: Provide UV resistant sealer and water-based polyurethane finish system.

1. Low-Emitting Materials: Provide wood finish in compliance with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation

of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

a. VOC Content Limits:

1) Clear Wood Finish, Varnish: 350 g/L.
2) Clear Wood Finish, Sanding Sealer: 350 g/L.
3) Clear Wood Finish, Lacquer: 550 g/L.

b. Methylene chloride and perchloroethylene may not be intentionally added to paints and coatings.

2. Sanding Sealer (Waterborne): For clear, transparent look.

a. Basic Coatings; Hydroline Sealer.
b. Bona US; NordicSeal.
1) EQc2, Low-Emitting Materials, General Emissions Evaluation: GreenGuard Gold certification.
c. Vermont Natural Coatings; PolyWhey 3000 Wood Floor Sealer.

3. Wood Stain: Not used.
4. Wood Coating, Clear Polyurethane Finish:

a. Basic Coatings; StreetShoe NXT, matte finish.
b. Bona US; BonaTraffic HD, Commercial Matte finish.
1) EQc2, Low-Emitting Materials, General Emissions Evaluation: GreenGuard Gold certification.
c. Vermont Natural Coatings; PolyWhey 3500 Wood Floor Finish, matte finish.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas and conditions, with Installer present, for compliance with requirements for maximum moisture content, installation tolerances, and other conditions affecting performance of wood flooring.

1. Verify that substrates comply with tolerances and other requirements specified in other Sections.
2. For adhesively applied wood flooring, verify that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Substrate Moisture Testing, General: Perform tests recommended by manufacturer or, if none, comply with applicable recommendations in NWFA/NOFMA's "Installation Guidelines: Wood Flooring."

1. Proceed with installation only after substrates pass testing.

C. Concrete Moisture Testing: Perform anhydrous calcium chloride test per ASTM F 1869, as follows:

1. Perform tests so that each test area does not exceed 200 sq. ft. and perform not less than 2 tests in each installation area with test areas evenly spaced in installation area.
2. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
3. Perform alkalinity and adhesion tests recommended in writing by manufacturer or, if none, according to NWFA's "Installation Guidelines: Wood Flooring." Proceed with installation only after substrates pass testing.

3.2 PREPARATION

A. Grind high spots and fill low spots on concrete substrates to produce a maximum 1/8-inch deviation in any direction when checked with a 10-foot straight edge.

1. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, and depressions in substrates.

B. Remove coatings, including curing compounds, and other substances on substrates that are incompatible with installation adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.

C. Broom or vacuum clean substrates to be covered immediately before product installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION

A. Comply with flooring manufacturer's written installation instructions, but not less than applicable recommendations in MFMA's "Installation Guidelines: Wood Flooring" for Athletic Flooring or NWFA/NOFMA's "Installing Hardwood Flooring", 1997 edition, for other flooring.

B. Engineered-Wood Flooring: Set in adhesive.

C. Wood Subfloor: Install according to requirements in Section 061000 - ROUGH CARPENTRY.

D. Provide expansion space at walls and other obstructions and terminations of flooring of not less than 3/4 inch.

E. Vapor Retarder:

1. Wood Flooring Nailed to Concrete: Install flooring over a layer of fluid applied vapor retarder product, turned up behind baseboards.

3.4 FIELD FINISHING

A. Machine-sand flooring to remove offsets, ridges, cups, and sanding-machine marks that would be noticeable after finishing. Vacuum and tack with a clean cloth immediately before applying finish.

1. Comply with applicable recommendations in NWFA/NOFMA's "Installing Hardwood Flooring", 1997 edition.

B. Fill and repair wood flooring seams and defects.

C. Cover and protect wood flooring before finishing.

D. Apply floor-finish materials in number of coats recommended by finish manufacturer for application indicated, but not less than one coat of floor sealer and three finish coats.

1. For water-based finishes, use finishing methods recommended by finish manufacturer to minimize grain raise.
2. First Coat: Apply sanding sealer.
3. Second Coat: Apply sanding sealer, if recommended by manufacturer. Sand lightly.

    a. Apply stains to achieve an even color distribution matching approved Samples.

4. Third, Fourth and Fifth Coat: Apply polyurethane finish. Sand lightly between coats.

E. Do not cover wood flooring after finishing until finish reaches full cure, and not before seven days after applying last finish coat.

3.5 PROTECTION

A. Protect installed wood flooring during remainder of construction period with covering of heavy kraft paper or other suitable material. Do not use plastic sheet or film that might cause condensation.

1. Do not move heavy and sharp objects directly over kraft-paper-covered wood flooring. Protect flooring with plywood or hardboard panels to prevent damage from storing or moving objects over flooring.

END OF SECTION

SECTION 096510

RESILIENT FLOORING AND ACCESSORIES

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Vinyl sheet floor covering.
2. Rubber sheet floor covering.
3. Linoleum sheet floor covering.
4. Vinyl floor tile.
5. Rubber floor tile.
6. Vinyl composition tile.
7. Resilient wall base and accessories.
8. Resilient stair accessories.
9. Substrate preparation for resilient flooring and accessories.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 096800 - CARPETING for carpet accessories.

1.3 PERFORMANCE REQUIREMENTS

A. Wet Dynamic Coefficient of Friction: For flooring exposed as a walking surface, provide products with the following values as determined by testing identical products per ANSI/ NFSI B101.3 - 2012 Test Method for Measuring Wet DCOF of Common Hard-Surface Floor Materials, or ANSI 326.3 - American National Standard Test Method for Measuring Dynamic Coefficient of Friction of Hard Surface Materials - 2017. Testing by other methods or earlier editions of the specified test method is not acceptable.

1. Wet Dynamic Coefficient of Friction: Not less than 0.43.

1.4 SUBMITTALS

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

1. For adhesives and sealants, include VOC content.
2. For resilient flooring products, include FloorScore documentation.

B. Shop Drawings: For each type of floor covering. Include floor covering layouts, locations of seams, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.

1. Show details of special patterns.

C. Samples for Verification: Full-size units of each color and pattern of resilient flooring required.

1. Resilient Wall Base and Accessories: Manufacturer's standard-size Samples, but not less than 12 inches long, of each resilient product color and pattern required.
2. For heat-welding bead, manufacturer's standard-size Samples, but not less than 9 inches long, of each color required.

D. Seam Samples for Sheet Flooring: For seamless-installation technique indicated and for each floor covering product, color, and pattern required; with seam running lengthwise and in center of 6-by-9-inch. Sample applied to a rigid backing and prepared by Installer for this Project.

E. Maintenance Data: For resilient products to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Provide products identical to those tested for fire-exposure behavior per test method indicated by a testing and inspecting agency acceptable to authorities having jurisdiction.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F. Store tiles on flat surfaces.

1.7 PROJECT CONDITIONS

A. Maintain temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F in spaces to receive floor tile during the following time periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. After postinstallation period, maintain temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

C. Close spaces to traffic during floor covering installation.

D. Close spaces to traffic for 48 hours after floor covering installation.

E. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 VINYL SHEET FLOOR COVERING

A. Unbacked Vinyl Sheet Floor Covering: ASTM F 1913.

1. Altro Group.
2. Armstrong World Industries, Inc.
3. Congoleum Corporation.
4. Forbo Flooring, Inc.
5. Gerflor, Architectural Floor Systems, Inc.
6. Lonseal, Inc.
7. Mannington Mills, Inc.
8. Tarkett, Inc.
9. TOLI International.

B. Style and Colors: As indicated on the Finish Legend.

C. Thickness: 0.080 inch.

D. Wearing Surface: Smooth.

E. Seaming Method: Standard.

2.2 RUBBER SHEET FLOOR COVERING

A. Rubber Sheet Floor Covering: ASTM F 1859, Type I (homogeneous rubber sheet).

1. American Biltrite.
2. Johnsonite, a division of Tarkett.
3. Mannington/Burke.
4. Mondo USA.
5. Nora Systems, Inc.
6. R.C.A. Rubber Co.

B. Style and Colors: As indicated on the Finish Legend.

C. Thickness: 0.125 inch min.

D. Wearing Surface: Molded pattern.

1. Molded-Pattern Figure: Raised discs.

E. Sheet Width: As standard with manufacturer.

F. Seaming Method: Standard.

2.3 LINOLEUM SHEET FLOOR COVERING

A. Sheet Flooring: ASTM F 2034, Type I, linoleum sheet with backing.

1. Armstrong World Industries, Inc.

2. Forbo Flooring, Inc.
3. Tarkett Inc.

B. Style and Colors: As indicated on the Finish Legend.

C. Thickness: 0.18 inch.

D. Sheet Width: 78 inches.

E. Seaming Method: Welded.

2.4 VINYL TILE FLOOR COVERING

A. Vinyl Tile Floor Covering: ASTM F 1700.

1. Armstrong World Industries, Inc.
2. Congoleum Corporation.
3. Mannington Mills, Inc.
4. Tarkett, Inc.

B. Style and Colors: As indicated on the Finish Legend.

C. Thickness: 0.080 inch.

D. Size: 18 by 18 inches.

2.5 RUBBER FLOOR TILE

A. Rubber Floor Tile: ASTM F 1344.

1. Endura.
2. Johnsonite, a division of Tarkett.
3. Mannington/Burke.
4. Mondo USA.
5. Nora Systems, Inc.
6. Roppe Corporation.

B. Style and Colors: As indicated on the Finish Legend.

C. Thickness: 0.125 inch.

D. Size: 24 by 24 inches nominal.

2.6 VINYL COMPOSITION TILE

A. Vinyl Composition Tile (VCT): ASTM F 1066.

1. Armstrong World Industries, Inc.
2. Congoleum Corporation.
3. Tarkett Inc.

B. Style and Colors: As indicated on the Finish Legend.

C. Thickness: 0.125 inch

D. Size: 12 by 12 inches.

2.7 RESILIENT WALL BASE

A. Wall Base: ASTM F 1861.

1. Armstrong World Industries, Inc.
2. Mannington Burke.
3. Johnsonite, a division of Tarkett.
4. Marley Flexco (USA), Inc.
5. Nora Systems, Inc.
6. Roppe Corporation.

B. Style and Colors: As indicated on the Finish Legend.

C. Type (Material Requirement): TS (rubber, vulcanized thermoset) or TP (rubber, thermoplastic).

D. Shape: Straight (toeless) at carpet and coved at resilient flooring.

E. Minimum Thickness: 0.125 inch.

F. Height: 4 inches.

G. Lengths: Cut lengths 48 inches long or coils in manufacturer's standard length.

H. Outside Corners: Premolded.

I. Inside Corners: Premolded.

J. Surface: Smooth.

2.8 RESILIENT STAIR ACCESSORIES

A. Treads and Risers: ASTM F 2169.

1. Mannington Burke.
2. Endura
3. Johnsonite, a division of Tarkett.
4. Mondo Rubber International, Inc.
5. Nora Systems, Inc.
6. Roppe Corporation.

B. Style and Colors: As indicated on the Finish Legend.

C. Material: Rubber, Composition A.

D. Size: Lengths and depths to fit each stair tread in one piece.

E. Stringers: Of same thickness as risers, height and length after cutting to fit risers and treads and to cover stair stringers; produced by same manufacturer as treads and recommended by manufacturer for installation with treads.

2.9 RESILIENT MOLDING ACCESSORY

A. Types Include the Following as Applicable: Cap for cove carpet, cap for cove resilient sheet floor covering, carpet edge for glue-down applications, nosing for carpet, nosing for resilient floor covering, reducer strip for resilient floor covering, joiner for tile and carpet

1. Mannington Mills, Inc.
2. Endura
3. Johnsonite, a division of Tarkett.
4. Mondo Rubber International, Inc.
5. Nora Systems, Inc.
6. Roppe Corporation.

B. Material: Rubber.

C. Profile and Dimensions: As indicated.

2.10 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, Portland cement based or blended hydraulic cement based formulation provided or approved by resilient product manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.

1. Low-Emitting Materials: Provide adhesives in compliance with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

a. VOC Content: 50 g/L or less.
b. Methylene chloride and perchloroethylene may not be intentionally added to adhesives. Do not use adhesives that contain urea formaldehyde.

C. Seamless-Installation Accessories:

1. Heat-Welding Bead: Manufacturer's solid-strand product for heat welding seams.

a. Color: Match floor covering.

D. Integral-Flash-Cove-Base Accessories:

1. Cove Strip: 1-inch radius provided or approved by manufacturer.
2. Cap Strip: Provided or approved by manufacturer.

E. Stair-Tread-Nose Filler: Two-part epoxy compound recommended by resilient tread manufacturer to fill nosing substrates that do not conform to tread contours.

F. Metal Edge Strips: Extruded aluminum with mill finish of width shown, of height required to protect exposed edges of tiles, and in maximum available lengths to minimize running joints.

G. Floor Polish: Provide protective liquid floor polish products as recommended by manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances, moisture content, and other conditions affecting performance.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written recommendations to ensure adhesion of resilient products.

B. Concrete Substrates: Prepare according to ASTM F 710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Alkalinity and Adhesion Testing: Perform tests recommended by flooring manufacturer. Proceed with installation only after substrate alkalinity falls within a range on pH scale not less than 5 or more than 9 pH, or as otherwise required in writing by manufacturer of flooring.
3. Moisture Vapor Emission Testing:

    a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours, or as otherwise required in writing by manufacturer of flooring.

4. Relative Humidity Testing:

    a. Perform relative humidity test, ASTM F 2170. Proceed with installation only after substrates have a maximum relative humidity level of 75 percent, or as otherwise required in writing by manufacturer of flooring.

5. Perform tests indicated above and as recommended by flooring manufacturer. Proceed with installation only after substrates pass testing.

C. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.

D. Use trowelable leveling and patching compound to fill cracks, holes, and depressions in substrates.

E. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

1. Do not install resilient products until they are same temperature as space where they are to be installed.

F. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, and dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 SHEET INSTALLATION

A. Comply with manufacturer's written instructions for installing floor coverings.

B. Unroll floor coverings and allow them to stabilize before cutting and fitting.

C. Lay out floor coverings as follows:

1. Maintain uniformity of floor covering direction.
2. Minimize number of seams; place seams in inconspicuous and low-traffic areas, at least 6 inches away from parallel joints in floor covering substrates.
3. Match edges of floor coverings for color shading at seams.
4. Avoid cross seams.

D. Scribe and cut floor coverings to butt neatly and tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, and door frames.

E. Extend floor coverings into toe spaces, door reveals, closets, and similar openings.

F. Maintain reference markers, holes, or openings that are in place or marked for future cutting by repeating on floor coverings as marked on substrates. Use chalk or other nonpermanent marking device.

G. Install floor coverings on covers for telephone and electrical ducts and similar items in installation areas. Maintain overall continuity of color and pattern between pieces of floor coverings installed on covers and adjoining floor covering. Tightly adhere floor covering edges to substrates that abut covers and to cover perimeters.

H. Adhere floor coverings to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

I. Seamless Installation:

1. Heat-Welded Seams: Comply with ASTM F 1516. Rout joints and use welding bead to permanently fuse sections into a seamless floor covering. Prepare, weld, and finish seams to produce surfaces flush with adjoining floor covering surfaces.

J. Integral-Flash-Cove Base: Cove floor coverings up vertical surfaces as indicated on Drawings. Support floor coverings at horizontal and vertical junction by cove strip. Butt at top against cap strip.

3.4 TILE INSTALLATION

A. Lay out tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.

1. Lay tiles in pattern indicated.

B. Match tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.

C. Scribe, cut, and fit tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, edgings, doorframes, thresholds, and nosings.

D. Extend tiles into toe spaces, door reveals, closets, and similar openings.

E. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent, nonstaining marking device.

F. Install tiles on covers for telephone and electrical ducts and similar items in finished floor areas. Maintain overall continuity of color and pattern with pieces of tile installed on covers. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.

G. Adhere tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.5 RESILIENT WALL BASE INSTALLATION

A. Apply wall base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

B. Install wall base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.

C. Tightly adhere wall base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

D. Do not stretch wall base during installation.

E. On masonry surfaces or other similar irregular substrates, fill voids along top edge of wall base with manufacturer's recommended adhesive filler material.

F. Premolded Corners: Install premolded corners before installing straight pieces.

3.6 RESILIENT ACCESSORY INSTALLATION

A. Resilient Stair Accessories:

1. Use stair-tread-nose filler to fill nosing substrates that do not conform to tread contours.
2. Tightly adhere to substrates throughout length of each piece.
3. For treads installed as separate, equal-length units, install to produce a flush joint between units.

B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor coverings that would otherwise be exposed.

3.7 CLEANING AND PROTECTION

A. Perform the following operations immediately after completing resilient product installation:

1. Remove adhesive and other blemishes from exposed surfaces.
2. Sweep and vacuum surfaces thoroughly.
3. Damp-mop surfaces to remove marks and soil.

    a. Do not wash surfaces until after time period recommended by manufacturer.

B. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods recommended in writing by manufacturer.

1. Apply protective floor polish to horizontal surfaces that are free from soil, visible adhesive, and surface blemishes if recommended in writing by manufacturer.

    a. Coordinate selection of floor polish with the Owner’s maintenance service.

2. Cover products installed on horizontal surfaces with undyed, untreated building paper until Substantial Completion.
3. Do not move heavy and sharp objects directly over surfaces. Place hardboard or plywood panels over flooring and under objects while they are being moved. Slide or roll objects over panels without moving panels.

END OF SECTION

SECTION 096710

RESINOUS FLOORING

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Epoxy flooring systems.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 079200 - JOINT SEALANTS for sealants installed at joints in resinous flooring systems.

1.3 PERFORMANCE REQUIREMENTS

A. Wet Dynamic Coefficient of Friction: For flooring exposed as a walking surface, provide products with the following values as determined by testing identical products per ANSI/ NFSI B101.3 - 2012 Test Method for Measuring Wet DCOF of Common Hard-Surface Floor Materials, or ANSI 326.3 - American National Standard Test Method for Measuring Dynamic Coefficient of Friction of Hard Surface Materials - 2017. Testing by other methods or earlier editions of the specified test method is not acceptable.

1. Wet Dynamic Coefficient of Friction: Not less than 0.43.

1.4 SUBMITTALS

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

1. Include manufacturer's technical data, application instructions, and recommendations for each resinous flooring component required.

B. Shop Drawings: Provide floor plans, to scale matching Architectural Plans, which indicate extent of each different resinous flooring system including system type, color and pattern, degree of slip resistance, and dimensioned locations of control joints and seams where systems meet.

1. Provide enlarged details, at minimum 3 inch = 1 foot scale, indicating conditions at walls, door frames, pits, curbs, equipment pedestals, etc.

C. Samples for Verification: For each resinous flooring system required, 6 inches square, applied to a rigid backing by Installer for this Project.

D. Material Certificates: For each resinous flooring component, signed by manufacturer.

E. Installer Certificates: Signed by manufacturer certifying that installers comply with specified requirements.

F. Maintenance Data: For resinous flooring to include in maintenance manuals.

G. Test Results: For field testing of substrate, signed by installer.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer (applicator) who is experienced in applying resinous flooring systems similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance, and who is acceptable to resinous flooring manufacturer.

1. Engage an installer who employs only persons trained and approved by resinous flooring manufacturer for applying resinous flooring systems indicated.
2. Engage an installer who is certified in writing by resinous flooring manufacturer as qualified to apply resinous flooring systems indicated.

B. Source Limitations: Obtain primary resinous flooring materials, including primers, resins, hardening agents, grouting coats, and topcoats, through one source from a single manufacturer. Provide secondary materials, including patching and fill material, joint sealant, and repair materials, of type and from source recommended by manufacturer of primary materials.

C. Mockups: Apply mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Apply full-thickness mockups on 48-inch- square floor area selected by Design Professional.

    a. Include 48-inch length of integral cove base.

2. Simulate finished lighting conditions for Design Professional's review of mockups.
3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

D. Pre-installation Conference: Prior to installation of flooring, meet at the Project site with the Manufacturer’s Representative, the Installer, the Architect, the Owner’s Representative and the Owner’s Testing Agency. Record discussions and furnish copy to each participant. Topics to be discussed shall include, but not be limited to:

1. Existing and new slab conditions
2. Owner’s Testing Agency results of mandatory testing
3. Surface preparation
4. Required room temperatures
5. Ventilation
6. Step-by-step application procedures

7. Curing time and methods
8. Protection of completed Work

E. Testing:

1. ASTM E 1907 Standard Guide to Methods of Evaluating Moisture Conditions of Concrete Floors to Receive Resilient Floor Coverings
   a. ASTM F 1869 Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Sub-floor Using Anhydrous Calcium Chloride
   b. ASTM D 4263 Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method
   c. ASTM F 2170 Standard Test Method for Determining Relative Humidity in Concrete Slabs Using in situ Probes
2. ASTM F 710 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring
3. ASTM D 4501 Standard Test Method for Shear Strength of Adhesive Bonds Between Rigid Substrates by the Block-Shear Method

1.6 DELIVERY, STORAGE, AND HANDLING

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

B. Store materials to prevent deterioration from moisture, heat, cold, direct sunlight, or other detrimental effects.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Comply with resinous flooring manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting resinous flooring application.

1. Maintain ambient air temperature between 65oF and 85oF.
2. Type I Concrete substrate shall be properly cured for a minimum of 30 days. Type III Concrete shall be properly cured for a minimum of 7 days.

B. Lighting: Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during resinous flooring application.

C. Close spaces to traffic during resinous flooring application and for not less than 24 hours after application, unless manufacturer recommends a longer period.

1.8 WARRANTY

A. Manufacturer shall furnish a single, written warranty covering 100% of the material and labor costs protecting the client from delamination, disbondment, and osmotic/hydrostatic failure for a period of three (3) years from date of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Crossfield Products Corp.
2. Dex-O-Tex.
3. Stonhard, Inc.
4. Tnemec Company Inc.

B. VOC Content, Floor Coatings: 100 g/L or less.

2.2 RESINOUS FLOORING SYSTEM

A. Troweled epoxy mortar with clear epoxy receiving coat, decorative quartz broadcast and clear epoxy sealer coat.

B. System Characteristics:

1. Color: As selected by Architect from manufacturer's full range.
2. Wearing Surface: Textured for slip resistance.
3. Integral Cove Base: 4 inches high with 1 inch radius.
4. Overall System Thickness: 3/16 inch (not including osmotic pressure barrier or grout).
5. VOC: Less than 100 g/l.

C. Components: Multi-layered trowel applied waterproof flooring surfacing system shall be composed of a primer bondcoat, waterproof membrane, traffic surfacing and finish coats, and shall conform to the following standards:

1. Traffic surface binder and all rubber emulsions shall be compounded with an aqueous synthetic rubber liquid containing no hydrocarbon solvents.
2. Aggregate for traffic surface coating shall be suitably graded mineral aggregate passing a #20 mesh sieve and retained on a #80 mesh sieve.
3. Fabric used as reinforcement for waterproof base and floor shall be 7-1/2 oz. woven polypropylene fabric.
4. Final Finish dressing shall be a single component, water-phase acrylic latex emulsion material, pigmented and of a consistence suitable for roller application.

D. System Components: Manufacturer's standard components which are compatible with each other and as follows:

2.3 ACCESSORY MATERIALS

A. Patching and Fill Material: Resinous product of or approved by resinous flooring manufacturer and recommended by manufacturer for application indicated.

PART 3 - EXECUTION

3.1 PREPARATION

A. General: Prepare and clean substrates according to resinous flooring manufacturer's written instructions for substrate indicated. Provide clean, dry, and neutral Ph substrate for resinous flooring application.

B. Concrete Substrates: Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with resinous flooring.

1. Roughen concrete substrates as follows:
   a. Shot-blast surfaces with an apparatus that abrades the concrete surface, contains the dispensed shot within the apparatus, and recirculates the shot by vacuum pickup.
   b. Comply with ASTM C 811 requirements, unless manufacturer's written instructions are more stringent.
2. Repair damaged and deteriorated concrete according to resinous flooring manufacturer's written recommendations.
3. Verify that concrete substrates are dry.
   a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with application only after substrates have maximum moisture-vapor-emission rate as required by the manufacturer.
   b. Perform plastic sheet test, ASTM D 4263. Proceed with application only after testing indicates absence of moisture in substrates.
   c. Perform additional moisture tests recommended by manufacturer. Proceed with application only after substrates pass testing.
4. Verify that concrete substrates have neutral pH and that resinous flooring will adhere to them. Perform tests recommended by manufacturer. Proceed with application only after substrates pass testing.

C. Resinous Materials: Mix components and prepare materials according to resinous flooring manufacturer's written instructions.

D. Use patching and fill material to fill holes and depressions in substrates according to manufacturer's written instructions.

E. Treat control joints and other nonmoving substrate cracks to prevent cracks from reflecting through resinous flooring according to manufacturer's written recommendations.

3.2 APPLICATION

A. General: Apply components of resinous flooring system according to manufacturer's written instructions to produce a uniform, monolithic wearing surface of thickness indicated.

1. Coordinate application of components to provide optimum adhesion of resinous flooring system to substrate, and optimum intercoat adhesion.
2. Cure resinous flooring components according to manufacturer's written instructions. Prevent contamination during application and curing processes.
3. At substrate expansion and isolation joints, provide joint in resinous flooring to comply with resinous flooring manufacturer's written recommendations.

a. Apply joint sealant to comply with manufacturer's written recommendations.

B. Apply primer over prepared substrate at manufacturer's recommended spreading rate.

C. Apply reinforcing membrane to substrate cracks.

D. Integral Cove Base: Apply cove base mix to wall surfaces before applying flooring. Apply according to manufacturer's written instructions and details including those for taping, mixing, priming, troweling, sanding, and topcoating of cove base. Round internal and external corners.

E. Apply self-leveling slurry body coat(s) in thickness indicated for flooring system.

1. Broadcast aggregates and, after resin is cured, remove excess aggregates to provide surface texture indicated.

F. Apply troweled or screeded body coat(s) in thickness indicated for flooring system. Hand or power trowel and grout to fill voids. When cured, sand to remove trowel marks and roughness.

G. Apply topcoat(s) in number of coats indicated for flooring system and at spreading rates recommended in writing by manufacturer.

3.3 CLEANING AND PROTECTING

A. Protect resinous flooring from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by resinous flooring manufacturer.

END OF SECTION

SECTION 096800

CARPETING

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Carpet sheet, for direct glue-down installation.
2. Carpet tile.
3. Carpet accessories.
4. Substrate preparation for carpet and accessories.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 096510 - RESILIENT FLOORING AND ACCESSORIES for resilient wall base and accessories installed with carpet.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include manufacturer's written data on physical characteristics, durability, and fade resistance. Include installation recommendations for each type of substrate required.

B. Shop Drawings: Show the following:

1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet.
2. Carpet type, color, and dye lot.
3. Seam locations, types, and methods.
4. Type of subfloor.
5. Type of installation.
6. Pattern type, repeat size, location, direction, and starting point.
7. Pile direction.
8. Type, color, and location of insets and borders.
9. Type, color, and location of edge, transition, and other accessory strips.
10. Transition details to other flooring materials.

C. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.

1. Sheet Carpet: 12-inch- square Sample.
   a. Carpet Seam: 6-inch Sample.
2. Carpet Tile: Full-size Sample.
3. Exposed Edge, Transition, and other Accessory Stripping: 12-inch-long Samples.

D. Product Schedule: Use same room and product designations indicated on Drawings and in schedules.

E. Maintenance Data: For carpet to include in maintenance manuals specified in Division 01. Include the following:

1. Methods for maintaining carpet, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
2. Precautions for cleaning materials and methods that could be detrimental to carpet.

1.4 QUALITY ASSURANCE

A. Carpeting Standard: Comply with the Carpet and Rug Institute's "CRI Carpet Installation Standard," 2011 edition, formerly CRI 104 "Standard For Installation Specification Of Commercial Carpet."

B. Installer Qualifications: An experienced installer who is certified by the Floor Covering Installation Board or who can demonstrate compliance with its certification program requirements.

C. Fire-Test-Response Characteristics: Provide products with the critical radiant flux classification indicated in Part 2, as determined by testing identical products per ASTM E 648 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.

D. Mockups: Before installing carpet, build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, STORAGE, AND HANDLING

A. General: Comply with CRI Carpet Installation Standard, Section 5, "Storage and Handling."

1.6 PROJECT CONDITIONS

A. General: Comply with CRI Carpet Installation Standard, Section 7, "Site Conditions."

B. Environmental Limitations: Do not install carpet until wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

C. Do not install carpet over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet manufacturer.

D. Where demountable partitions, equipment, or other items are indicated for installation on top of carpet, install carpet before installing these items.

1.7 WARRANTY

A. General Warranty: Special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Special Carpet Warranty: Written warranty, signed by carpet manufacturer agreeing to replace carpet that does not comply with requirements or that fails within specified warranty period. Warranty does not include deterioration or failure of carpet due to unusual traffic, failure of substrate, vandalism, or abuse. Failures include, but are not limited to, more than 10 percent loss of face fiber, edge raveling, snags, runs, and delamination.

1. Warranty Period: Ten years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CARPET

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

1. Carpet Types (CPT-#): Refer to Finish Schedule.

2.2 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided by or recommended by the carpet manufacturer.

B. Adhesives: Water-resistant, mildew-resistant, nonstaining type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet and that is recommended by carpet manufacturer.

1. VOC Limits: Provide adhesives with VOC content not more than 50g/L when calculated according to 40 CFR 59, Subpart D (EPA method 24).

C. Seaming Cement, for Sheet Carpet: Hot-melt adhesive tape or similar product recommended by carpet manufacturer for taping seams and butting cut edges at backing to form secure seams and to prevent pile loss at seams.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet performance. Verify that substrates and conditions are satisfactory for carpet installation and comply with requirements specified.

B. Concrete Subfloors: Comply with CRI Carpet Installation Standard, Section 9, “Testing Concrete Substrates.” Verify that concrete slabs comply with ASTM F 710 and the following:

1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by the carpet manufacturer.
2. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.

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

3.2 PREPARATION

A. General: Comply with CRI Carpet Installation Standard, Section 7.3, "Site Conditions; Floor Preparation," and carpet manufacturer's written installation instructions for preparing substrates indicated to receive carpet installation.

B. Concrete Substrates: Prepare according to ASTM F 710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Alkalinity and Adhesion Testing: Perform tests recommended by flooring manufacturer. Proceed with installation only after substrate alkalinity falls within a range on pH scale not less than 5 or more than 9 pH, or as otherwise required in writing by manufacturer of flooring.
3. Moisture Vapor Emission Testing:

    a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours, or as otherwise required in writing by manufacturer of flooring.

4. Relative Humidity Testing:

    a. Perform relative humidity test, ASTM F 2170. Proceed with installation only after substrates have a maximum relative humidity level of 75 percent, or as otherwise required in writing by manufacturer of flooring.

5. Perform tests indicated above and as recommended by flooring manufacturer. Proceed with installation only after substrates pass testing.

C. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, and depressions in substrates.

D. Broom and vacuum clean substrates to be covered immediately before installing carpet. After cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION

A. Carpet Sheet, Direct-Glue-Down Installation: Comply with CRI Carpet Installation Standard, Section 13, "Direct Glue-Down Installation."

1. Carpet Sheet, Stair Installation: Comply with CRI Carpet Installation Standard, Section 17, "Carpet on Stairs" for glue-down installation.
2. Comply with carpet sheet manufacturer's written recommendations for seam locations and direction of carpet; maintain uniformity of carpet direction and lay of pile. At doorways, center seams under the door in closed position.

B. Carpet Tile: Comply with CRI Carpet Installation Standard, Section 18, "Modular Carpet," and with carpet tile manufacturer's written installation instructions.

1. Installation Method: Partial glue down; install periodic tiles with releasable, pressure-sensitive adhesive.
2. Maintain dye lot integrity. Do not mix dye lots in same area.

C. Cut and fit carpet to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet manufacturer.

D. Extend carpet into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

E. Do not bridge building expansion joints with carpet.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.

G. Install pattern parallel to walls and borders.

3.4 CLEANING AND PROTECTION

A. Perform the following operations immediately after installing carpet:

1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet manufacturer.
2. Remove yarns that protrude from carpet surface.
3. Vacuum carpet using commercial machine with face-beater element and HEPA filter.

B. Protect installed carpet to comply with CRI Carpet Installation Standard, Section 20, "Protecting Indoor Installations."

C. Protect carpet against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet manufacturer.

END OF SECTION

SECTION 097200

WALL COVERINGS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Vinyl wall covering.
2. Textile wall covering.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 099000 - PAINTING AND COATING for primers.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include data on physical characteristics, durability, fade resistance, and flame-resistance characteristics.

B. Shop Drawings: Show location and extent of each wall-covering type. Indicate pattern placement, seams and termination points.

C. Samples for Verification: Full width by 3 ft. long section of wall covering.

1. Sample from same print run or dye lot to be used for the Work, with specified treatments applied. Show complete pattern repeat. Mark top and face of fabric.

D. Product Schedule: For wall coverings. Use same designations indicated on Drawings.

E. Qualification Data: For qualified testing agency.

F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for wall covering.

G. Maintenance Data: For wall coverings to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: As determined by testing identical wall coverings applied with identical adhesives to substrates according to test method indicated below by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Surface-Burning Characteristics: As follows, per ASTM E 84:

a. Flame-Spread Index: 25 or less.
b. Smoke-Developed Index: 450 or less.

2. Fire-Growth Contribution: Textile wall coverings tested according to NFPA 265 and complying with test protocol and criteria in the 2003 IBC.

B. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.

1. Build mockups for each type of wall covering on each substrate required. Comply with requirements in ASTM F 1141.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install wall coverings until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above ceilings is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

B. Lighting: Do not install wall covering until a permanent level of lighting is provided on the surfaces to receive wall covering.

C. Ventilation: Provide continuous ventilation during installation and for not less than the time recommended by wall-covering manufacturer for full drying or curing.

PART 2 - PRODUCTS

2.1 WALL COVERINGS

A. General: Provide rolls of each type of wall covering from same print run or dye lot.

2.2 VINYL WALL COVERING

A. Vinyl Wall-Covering Standards: Provide mildew-resistant products complying with the following:

1. ASTM F 793 for strippable wall coverings that qualify as Category V, Type II, Commercial Serviceability products.

B. Colors, Textures, and Patterns: As indicated on the Finish Schedule.

2.3 TEXTILE WALL COVERING

A. Wall-Covering Standard: Provide mildew-resistant strippable wall coverings that comply with ASTM F 793 for Category V, Type II, Commercial Serviceability products.

B. Colors, Textures, and Patterns: As indicated on the Finish Schedule.

2.4 ACCESSORIES

A. Adhesive: Mildew-resistant, nonstaining, strippable adhesive, for use with specific wall covering and substrate application; as recommended in writing by wall-covering manufacturer.

1. Adhesive shall have VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Primer/Sealer: Mildew resistant, complying with requirements in Section 099000 - PAINTING AND COATING and recommended in writing by wall-covering manufacturer for intended substrate.

C. Wall Liner: Nonwoven, synthetic underlayment and adhesive as recommended by wall-covering manufacturer.

D. Seam Tape: As recommended in writing by wall-covering manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for levelness, wall plumbness, maximum moisture content, and other conditions affecting performance of the Work.

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

3.2 PREPARATION

A. Comply with manufacturer's written instructions for surface preparation.

B. Clean substrates of substances that could impair bond of wall covering, including dirt, oil, grease, mold, mildew, and incompatible primers.

C. Prepare substrates to achieve a smooth, dry, clean, structurally sound surface free of flaking, unsound coatings, cracks, and defects.

1. Moisture Content: Maximum of 5 percent on new plaster, concrete, and concrete masonry units when tested with an electronic moisture meter.
2. Plaster: Allow new plaster to cure. Neutralize areas of high alkalinity. Prime with primer as recommended in writing by primer/sealer manufacturer and wall-covering manufacturer.
3. Gypsum Board: Prime with primer as recommended in writing by primer/sealer manufacturer and wall-covering manufacturer.

4. Painted Surfaces: Treat areas susceptible to pigment bleeding.

D. Check painted surfaces for pigment bleeding. Sand gloss, semigloss, and eggshell finish with fine sandpaper.

E. Remove hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.

F. Acclimatize wall-covering materials by removing them from packaging in the installation areas not less than 24 hours before installation.

G. Install wall liner, with no gaps or overlaps, where required by wall-covering manufacturer. Form smooth wrinkle-free surface for finished installation. Do not begin wall-covering installation until wall liner has dried.

3.3 INSTALLATION

A. General: Comply with wall covering manufacturers' written installation instructions applicable to products and applications indicated except where more stringent requirements apply.

B. Cut wall-covering strips in roll number sequence. Change roll numbers at partition breaks and corners.

C. Install strips in same order as cut from roll.

D. Install wall covering with no gaps or overlaps, no lifted or curling edges, and no visible shrinkage.

E. Match pattern 6 ft. above the finish floor.

F. Install seams vertical and plumb at least 6 in. from outside corners and 6 in. from inside corners unless a change of pattern or color exists at corner. No horizontal seams are permitted.

G. Fully bond wall covering to substrate. Remove air bubbles, wrinkles, blisters, and other defects.

H. Trim edges and seams for color uniformity, pattern match, and tight closure. Butt seams without any overlay or spacing between strips.

3.4 CLEANING

A. Remove excess adhesive at finished seams, perimeter edges, and adjacent surfaces.

B. Use cleaning methods recommended in writing by wall-covering manufacturer.

C. Replace strips that cannot be cleaned.

D. Reinstall hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.

END OF SECTION

SECTION 098120

SPRAYED ACOUSTIC INSULATION

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Spray-applied acoustic insulation, cellulose.
2. Spray-applied acoustic insulation, fiberglass.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 092110 - GYPSUM BOARD ASSEMBLIES for non-load-bearing steel framing and furring that support insulation; for sound attenuation blankets and acoustical sealants.

1.3 SUBMITTALS

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

B. Shop Drawings: Show locations including plans, elevations and relationship to adjacent construction.

C. Samples: Minimum 6 by 6 inch sample for appearance.

1.4 QUALITY ASSURANCE

A. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

B. Finish Mockups: Apply mockups of at least 100 sq. ft. in surface area to demonstrate aesthetic effects and qualities of materials and execution.

1. Simulate finished lighting conditions for review of mockups.
2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes.

1.6 PROJECT CONDITIONS

A. Comply with manufacturer's recommendations for application temperature.

PART 2 - PRODUCTS

2.1 SPRAY-APPLIED ACOUSTIC INSULATION, CELLULOSE

A. Self-Supported, Spray-Applied Cellulosic Insulation: ASTM C1149, Type I (materials applied with liquid adhesive; suitable for either exposed or enclosed applications), chemically treated for flame-resistance, processing, and handling characteristics.

B. Material/Product: Provide K-13 by International Cellulose Corporation or Architect approved equal; complying with the following:

1. Color: Light grey.
2. NRC Rating at 1 inch thick: ASTM C423, NRC0.80.
3. Flame Spread and Smoke Density: Less than 25 flame spread and less than 50 smoke density per ASTM E84/UL 723.
4. Primer: VOC content of 200 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.2 SPRAY-APPLIED ACOUSTIC INSULATION, FIBERGLASS

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. Monoglass by Monoglass Inc.
2. TC-417 by ThermaCoustic Industries.

B. Spray-Applied Fiberglass Insulation:

1. Surface Burning Characteristics: ASTM E84, flame spread 25 or less, smoke developed 50 or less.
2. Non-Combustibility: ASTM E136, non-combustible.
3. Noise Reduction: ASTM C423, Minimum NRC 0.95 at 2 inches thick.
4. Mechanical Fasteners: Provide mechanical fasteners for horizontal applications over 5 inches thick and vertical applications over 7 inches thick.
5. Adhesion/Cohesion: ASTM E736: Greater than 1.7 kPa.
6. Bonding adhesive if required by manufacturer shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, for conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Apply spray-applied insulation according to manufacturer's written instructions and approved submittals.

B. Do not apply insulation until installation of pipes, ducts, conduits, wiring, and electrical outlets in walls is completed and windows, electrical boxes, and other items not indicated to receive insulation are masked. After insulation is applied for vertical applications, make flush with face of studs by using method recommended by insulation manufacturer.

3.3 CLEANING AND PROTECTION

A. Remove temporary protection and enclosure of other work. Promptly remove overspray from door frames, windows, and other surfaces.

END OF SECTION

SECTION 098430

SOUND-ABSORBING PANELS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Back-mounted acoustical wall panels.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 061000 - ROUGH CARPENTRY for wood blocking.
2. Section 095100 - ACOUSTICAL CEILINGS for acoustical ceiling panels supported by exposed suspension system and tested for noise reduction.

1.3 DEFINITIONS

A. NRC: Noise reduction coefficient.

1.4 SUBMITTALS

A. Product Data: For each type of panel edge, core material, and mounting indicated.

B. Shop Drawings: For acoustical wall panels. Include mounting devices and details; details at panel head, base, joints, and corners; and details at ceiling, floor base, and wall intersections. Include elevations showing panel sizes and direction of fabric weave and pattern matching. Indicate panel edge and core materials.

C. Coordination Drawings: Show intersections with wall base, electrical receptacles and switches, and other adjacent work.

D. Samples for Initial Selection: For each type of fabric facing material from acoustical wall panel manufacturer's full range.

E. Samples for Verification: For the following products. Prepare Samples from same material to be used for the Work.

1. Fabric: Full-width by 36-inch-long Sample from dye lot to be used for the Work, and as follows:

a. With specified treatments applied.
b. Show complete pattern repeat.
c. Mark top and face of fabric.

2. Panel Edge: 12-inch-long Sample showing edge profile, corner, and finish.
3. Core Material: 12-inch-square Sample showing corner.
4. Mounting Device: Full-size Sample.
5. Sample Panels: No larger than 36 by 36 inches. Show joints and mounting methods.

F. Product Certificates: For each type of acoustical wall panel, signed by product manufacturer.

G. Qualification Data: For fabricator and testing agency.

H. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each type of acoustical wall panel.

I. Maintenance Data: For acoustical wall panels to include in maintenance manuals. Include fabric manufacturers' written cleaning and stain-removal recommendations.

J. Warranty: Special warranty specified in this Section.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

B. Source Limitations: Obtain acoustical wall panels through one source from a single manufacturer.

C. Fire-Test-Response Characteristics: Provide acoustical wall panels 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.

D. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Comply with fabric and acoustical wall panel manufacturers' written instructions for minimum and maximum temperature and humidity requirements for shipment, storage, and handling.

B. Deliver materials and panels in unopened bundles and store in a temperature-controlled dry place with adequate air circulation.

C. Protect panel edges from crushing and impact.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not install acoustical wall panels until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Lighting: Do not install acoustical wall panels until a permanent level of lighting is provided on surfaces to receive acoustical wall panels.

C. Air-Quality Limitations: Protect acoustical wall panels from exposure to airborne odors, such as tobacco smoke, and install panels under conditions free from odor contamination of ambient air.

D. Field Measurements: Verify locations of acoustical wall panels by field measurements before fabrication and indicate measurements on Shop Drawings.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of acoustical wall panels that fail in performance, materials, or workmanship within specified warranty period.

1. Failure in performance includes, but is not limited to, acoustical performance.
2. Failures in materials include, but are not limited to, fabric sagging, distorting, or releasing from panel edge; or warping of core.
3. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers that may be incorporated into the Work include, but are not limited to, the following:

1. Decoustics Ltd.
2. Kinetics Noise Control.
3. MBI Products Company.
4. Quiet Concepts, a division of PCI Industries.
5. Sound Concepts.
6. Wall Technology, an Owens Corning Company.

B. Basis-of-Design:

2.2 CORE MATERIALS

A. Glass-Fiber Board: ASTM C 612, Type IA or Types IA and IB; density as specified, unfaced, dimensionally stable, molded rigid board, with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.

1. Nominal Core Density: 4 to 7 lb/cu. ft.

2.3 BACK-MOUNTED, EDGE-REINFORCED ACOUSTICAL WALL PANELS WITH GLASS-FIBER BOARD CORE

A. Panel Construction: Manufacturer's standard panel construction consisting of facing material laminated to front face, edges, and back border of dimensionally stable, rigid glass-fiber board core; with edges chemically hardened to reinforce panel perimeter against warpage and damage.

1. Nominal Core Thickness: 1 inch
2. Overall System NRC: Not less than 0.80, for Type A mounting per ASTM E 795.
3. Panel Width: As indicated on Drawings
4. Panel Height: Fabricated height as indicated on Drawings.
5. Panel Edge Detail: Square.
6. Corner Detail: Square to form continuous profile to match edge detail.

B. Facing Material: Fabric from same dye lot; color and pattern as selected by Architect from manufacturer's full range.

1. Manufacturer: As indicated on the Finish Schedule.

C. Back-Mounting Devices: Concealed on backside of panel, recommended to support weight of panel, and as follows:

1. As recommended by manufacturer.

2.4 FABRICATION

A. Sound-Absorption Performance: Provide acoustical wall panels with minimum NRCs indicated, as determined by testing per ASTM C 423 for mounting type specified.

B. Acoustical Wall Panels: Panel construction consisting of facing material adhered to[face,] edges and back border of dimensionally stable core; with rigid edges to reinforce panel perimeter against warpage and damage.

1. Glass-Fiber Board: Resin harden areas of core for attachment of mounting devices.

C. Fabric Facing: Stretched straight, on the grain, tight, square, and free from puckers, ripples, wrinkles, sags, blisters, seams, adhesive, or other foreign matter. Applied with visible surfaces fully covered.

1. Where square corners are indicated, tailor corners.
2. Where radius or other nonsquare corners are indicated, attach facing material so there are no seams or gathering of material.
3. Where fabrics with directional or repeating patterns or directional weave are indicated, mark fabric top and attach fabric in same direction so pattern or weave matches in adjacent panels.

D. Dimensional Tolerances of Finished Units: Plus or minus 1/16 inch for the following:

1. Thickness.
2. Edge straightness.
3. Overall length and width.

4. Squareness from corner to corner.
5. Chords, radii, and diameters.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fabric, substrates, blocking, and conditions, with Installer present, for compliance with requirements, installation tolerances, and other conditions affecting performance of acoustical wall panels.

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

3.2 INSTALLATION

A. Install acoustical wall panels in locations indicated with vertical surfaces and edges plumb, top edges level and in alignment with other panels, faces flush, and scribed to fit adjoining work accurately at borders and at penetrations.

B. Comply with acoustical wall panel manufacturer's written instructions for installation of panels using type of concealed mounting accessories indicated or, if not indicated, as recommended by manufacturer. Anchor panels securely to supporting substrate.

C. Match and level fabric pattern and grain among adjacent panels.

D. Installation Tolerances: As follows:

1. Variation from Level and Plumb: Plus or minus 1/16 inch.
2. Variation of Panel Joints from Hairline: Not more than 1/16 inch wide.

3.3 CLEANING

A. Clip loose threads; remove pills and extraneous materials.

B. Clean panels with fabric facing, on completion of installation, to remove dust and other foreign materials according to manufacturer's written instructions.

3.4 PROTECTION

A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, to ensure that acoustical wall panels are without damage or deterioration at time of Substantial Completion.

B. Replace acoustical wall panels that cannot be cleaned and repaired, in a manner approved by Architect, before time of Substantial Completion.

END OF SECTION

SECTION 099000

PAINTING AND COATING

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Field painting of exposed interior items and surfaces.
2. Field painting of exposed exterior items and surfaces.
3. Surface preparation for painting.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 051200 - STRUCTURAL STEEL FRAMING for shop priming structural steel.
2. Section 055000 - METAL FABRICATIONS for shop priming ferrous metal.
3. Section 055100 - METAL STAIRS AND RAILINGS for shop priming ferrous metal.
4. Section 064020 - INTERIOR ARCHITECTURAL WOODWORK for shop priming interior architectural woodwork.
5. Section 074610 - FIBER-CEMENT SIDING for factory priming siding and trim.
6. Section 078100 - APPLIED FIREPROOFING for intumescent fire-resistive coatings.
7. Section 081110 - HOLLOW METAL DOORS AND FRAMES for factory priming steel doors and frames.
8. Section 081400 - FLUSH WOOD DOORS for factory finishing.
9. Section 092110 - GYPSUM BOARD ASSEMBLIES for surface preparation of gypsum board.

1.3 DEFINITIONS AND EXTENT

A. General: Standard coating terms defined in ASTM D 16 apply to this Section.

1. Flat refers to a lusterless or matte finish with a gloss range below 15 when measured at an 85-degree meter.
2. Eggshell refers to low-sheen finish with a gloss range between 20 and 35 when measured at a 60-degree meter.
3. Semigloss refers to medium-sheen finish with a gloss range between 35 and 70 when measured at a 60-degree meter.
4. Full gloss refers to high-sheen finish with a gloss range more than 70 when measured at a 60-degree meter.

B. This Section includes surface preparation and field painting of exposed exterior and interior items and surfaces.

1. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.

C. Paint exposed surfaces, except where these Specifications indicate that the surface or material is not to be painted or is to remain natural. If an item or a surface is not specifically mentioned, paint the item or surface the same as similar adjacent materials or surfaces. If a color of finish is not indicated, Architect will select from standard colors and finishes available.

1. Painting includes field painting of exposed bare and covered pipes and ducts (including color coding), hangers, exposed steel and iron supports, and surfaces of mechanical and electrical equipment that do not have a factory-applied final finish.

D. Do NOT paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.

1. Prefinished items include the following factory-finished components:

a. Architectural woodwork.
b. Acoustical wall panels.
c. Toilet enclosures.
d. Metal lockers.
e. Kitchen appliances.
f. Elevator entrance doors and frames.
g. Elevator equipment.
h. Finished mechanical and electrical equipment.
i. Light fixtures.

2. Concealed surfaces include walls or ceilings in the following generally inaccessible spaces:

a. Foundation spaces.
b. Furred areas.
c. Ceiling plenums.
d. Utility tunnels.
e. Pipe spaces.
f. Duct shafts.
g. Elevator shafts.

3. Finished metal surfaces include the following:

a. Anodized aluminum.
b. Stainless steel.
c. Chromium plate.
d. Copper and copper alloys.
e. Bronze and brass.

4. Operating parts include moving parts of operating equipment and the following:

a. Valve and damper operators.

b. Linkages.
c. Sensing devices.
d. Motor and fan shafts.

5. Labels: Do not paint over UL, FMG, or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

1.4 SUBMITTALS

A. Product Data: For each paint system indicated. Include block fillers and primers.

1. Material List: An inclusive list of required coating materials. Indicate each material and cross-reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.
2. Manufacturer's Information: Manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material.

B. Samples for Verification: For each color and material to be applied, with texture to simulate actual conditions, on representative Samples of the actual substrate.

1. Provide stepped Samples, defining each separate coat, including block fillers and primers. Use representative colors when preparing Samples for review. Resubmit until required sheen, color, and texture are achieved.
2. Provide a list of materials and applications for each coat of each Sample. Label each Sample for location and application.
3. Submit two 8 inch by 12 inch Samples for each type of finish coating for Architect's review of color and texture only.

C. Qualification Data: For Applicator.

1.5 QUALITY ASSURANCE

A. Applicator Qualifications: A firm or individual experienced in applying paints and coatings similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.

B. Source Limitations: Obtain block fillers and primers for each coating system from the same manufacturer as the finish coats.

C. Mockups: Provide a full-coat benchmark finish sample for each type of coating and substrate required. Comply with procedures specified in PDCA P5. Duplicate finish of approved sample Submittals.

1. Architect will select one room or surface to represent surfaces and conditions for application of each type of coating and substrate.

a. Wall Surfaces: Provide samples on at least 100 sq. ft.
b. Small Areas and Items: Architect will designate items or areas required.

2. Apply benchmark samples, according to requirements for the completed Work, after permanent lighting and other environmental services have been activated. Provide required sheen, color, and texture on each surface.

a. After finishes are accepted, Architect will use the room or surface to evaluate coating systems of a similar nature.

3. Final approval of colors will be from benchmark samples.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label and the following information:

1. Product name or title of material.
2. Product description (generic classification or binder type).
3. Manufacturer's stock number and date of manufacture.
4. Contents by volume, for pigment and vehicle constituents.
5. Thinning instructions.
6. Application instructions.
7. Color name and number.
8. VOC content.

B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F. Maintain storage containers in a clean condition, free of foreign materials and residue.

1. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily.

1.7 PROJECT CONDITIONS

A. Apply waterborne paints only when temperatures of surfaces to be painted and surrounding air are between 50 and 90 deg F.

B. Apply solvent-thinned paints only when temperatures of surfaces to be painted and surrounding air are between 45 and 95 deg F.

C. Do not apply paint in snow, rain, fog, or mist; or when relative humidity exceeds 85 percent; or at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacturer during application and drying periods.

1.8 EXTRA MATERIALS

A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Paint: Furnish four unopened gallons of each type of paint and coating work, in color and gloss as used for the Project.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work are listed in the Finish Schedule at the end of this Section.

2.2 PAINT MATERIALS, GENERAL

A. Material Compatibility: Provide block fillers, primers, and finish-coat materials that are compatible with one another and with the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

B. Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified that are factory formulated and recommended by manufacturer for application indicated. Paint-material containers not displaying manufacturer's product identification will not be acceptable.

1. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers. Furnish manufacturer's material data and certificates of performance for proposed substitutions.

C. Paint Colors (PT-#): Refer to Finish Schedule.

D. VOC Content for Interior Paints and Coatings: Products shall comply with VOC limits of authorities having jurisdiction and, for interior paints and coatings applied at Project site, the following VOC limits, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

1. Flat Paints and Coatings: 50 g/L (SCAQMD and CARB).
2. Nonflat Paints and Coatings: 50 g/L (SCAQMD) or 100 g/L (CARB).
3. Nonflat, High Gloss Paints and Coatings: 50 g/L (SCAQMD) or 150 g/L (CARB).
4. Dry-Fog Coatings: 50 g/L (SCAQMD) or 150 g/L (CARB).
5. Primers, Sealers, and Undercoaters: 100 g/L.
6. Anticorrosive and Antirust Paints Applied to Ferrous Metals (Industrial Maintenance and Rust Preventative Coatings): 100 g/L (SCAQMD) or 250 g/L (CARB).
7. Zinc-Rich Industrial Maintenance Primers: 100 g/L (SCAQMD) or 340 g/L (CARB).
8. Pretreatment Wash Primers: 420 g/L.
9. Floor Coatings: 50 g/L (SCAQMD) or 100 g/L (CARB).
10. Shellacs, Clear: 730 g/L.
11. Shellacs, Pigmented: 550 g/L.
12. Clear Wood Finishes: 275 g/L.
13. Stains, Exterior: 100 g/L (SCAQMD) or 250 g/L (CARB).
14. Stains, Interior: 250 g/L.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for paint application.

1. Proceed with paint application only after unsatisfactory conditions have been corrected and surfaces receiving paint are thoroughly dry.
2. Start of painting will be construed as Applicator's acceptance of surfaces and conditions within a particular area.

B. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.

1. Notify Architect about anticipated problems when using the materials specified over substrates primed by others.

3.2 PREPARATION

A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of size or weight of the item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.

B. Cleaning: Before applying paint or other surface treatments, clean substrates of substances that could impair bond of the various coatings. Remove oil and grease before cleaning.

1. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

C. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions and technical bulletins for each particular substrate condition and as specified.

1. Provide barrier coats over incompatible primers or remove and reprime.
2. Cementitious Materials: Prepare concrete, concrete unit masonry, cement plaster, and mineral-fiber-reinforced cement panel surfaces to be painted. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation.

a. Use abrasive blast-cleaning methods if recommended by paint manufacturer.
b. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not paint surfaces if moisture content exceeds that permitted in manufacturer's written instructions.

c. Clean concrete floors to be painted with a 5 percent solution of muriatic acid or other etching cleaner. Flush the floor with clean water to remove acid, neutralize with ammonia, rinse, allow to dry, and vacuum before painting.

3. Wood: Clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sand surfaces exposed to view smooth and dust off.

   a. Scrape and clean small, dry, seasoned knots, and apply a thin coat of white shellac or other recommended knot sealer before applying primer. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler. Sand smooth when dried.
   b. Prime, stain, or seal wood to be painted immediately on delivery. Prime edges, ends, faces, undersides, and back sides of wood, including cabinets, counters, cases, and paneling.
   c. If transparent finish is required, backprime with spar varnish.
   d. Backprime paneling on interior partitions where masonry, plaster, or other wet wall construction occurs on back side.
   e. Seal tops, bottoms, and cutouts of unprimed wood doors with a heavy coat of varnish or sealer immediately on delivery.

4. Ferrous Metals: Clean ungalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with SSPC's recommendations.

   a. Exterior Exposed Steel: Clean steel surfaces in accordance with SSPC-SP 6/NACE No. 3 Commercial Blast Cleaning. Abrasive blast cleaned surfaces shall exhibit a uniform, angular profile of 1.5-3.0 mils. Prime cleaned surfaces within 8 hours and prior to surface rusting.
   b. Interior Exposed Steel, in Humid Environments: Clean steel surfaces in accordance with SSPC-SP 6/NACE No. 3 Commercial Blast Cleaning. Abrasive blast cleaned surfaces shall exhibit a uniform, angular profile of 1.5-3.0 mils. Prime cleaned surfaces within 8 hours and prior to surface rusting.
   c. Interior Exposed Steel, in Dry Environments: Clean steel surfaces in accordance with SSPC-SP2 or SP3 Hand or Power Tool Cleaning.

5. Galvanized Surfaces: Clean galvanized surfaces in accordance with SSPC-SP16 Brush off Blast Cleaning of Galvanized Steel and NonFerrous Metals, to achieve a minimum 1 mil anchor profile.

D. Material Preparation: Mix and prepare paint materials according to manufacturer's written instructions.

1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
2. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.
3. Use only thinners approved by paint manufacturer and only within recommended limits.

E. Tinting: Tint each undercoat a lighter shade to simplify identification of each coat when multiple coats of same material are applied. Tint undercoats to match the color of the finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat.

3.3 APPLICATION

A. General: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.

1. Paint colors, surface treatments, and finishes are indicated in the paint schedules.
2. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
3. Provide finish coats that are compatible with primers used.
4. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, grilles, convector covers, covers for finned-tube radiation, and similar components are in place. Extend coatings in these areas, as required, to maintain system integrity and provide desired protection.
5. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
6. Paint interior surfaces of ducts with a flat, nonspecular black paint where visible through registers or grilles.
7. Paint backsides of access panels and removable or hinged covers to match exposed surfaces.
8. Finish exterior doors and doors in wet areas on tops, bottoms, and side edges the same as exterior faces.
9. Sand lightly between each succeeding enamel or varnish coat.

B. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.

1. The number of coats and film thickness required are the same regardless of application method. Do not apply succeeding coats until previous coat has cured as recommended by manufacturer. If sanding is required to produce a smooth, even surface according to manufacturer's written instructions, sand between applications.
2. Omit primer over metal surfaces that have been shop primed and touchup painted.
3. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance. Give special attention to ensure that edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.
4. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried to where it feels firm, and does not deform or feel sticky under moderate thumb pressure, and until application of another coat of paint does not cause undercoat to lift or lose adhesion.

C. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.

1. Brushes: Use brushes best suited for type of material applied. Use brush of appropriate size for surface or item being painted.
2. Rollers: Use rollers of carpet, velvet-back, or high-pile sheep's wool as recommended by manufacturer for material and texture required.
3. Spray Equipment: Use airless spray equipment with orifice size as recommended by manufacturer for material and texture required.

D. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate to achieve dry film thickness indicated. Provide total dry film thickness of the entire system as recommended by manufacturer.

E. Mechanical and Electrical Work: Painting of mechanical and electrical work is limited to items exposed in equipment rooms and occupied spaces.

F. Mechanical items to be painted include, but are not limited to, the following:

1. Uninsulated metal piping.
2. Uninsulated plastic piping.
3. Pipe hangers and supports.
4. Tanks that do not have factory-applied final finishes.
5. Visible portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets.
6. Duct, equipment, and pipe insulation having "all-service jacket" or other paintable jacket material.
7. Mechanical equipment that is indicated to have a factory-primed finish for field painting.

G. Electrical items to be painted include, but are not limited to, the following:

1. Switchgear.
2. Panelboards.
3. Electrical equipment that is indicated to have a factory-primed finish for field painting.

H. Block Fillers: Apply block fillers to concrete masonry block at a rate to ensure complete coverage with pores filled.

I. Prime Coats: Before applying finish coats, apply a prime coat, as recommended by manufacturer, to material that is required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn-through or other defects due to insufficient sealing.

J. Pigmented (Opaque) Finishes: Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.

K. Transparent (Clear) Finishes: Use multiple coats to produce a glass-smooth surface film of even luster. Provide a finish free of laps, runs, cloudiness, color irregularity, brush marks, orange peel, nail holes, or other surface imperfections.

1. Provide satin finish for final coats.

L. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.

3.4 FIELD QUALITY CONTROL

A. The Owner reserves the right to invoke the following test procedure at any time and as often as the Owner deems necessary during the period when paint is being applied:

1. The Owner will engage a qualified independent testing agency to sample paint material being used. Samples of material delivered to Project will be taken, identified, sealed, and certified in the presence of Contractor.
2. Testing agency will perform appropriate tests for the following characteristics as required by the Architect.
3. The Architect may direct Contractor to stop painting if test results show material being used does not comply with specified requirements. Contractor shall remove noncomplying paint from Project site, pay for testing, and repaint surfaces previously coated with the noncomplying paint. If necessary, Contractor may be required to remove noncomplying paint from previously painted surfaces if, on repainting with specified paint, the two coatings are incompatible.

3.5 CLEANING

A. Cleanup: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from Project site.

1. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping without scratching or damaging adjacent finished surfaces.

3.6 PROTECTION

A. Protect work of other trades, whether being painted or not, against damage from painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Architect.

B. Provide "Wet Paint" signs to protect newly painted finishes. After completing painting operations, remove temporary protective wrappings provided by others to protect their work.

1. After work of other trades is complete, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA P1.

3.7 PAINT SCHEDULE

A. Schedule: Provide products and number of coats specified. Use of manufacturer's proprietary product names to designate colors, materials, generic class, standard of quality and performance criteria and is not intended to imply that products named are required to be used to the exclusion of equivalent performing products of other manufacturers.

B. Exterior Paint Schedule:

1. Exterior Galvanized Metal (not shop-finished under Section 051200 - STRUCTURAL STEEL FRAMING, Section 055000 - METAL FABRICATIONS, or Section 055100 - METAL STAIRS AND RAILINGS), Alliphatic Acrylic Polyurethane System:

a. Surface Preparation: SSPC-SP16 Brush-off Blast of Galvanized Steel.
b. One Coat:

1) Tnemec 66HS Hi-Build Epoxoline at 3.0 mils DFT.
2) PPG PMC Amerlock 400 Hi-Build Epoxy at 4.0-5.0 mils DFT.
3) Dupont 25P High Solids at 4.0 mils DFT.
4) International Intergard 475 HS at 5.0 to 10.0 mils DFT.

c. And One Coat:

1) Tnemec 73 Endura-Shield at 3.0 mils DFT.
2) PPG PMC Amercoat 450H Polyurethane at 3.0 mils DFT.
3) Dupont Imron 2.8 Urethane at 3.0 to 4.0 mils DFT.
4) International Interthane 990 HS at 3.0 to 4.0 mils DFT.

2. Exterior Ferrous Metal, Urethane System:

a. Surface Preparation: SSPC-SP6.
b. One Coat:

1) Tnemec 90G-1K97 at 3 mils DFT; shop applied under other Sections; use for touch up.
2) PPG PMC Amercoat 68 MCZ at 3 mils DFT; shop applied under other Sections; use for touch up.
3) Dupont Urethane Ganicin Zinc Rich Primer 80%zinc load at 3.0 mils DFT.
4) International Interzinc 315 at 2.0 to 3.0 mils DFT.

c. And One Coat:

1) Tnemec 66HS Hi-Build Epoxoline at 3.0 mils DFT.
2) PPG PMC Amerlock 400 Hi-Build Epoxy at 3.0 to 5.0 mils DFT.
3) Dupont 25P High Solids Epoxy at 4.0 to 6.0 mils DFT.
4) International Intergard 475 HS at 4.0 to 8.0 mils DFT.

d. And One Coat:

1) Tnemec 73 Endura-Shield at 3.0 mils DFT.
2) PPG PMC Amerlock 450H Polyurethane Topcoat at 3.0 mils DFT.
3) Dupont High Solids Imron Urethane at 4.0 mils DFT.
4) International Interthane 990 HS at 2.0 to 3.0 mils DFT.

3. Exterior Aluminum (where required), Painted Finish:

a. Surface Preparation: Pressure wash with Oakite and sand with 3M Scotch-Brite nylon pads.
b. One Coat:

1) Tnemec 66HS Hi-Build Epoxoline at 2.0 mils DFT.
2) PPG PMC Amerlock 400 Hi-Build Epoxy at 2.0 to 3.0 mils DFT.
3) Dupont 25P High Solids at 4.0 mils DFT.
4) International Intergard 475 HS at 5.0 to 10.0 mils DFT.

c. And One Coat:

1) Tnemec 73 Endura-Shield at 2.0 mils DFT.
2) PPG PMC Amercoat 450H Polyurethane at 3.0 mils DFT.
3) Dupont High Solids Imron 2.8 at 4.0 mils DFT.
4) International Interthane 990 HS at 3.0 to 4.0 mils DFT.

4. Exterior Existing Prepainted Steel, for Sandblasting and Painted Finish:

a. Surface Preparation- SSPC-SP 6 Commercial Blast Cleaning.
b. One Coat:

1) Tnemec 90-97 or 90G-1K97 at 3 to 3.5 mils DFT.
2) PPG PMC Amercoat 68 MCZ at 3.0 mils DFT.
3) Dupont Ganicin 80% Zinc load Zinc Rich Primer at 3.0 to 3.5 mils DFT.

c. And One Coat:

1) Tnemec 73 Endura-Shield at 3.0 to 4.0 mils DFT.
2) PPG PMC Amerlock 400 at 4.0 DFT.
3) Dupont Imron 2.8 at 4.0 to 5.0 mils DFT.

d. And One Coat:

1) Tnemec 1070, 1071, or 1072 Flouronar at 2.5 to 3.5 mils DFT.
2) PPG PMC Corolon Coating at 5.0 mils DFT.
3) Dupont Flouropolymer at 3.0 mils DFT.

5. Exterior Existing Prepainted Steel, for Overcoat Painted Finish:

a. Surface Preparation: Water Blast 5000 psi and SSPC-SP3 Power Tool Clean.
b. One Coat:

1) Tnemec 394 Omnithane at 3.0 to 3.5 mils DFT.
2) PPG PMC Amerlock 400 Hi-Build Epoxy at 3.0 to 4.0 mils DFT.
3) RD Coatings Elasto Metal at 3.0 mils DFT.
4) International Interplus 356 at 3.0 to 5.0 mils DFT.

c. And One Coat:

1) Tnemec 66HS Hi-Build Epoxoline at 3.0 to 5.0 mils DFT.
2) PPG PMC Amerlock 400 at 3.0 to 4.0 mils DFT.
3) RD Coatings Elasto Metal at 7.0 mils DFT.
4) International Intergard 475 HS at 5.0 to 10.0 mils DFT.

d. And One Coat:

1) Tnemec 73 Endura-Shield at 3.0 to 5.0 mils DFT.
2) PPG PMC Amercoat 450H at 3.0 mils DFT.
3) RD Coatings MurCryl at 3.0 to 4.0 mils DFT.
4) International Interthane 990 HS at 3.0 to 4.0 mils DFT.

6. Exterior Wood, for Stained Finish:

a. Two Coats:

1) Cabot Water-Based Semi-Transparent Stain 1300.
2) Akzo Nobel Paints; Sikkens, approved equal.
3) Moore, approved equal.

7. Exterior Wood and Cellular PVC, for Painted Finish:

a. Factory Primed per Section 062010 - EXTERIOR FINISH CARPENTRY.

or

b. One Coat, Primer:

1) California Paint Grip-Coat Bonding Primer 505 series.
2) Duron Bond N-Seal Exterior Acrylic Latex Primer 08-124.
3) Moore Ultra Spec Exterior Primer N558.
4) PPG Seal Grip Acrylic Latex Primer.
5) S-W Exterior Latex Acrylic Wood Primer.

c. And Two Coats, Flat Finish:

1) California Paint Fresh Coat 100% Acrylic Velvet Flat 450 series.
2) Duron Weathershield Exterior 100% Acrylic Flat House Paint 34-914.
3) Moore Ultra Spec Exterior Flat Finish N447.
4) PPG Sun-Proof Exterior Flat Latex 72 line, N105 or 183.
5) S-W SuperPaint VinylSafe Exterior Latex Acrylic Flat A80 series.

or

d. And Two Coats, Semi-Gloss Finish:

1) California Paint Fresh Coat 100% Acrylic Satin-Gloss 471 series.
2) Duron Weathershield Exterior 100% Acrylic Semi-Gloss House Paint.
3) Moore Ultra Spec Exterior Gloss Finish N449.
4) PPG Sun-Proof Exterior Semi-Gloss Latex 78 line, N096 or 170.
5) S-W SuperPaint VinylSafe Exterior Latex Acrylic Satin A89 series.

8. Exterior Fiber-Reinforced Cement Board, for Painted Finish:

a. Factory Primed per Section 074610 - FIBER-CEMENT SIDING.
b. Two Coats, Flat Finish:

1) Duron Weathershield Exterior 100% Acrylic Flat House Paint 34-914.
2) PPG Sun-Proof Exterior Flat Latex 72 line, N105 or 183.
3) S-W SuperPaint Exterior Latex Acrylic Flat A80 series.
4) California Paint Fresh Coat 100& Acrylic Velvet Flat 450 series.

or

c. Two Coats, Semi-Gloss Finish:

1) Duron Weathershield Exterior 100% Acrylic Semi-Gloss House Paint.
2) PPG Sun-Proof Exterior Semi-Gloss Latex 78 line, N096 or 170.
3) S-W SuperPaint Exterior Latex Acrylic Satin A89 series.
4) California Paint Fresh Coat Satin-Gloss 100% Acrylic 471 series.

C. Interior Paint Schedule, Typical:

1. Interior Gypsum Wallboard and Plaster, Latex Paint Finish:

a. One Coat, Primer:

1) Imperial Paints ECOS Interior Wall Primer.
2) Moore Ultra Spec 500 Interior Latex Primer 534.
3) PPG Speedhide Zero VOC Interior Primer 6-4900XI.
4) S-W Harmony Interior Primer B11 series.
5) S-W ProMar 200 HP Zero VOC Interior Primer.

b. And Two Coats, Flat Finish: At ceilings and elsewhere as indicated.

1) Imperial Paints ECOS Interior Flat.
2) Moore Ultra Spec 500 Interior Latex Flat 536.
3) PPG Speedhide Zero VOC Interior Latex Flat 6-4110XI.
4) S-W ProMar 400 HP Zero VOC Interior Flat.

c. And Two Coats, Eggshell Finish: At walls and elsewhere as indicated.

1) Imperial Paints ECOS Interior Eggshell.
2) Moore Ultra Spec 500 Interior Latex Low Sheen 537.
3) PPG Speedhide Zero VOC Interior Latex Eggshell 6-4310XI.
4) S-W ProMar 200 HP Zero VOC Interior Eg-Shel.

or

d. And Two Coats, Semi-Gloss Finish: At toilet rooms, other wet areas, and elsewhere as indicated.

1) Imperial Paints ECOS Interior Satin.
2) Moore Ultra Spec 500 Interior Latex Semi-Gloss 539.
3) PPG Speedhide Zero VOC Interior Latex Semi-Gloss 6-4510XI.
4) S-W ProMar 200 HP Zero VOC Interior Semi-Gloss.

2. Interior Architectural Woodwork, Finish Carpentry, and Wood Doors (softwoods, paint grade hardwoods, MDF, MDO, and hardwood veneers), Latex Paint Finish:

a. One Coat, Primer:

1) Imperial Paints ECOS Interior Wood Primer.
2) Moore Ultra Spec 500 Interior Latex Primer 534.
3) PPG Speedhide Zero VOC Interior Primer 6-4900XI.
4) S-W ProMar 200 HP Zero VOC Interior Primer.

b. And Two Coats, Semi-Gloss:

1) Imperial Paints ECOS Interior Satin.
2) Moore Ultra Spec 500 Interior Latex Semi-Gloss 539.
3) PPG Speedhide Zero VOC Interior Latex Semi-Gloss 6-4510XI.
4) S-W ProMar 200 HP Zero VOC Interior Semi-Gloss.

3. Interior Architectural Woodwork, Finish Carpentry and Millwork (hardwoods and hardwood veneers, except paint grade and factory-finished items), Transparent Polyurethane Finish:

a. Sand: 120 grit sandpaper.
b. Sand: 220 grit sandpaper.

c. One Coat, Stain: Not Used.
d. And Three Coats, Satin Finish:

1) American Formulating & Manufacturing, Safecoat Polyureseal BP.
2) Imperial Paints ECOS Woodshield Varnish.Moore Benwood Stays Clear Acrylic Polyurethane Low Lustre W423.
4) Vermont Natural Coatings; PolyWhey Natural Furniture Finish.

e. Sand Between Urethane Coats: 220 grit sandpaper.

4. Interior Concrete Masonry Unit (CMU), Latex Paint Finish:

a. One Coat, Block Filler:

1) Moore Ultra Spec Hi-Build Masonry Block Filler 571.
2) PPG Speedhide Interior Masonry Hi Fill Latex Block Filler 6-15XI.
3) S-W PrepRite Block Filler B25W25.

b. And Two Coats, Eggshell Finish: At walls and elsewhere as indicated.

1) Moore Ultra Spec 500 Interior Latex Low Sheen 537.
2) PPG Speedhide Zero VOC Interior Latex Semi-Gloss 6-4510XI.
3) S-W ProMar 200 HP Zero VOC Interior Eg-Shel.

5. Interior Concrete Floor, Clear Exposed Sealer (Silicate type):

a. One Coat:

1) Curecrete Chemical; Ashford Formula.
2) Tnemec (Chem Probe); Series 629 CT Densifyer.
3) WR Meadows; Liqui-Hard.
4) Laticrete; L&M Seal Hard.
5) Prosoco; Consolideck LS.

D. Interior Paint Schedule, High Performance and Specialty Systems:

1. Interior Concrete Ceiling Surfaces in Dry Areas, Acrylic Paint Finish:

a. One Coat:

1) Tnemec 151 Elasto-Grip at 2.0 mils DFT.
2) PPG PMC Amerlock Sealer at 1.0 mils DFT.
3) Dupont High Solids Acrylic Primer at 2.0 mils DFT.
4) International Intercryl 520 at 3.0 mils DFT.

b. And Two Coats, Semi-Gloss Finish:

1) Tnemec 1028/1029 Enduratone at 2.0 –3.0 mils DFT per coat min.
2) PPG PMC Amercoat 220 at 3.0 mils DFT.
3) Dupont High Solids Acrylic at 3.0 mils DFT.
4) International Intercryl 530 at 3.0 mils DFT.

2. Interior Concrete Masonry Units, Epoxy/Acrylic Coating:

    a. Surface Preparation: Cured, clean and dry, free of surface contaminants.
    b. One Coat: Tnemec 130 Envirofil at 100 sqft/gal.
    c. And One Coat: Tnemec 27WB at 8-10 mils DFT.
    d. And One Coat: Tnemec 1028 at 2-3 mils DFT.

3. Interior Metals (Not specified to receive other coating systems/not shop finished), Epoxy Painted Finish:

    a. One Coat: Approved primer, in shop under other Sections (where specified). If not shop primed, provide primer recommended by finish coating manufacturer.
    b. And One Coat:

        1) Tnemec 1029 Enduratone at 2.0 mils DFT.
        2) PPG PMC Amerlock 400 at 2.0 to 4.0 mils DFT.
        3) Dupont 25P at 3.0 to 4.0 mils DFT.
        4) International Interseal 670 HS at 3.0 mils DFT.

    c. And One Coat:

        1) Tnemec 1029 Enduratone at 2.0 to 3.0 mils DFT.
        2) PPG PMC Amerlock 400 at 2.0 to 4.0 mils DFT.
        3) Dupont High Solids Acrylic Coating 3.0 mils DFT.
        4) International Intercryl 530 at 3.0 to 4.0 mils DFT.

4. Interior Exposed Steel, Joists, Ductwork, Conduit and Similar Items (where indicated), Dry-Fall or Dry-Fog Painted System:

    a. One Coat:

        1) Moore Latex Dry Fall Flat 395 at 2.5 to 3.0 mils DFT.
        2) S-W WB Acrylic Dryfall B42 at 2.5 to 3.0 mils DFT.
        3) Tnemec 115 WB Unibond at 2.5 to 3.0 mils DFT.
        4) International Intercryl 530 at 2.5 to 3.0 mils DFT.
        5) PPG PMC Amercoat 220 Acrylic at 3.0 mils DFT.
        6) RD Coatings Muracryl at 2.0 to 3.0 mils DFT.

E. Mechanical and Electrical Work: Paint all exposed items throughout the project except factory finished items with factory-applied baked enamel finishes which occur in mechanical rooms or areas, and excepting chrome or nickel plating, stainless steel, and aluminum other than mill finished. Paint all exposed ductwork and inner portion of all ductwork. Same as specified for other interior metals, hereinabove.

END OF SECTION

SECTION 101100

VISUAL DISPLAY SURFACES

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Markerboards.
2. Tackboards.
3. Marker wall coverings.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 064020 - INTERIOR ARCHITECTURAL WOODWORK for custom wood trim for visual display surfaces.
2. Section 099000 - PAINTING AND COATING for primers under marker wall covering.

1.3 SUBMITTALS

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

B. Samples: For each type of visual display surface indicated, for units with factory-applied color finishes, and as follows:

1. Actual sections of visual display surfaces.
2. Fabric swatches fabric-faced tack assemblies.

C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Show location of panel joints.
2. Show location of special-purpose graphics for visual display surfaces.
3. Include sections of typical trim members.

D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for surface-burning characteristics of fabrics.

E. Maintenance Data: For visual display surfaces to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of visual display surface through one source from a single manufacturer.

B. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

C. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver factory-built visual display boards, including factory-applied trim where indicated, completely assembled in one piece without joints, where possible. If dimensions exceed maximum manufactured panel size, provide two or more pieces of equal length as acceptable to Architect. When overall dimensions require delivery in separate units, prefit components at the factory, disassemble for delivery, and make final joints at the site.

B. Store visual display units vertically with packing materials between each unit.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify dimensions 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 visual display surfaces without field measurements. Coordinate wall construction to ensure that actual dimensions correspond to established dimensions.
2. Allow for trimming and fitting where taking field measurements before fabrication might delay the Work.

PART 2 - PRODUCTS

2.1 MARKERBOARD ASSEMBLIES

A. Porcelain-Enamel Markerboard Assembly: Balanced, high-pressure, factory-laminated markerboard assembly of 3-ply construction consisting of backing sheet, core material, and 0.021-inch-thick, porcelain-enamel face sheet.

1. Available Manufacturers:

a. AACRO Products, Inc.
b. Claridge Products & Equipment, Inc.
c. Peter Pepper Products.
d. MooreCo; Best-Rite Manufacturing.
e. Steelcase Company; PolyVision products.

2. Manufacturer's Standard Core: Minimum 1/4 inch thick, with manufacturer's standard moisture-barrier backing with binder containing no added urea formaldehyde.
3. Fire Rating: ASTM E 84, Class A.
4. Color: White, low gloss finish.
5. Laminating Adhesive: Manufacturer's standard moisture-resistant thermoplastic type.

B. Glass Markerboards: 6-mm tempered glass markerboard, with smooth polished edge and eased corners; color coated on back surface.

1. Clear Tempered Glass: ASTM C 1048, Kind FT, Condition A, Type I, Class 1, Quality Q3, with exposed edges seamed before tempering.
2. Mounting: Round, stainless-steel standoffs, holding glass approximately 1 inch from wall surface; mounted in notches in standoffs at top and bottom edges of markerboard.
3. Color and Surface: As selected by the Architect.
4. Marker Tray: Glass, supported by stainless-steel clips.

2.2 TACKBOARD ASSEMBLIES

A. Linoleum Resilient Tackboard: Uni-color linoleum resilient homogeneous tackable surface consisting of linseed oil, granulated cork, rosin binders and dry pigments calendared onto a natural burlap backing with integral color throughout with surface-burning characteristics indicated.

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

   a. Forbo Industries; Bulletin Board.
   b. WallTalkers; Tac-wall.

2. Thickness: 1/4 inch.
3. Manufacturer's Standard Core: Minimum 1/4 inch thick, with manufacturer's standard backing with binder containing no added urea formaldehyde.
4. Fire Rating: ASTM E 84, Class A.
5. Colors: Refer to Finish Schedule.

B. Fabric-Wrapped Tackboard:

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

   a. Claridge Products & Equipment, Inc.
   b. Egan Visual Inc.
   c. MooreCo; Best-Rite Manufacturing.
   d. Peter Pepper Products.
   e. Steelcase Company.

2. Manufacturer's Standard Core: Minimum 1/4 inch thick, with manufacturer's standard backing with binder containing no added urea formaldehyde.
3. Fire Rating: ASTM E 84, Class A.
4. Fabric Facing Material, Colors and Patterns: Refer to Finish Schedule.

2.3 VISUAL DISPLAY WALL COVERINGS

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

1. Best-Rite Manufacturing.
2. Egan Visual Inc.
3. Marsh Industries, Inc.; Visual Products Group.
4. Omnova Solutions Inc.; Decorative Products; Commercial Wallcovering.
5. WallTalkers; a division of RJF International Corporation.

B. Visual Display Wall Covering: Intended for use with dry-erase markers and as a projection surface and consisting of moderate-gloss, plastic film bonded to fabric backing; not less than 0.020-mil total thickness.

1. Surface Graphics: 2-inch-square grid.
2. Color: As selected by Architect from manufacturer's full range.

C. Magnetic Visual Display Wall Covering: Intended for use with dry-erase markers and magnetic aids and consisting of moderate-gloss plastic film bonded to ferrous-powdered fabric backing; not less than 0.025-mil total thickness.

1. Color: As selected by Architect from manufacturer's full range.

D. Primer/Sealer: Mildew-resistant primer/sealer complying with requirements in Section 099000 - PAINTING AND COATING and recommended in writing by wall covering manufacturer for intended substrate.

2.4 ACCESSORIES

A. Aluminum Frames and Trim: Factory-applied, fabricated from not less than 0.062-inch-thick, extruded aluminum; of size and shape indicated.

1. Chalk/Marker Tray: Manufacturer's standard, continuous tray.

B. Adhesive: Mildew-resistant, nonstaining adhesive, for use with specific visual display surfaces and substrate application, as recommended in writing by visual display surface manufacturer.

1. Adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.5 FABRICATION

A. Porcelain-Enamel Visual Display Assemblies: Laminate porcelain-enamel face sheet and backing sheet to core material under heat and pressure with manufacturer's standard flexible, waterproof adhesive.

B. Factory-Assembled Visual Display Units: Coordinate factory-assembled units with trim and accessories indicated. Join parts with a neat, precision fit.

C. Aluminum Frames and Trim: Fabricate units straight and of single lengths, keeping joints to a minimum. Miter corners to neat, hairline closure.

2.6 ALUMINUM FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

D. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 611.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, surface conditions of wall, and other conditions affecting performance.

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

3.2 PREPARATION

A. Remove dirt, scaling paint, projections, and depressions that will affect smooth, finished surfaces of visual display boards.

B. Prepare surfaces to achieve a smooth, dry, clean surface free of flaking, unsound coatings, cracks, defects, and substances that will impair bond between visual display boards and surfaces.

3.3 INSTALLATION

A. General: Install visual display surfaces in locations and at mounting heights indicated on Drawings, or if not indicated, at heights indicated below. Keep perimeter lines straight, level, and plumb. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.

1. Join adjacent wall panels with concealed steel splines for smooth alignment.
2. Where markerboards abut, install with clean, trimless butt joints.

3.4 CLEANING AND PROTECTION

A. Clean visual display surfaces according to manufacturer's written instructions. Attach one cleaning label to visual display surface in each room.

B. Touch up factory-applied finishes to restore damaged or soiled areas.

C. Cover and protect visual display surfaces after installation and cleaning.

END OF SECTION

SECTION 101400

SIGNAGE

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Code-required interior panel signage, including but not limited to, accessibility signage, toilet room signage and mechanical and electrical room signage.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Division 26 - ELECTRICAL for illuminated exit signs.

1.3 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of sign.

B. Shop Drawings: Include plans, elevations, and large-scale sections of typical members and other components. Show mounting methods, grounds, mounting heights, layout, spacing, reinforcement, accessories, and installation details.

1. Provide message list for each sign, including large-scale details of wording, lettering, artwork, and braille layout.

C. Samples for Verification: For each type of sign, include the following Samples to verify color selected:

1. Panel Signs: Full-size Samples of each type of sign required.
2. Approved samples will not be returned for installation into Project.

D. Maintenance Data: For signage cleaning and maintenance requirements to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain each sign type through one source from a single manufacturer.

B. Regulatory Requirements: Comply with the Americans with Disabilities Act (ADA) and with code provisions as adopted by authorities having jurisdiction.

1.5 PROJECT CONDITIONS

A. Field Measurements: Where sizes of signs are determined by dimensions of surfaces on which they are installed, verify dimensions by field measurement before fabrication and indicate measurements on Shop Drawings.

1.6 COORDINATION

A. For signs supported by or anchored to permanent construction, advise installers of anchorage devices about specific requirements for placement of anchorage devices and similar items to be used for attaching signs.

PART 2 - PRODUCTS

2.1 PANEL SIGNS

A. General: Provide signs that comply with requirements indicated for materials, thicknesses, finishes, colors, designs, shapes, sizes, and details of construction as indicated. Produce smooth panel sign surfaces constructed to remain flat under installed conditions within tolerance of plus or minus 1/16 inch measured diagonally. Provide the following:

1. Code-Required Signs for Certificate of Occupancy:

   a. Type: Photopolymer on acrylic or printed acrylic / aluminum as applicable.
   b. Color: Selected from manufacturer's standard colors including metallic silver, off white, champagne, light gray, dark red, dark green, dark blue, dark bronze, charcoal.
   c. Color: Custom color as selected.
   d. Type Size: As selected.
   e. Typeface: As selected.

2. Interior Signs Based on Owner's Requirements:

   a. Type: Photopolymer on acrylic or printed acrylic as applicable.
   b. Color: Selected from manufacturer's standard colors including metallic silver, off white, champagne, light gray, dark red, dark green, dark blue, dark bronze, charcoal.
   c. Color: Custom color as selected.
   d. Type Size: As selected.
   e. Typeface: As selected.

3. Exterior Signs:

   a. Type: As indicated on the Drawings.
   b. Type – Entrance: Fabricated [monolithic] [curved panel] aluminum sign with [masked and painted] [dimensional] [stencil cut] graphics and [non-] [internally] illuminated.

b. Type – Wall: Fabricated aluminum panel with [masked and painted] [dimensional] [stencil cut] graphics and [non-] [halo] [internally] illuminated.
c. Type – Wall: Fabricated [aluminum] [stainless steel] [painted] letters and [non-] [halo] [internally] illuminated.
d. Type – Directional: Fabricated aluminum sign, 3 inches deep, double post and panel, vinyl graphics.
e. Type – Regulatory: Single 18 by 12 by 0.125 inches painted aluminum panel on a 2 inch square aluminum post, vinyl graphics.

4. Specialty Signs:

a. Type: Custom as indicated on the Drawings.

B. Tactile and Braille Copy: Manufacturer's standard process for producing copy complying with ADA Accessibility Guidelines and ICC/ANSI A117.1. Text shall be accompanied by Grade 2 braille. Produce precisely formed characters with square cut edges free from burrs and cut marks.

1. Raised-Copy Thickness: Not less than 1/32 inch

C. Symbols of Accessibility: Provide 6-inch- high symbol fabricated from opaque nonreflective vinyl film, 0.0035-inch nominal thickness, with pressure-sensitive adhesive backing suitable for both exterior and interior applications.

2.2 ACCESSORIES

A. Mounting Methods: Use double-sided vinyl tape fabricated from materials that are not corrosive to sign material and mounting surface.

B. Anchors and Inserts: Provide nonferrous-metal or hot-dip galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or lead expansion-bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete or masonry work.

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.

B. Verify that items provided under other sections of Work are sized and located to accommodate signs.

C. Examine supporting members to ensure that surfaces are at elevations indicated or required to comply with authorities having jurisdiction and are free from dirt and other deleterious matter.

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

3.2 INSTALLATION

A. General: Locate signs and accessories where indicated, using mounting methods of types described and in compliance with manufacturer's written instructions.

1. Install signs level, plumb, and at heights indicated, with sign surfaces free from distortion and other defects in appearance.
2. Interior Wall Signs: Install signs on walls adjacent to latch side of door where applicable. Where not indicated or possible, such as double doors, install signs on nearest adjacent walls. Locate to allow approach within 3 inches of sign without encountering protruding objects or standing within swing of door.

B. Wall-Mounted Panel Signs: Attach panel signs to wall surfaces using methods indicated below:

1. Vinyl-Tape Mounting: Use double-sided foam tape to mount signs to smooth, nonporous surfaces. Do not use this method for vinyl-covered or rough surfaces.

3.3 CLEANING AND PROTECTION

A. After installation, clean soiled sign surfaces according to manufacturer's written instructions. Protect signs from damage until acceptance by the Architect.

END OF SECTION

SECTION 102210

WIRE MESH PARTITIONS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Wire mesh fabrications for the following applications:
   a. Standard-duty interior partitions.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 055100 - METAL STAIRS AND RAILINGS for railing systems requiring wire mesh railing insert panels.
2. Section 087100 - DOOR HARDWARE for lock cylinders and keying.

1.3 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for wire mesh items.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

C. Samples for Verification: 12-by-12-inch panel constructed of specified frame members and wire mesh. Show method of finishing members at intersections.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver wire mesh items crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.

1.5 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of construction contiguous with wire mesh items 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 location dimensions and proceed with fabricating wire mesh items without field measurements. Coordinate with adjacent construction to ensure that actual location dimensions correspond to established dimensions.

1.6 COORDINATION

A. Coordinate installation of anchorages for wire mesh items supported or anchored to permanent construction. 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. 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. Acorn Wire & Iron Works, Inc.
2. Jesco Industries, Inc.
3. King Wire Partitions, Inc.
4. Miller Wire Works, Inc.
5. Standard Wire & Steel Works.
6. Wire Crafters, Inc.

2.2 MATERIALS

A. Steel Wire: ASTM A 510.

B. Steel Plates, Channels, Angles, and Bars: ASTM A 36/A 36M.

C. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.

D. Steel Pipe: ASTM A 53/A 53M, Schedule 40, unless another weight is indicated or required by structural loads.

E. Square Steel Tubing: Cold-formed structural-steel tubing, ASTM A 500.

F. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with G60 (Z180) zinc (galvanized) or A60 (ZF180) zinc-iron-alloy (galvannealed) coating designation.

G. Panel-to-Panel Fasteners: Manufacturer's standard steel bolts.

H. Postinstalled Expansion Anchors in Concrete: 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.

I. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated and fabricated from corrosion-resistant materials; with clips or other accessory devices for attaching hangers of type indicated, and with capability to sustain, without failure, a load equal to 10 times that imposed by wire mesh construction, as determined by testing per ASTM E 1190, conducted by a qualified testing and inspecting agency.

2.3 PAINT

A. Shop Primers: Provide primers to comply with applicable requirements in Section 099000 - PAINTING AND COATING.

2.4 STANDARD-DUTY WIRE MESH PARTITIONS

A. Mesh: 0.135-inch-diameter, intermediate-crimp steel wire woven into 1-1/2-inch diamond mesh.

B. Vertical Panel Framing: 1-1/4-by-5/8-by-0.0966-inch cold-rolled, C-shaped steel channels with 1/4-inch- (6-mm-) diameter bolt holes spaced not more than 18 inches o.c. along center of framing.

C. Horizontal Panel Framing: 1-by-1/2-by-1/8-inch cold-rolled steel channels.

D. Horizontal Panel Stiffeners: 1-by-1/2-by-1/8-inch cold-rolled steel channels with wire woven through, or two 1-by-3/8-by-1/8-inch cold-rolled steel channels bolted or riveted toe to toe through mesh.

E. Top Capping Bars: 2-1/4-by-1-inch cold-rolled steel channels.

F. Posts for 90-Degree Corners: 1-1/4-by-1-1/4-by-1/8-inch steel angles with 1/4-inch- diameter bolt holes aligning with bolt holes in vertical framing; with floor anchor clips.

G. Posts for Other-Than-90-Degree Corners: Manufacturer's standard steel pipe or tubing with 1/4-inch- diameter bolt holes aligning with bolt holes in vertical framing.

H. Floor Shoes: Steel, cast iron, or cast aluminum, 2 inches (50 mm) high; sized to suit vertical framing, drilled for attachment to floor, and with set screws for leveling adjustment.

I. Swinging Doors: Fabricated from same mesh as partitions, with framing fabricated from 1-1/4-by-1/2-by-1/8-inch steel channels or C-channels, banded with 1-1/4-by-1/8-inch flat steel bar cover plates on 3 sides, and with 1/8-inch-thick angle strike bar and cover on strike jamb.

1. Hinges: Full-surface type, 3-by-3-inch steel, 1-1/2 pairs per door; bolted, riveted, or welded to door and jamb framing.
2. Cylinder Lock: Mortise type with cylinder specified in Section 087100 - DOOR HARDWARE operated by key outside and recessed knob inside.

J. Accessories:

1. Sheet Metal Base: 0.0598-inch- thick, cold-rolled steel sheet.
2. Adjustable Filler Panels: 0.0598-inch- thick, cold-rolled steel sheet; capable of filling openings from 2 to 12 inches.
3. Wall Clips: Manufacturer's standard, cold-rolled steel sheet.

K. Finishes for Interior Locations: Powder-coated finish, color as selected.

2.5 WIRE MESH CEILINGS

A. Mesh, Framing, and Stiffeners: Fabricated from same mesh and framing as wire mesh partition panels.

B. Perimeter Partition Supports: 1-1/2-by-1-1/2-by-1/8-inch steel angle, with 1/4-inch-diameter bolt holes aligned for bolting to top of wire mesh partitions and to sides of wire mesh ceiling panels.

C. Wall Supports: 1-1/2-by-1-1/2-by-1/8-inch steel angle punched for attachment to wall and wire mesh ceiling panels.

D. Intermediate Supports: Steel I-beam, as recommended by manufacturer.

E. Intermediate Support Posts: 2-by-2-by-1/8-inch steel pipe or tubing.

F. Finishes: Match adjacent wire mesh partitions.

2.6 FABRICATION

A. General: Fabricate wire mesh items from components of sizes not less than those indicated. Use larger-size components as recommended by wire mesh item manufacturer. Provide bolts, hardware, and accessories as required for complete installation.

1. Fabricate wire mesh items to be readily disassembled.
2. Welding: Weld corner joints of framing and grind smooth.

B. Standard Duty Wire Mesh Partitions: Fabricate wire mesh partitions with cutouts for pipes, ducts, beams, and other items indicated. Finish edges of cutouts to provide a neat, protective edge.

1. Mesh: Securely clinch mesh to framing.
2. Framing: Fabricate framing with mortise and tenon corner construction.

a. Provide horizontal stiffeners as indicated or, if not indicated, as required by panel height and as recommended by wire mesh partition manufacturer. Weld horizontal stiffeners to vertical framing.
b. Fabricate partition and door framing with slotted holes for connecting adjacent panels.

3. Fabricate wire mesh partitions with 3 inches of clear space between finished floor and bottom horizontal framing.
4. Doors: Align bottom of door with bottom of adjacent panels.

a. For doors that do not extend full height of partition, provide transom over door, fabricated from same mesh and framing as partition panels.

5. Hardware Preparation: Mortise, reinforce, drill, and tap doors and framing as required to install hardware.

2.7 FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Finish wire mesh items after assembly.
2. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other

components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

B. Powder-Coated Finish: Apply manufacturer's standard baked finish, complying with manufacturer's written instructions for surface preparation including pretreatment, application, baking, and minimum dry film thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

B. Examine floors for suitable conditions where wire mesh items will be installed.

C. Examine walls to which wire mesh items will be attached for properly located blocking, grounds, and other solid backing for attachment of support fasteners.

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

3.2 ERECTION

A. Wire Mesh Partitions:

1. Anchor wire mesh partitions to floor with 3/8-inch-diameter, postinstalled expansion anchors at 12 inches o.c. through anchor clips located at each post and corner. Shim anchor clips as required to achieve level and plumb installation.
2. Anchor wire mesh partitions to walls at 12 inches o.c. through back corner panel framing.
3. Secure top capping bars to top framing channels with 1/4-inch- diameter "U" bolts spaced not more than 28 inches o.c.
4. Provide line posts at locations indicated.
5. Where standard-width wire mesh partition panels do not fill entire length of run, provide adjustable filler panels to fill openings.
6. Install doors complete with door hardware.
7. Install security windows complete with window hardware.
8. Weld or bolt sheet metal bases.
9. Bolt accessories to wire mesh partition framing.

3.3 ADJUSTING AND CLEANING

A. Adjust doors to operate easily without binding.

B. Check and readjust operating hardware items just before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work including doors and framing that are warped, bowed, or otherwise unacceptable.

C. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint; paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

END OF SECTION

SECTION 102220

FOLDING PANEL PARTITIONS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Manual-operated, continuously hinged panel partitions.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 055000 - METAL FABRICATIONS for framing and supports.
2. Section 061000 – ROUGH CARPENTRY for concealed blocking.

1.3 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Provide operable panel partitions capable of withstanding the effects of earthquake motions determined according to Code requirements.

B. Acoustical Performance: Provide operable panel partitions tested by a qualified testing agency for the following acoustical properties according to test methods indicated:

1. Sound Transmission Requirements: Operable panel partition assembly tested in a full-scale opening, 14 by 9 feet for laboratory sound transmission loss performance according to ASTM E 90, determined by ASTM E 413, and rated for not less than the STC indicated.

1.4 SUBMITTALS

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

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Indicate storage and operating clearances. Indicate location and installation requirements for hardware and track, blocking, and direction of travel.

C. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. 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.

D. Setting Drawings: For embedded items and cutouts required in other work, including support-beam punching template.

E. Samples for Verification: For each type of finish, covering, or facing indicated, prepared on Samples of size indicated below.

1. Applied Facing: Full width by not less than 8-inch-long section of fabric from dye lot to be used for the Work, with specified treatments applied. Show complete pattern repeat.

F. Product Test Reports: Based on evaluation of comprehensive tests performed by a certified testing agency, for each operable panel partition.

G. Maintenance Data: For operable panel partitions to include in maintenance manuals.

1. Panel finish facings and finishes for exposed trim and accessories. Include precautions for cleaning materials and methods that could be detrimental to finishes and performance.
2. Seals, hardware, track, carriers, and other operating components.

H. Warranty: Special warranty specified in this Section.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

B. 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.

C. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protectively package and sequence panels in order for installation. Clearly mark packages and panels with numbering system used on Shop Drawings. Do not use permanent markings on panels.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify operable panel partition openings by field measurements before fabrication and indicate measurements on Shop Drawings.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of operable panel partitions that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Faulty operation of operable panel partitions.
b. Deterioration of metals, metal finishes, and other materials beyond normal wear.

2. Panel Warranty Period: Two years from date of Substantial Completion.
3. Track Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Hufcor, Inc.
2. Moderco.
3. Modernfold.

2.2 MATERIALS

A. Steel Frame: Steel sheet, manufacturer's standard nominal specified thickness for uncoated steel.

B. Steel Face/Liner Sheets: Tension-leveled steel sheet, manufacturer's standard thickness.

C. Gypsum Board: ASTM C 1396.

2.3 OPERABLE PANELS

A. Panel Construction: Provide top reinforcement as required to support panel from suspension components and provide reinforcement for hardware attachment. Fabricate panels with tight hairline joints and concealed fasteners. Fabricate panels so finished in-place partition is rigid; level; plumb; aligned, with tight joints and uniform appearance; and free of bow, warp, twist, deformation, and surface and finish irregularities.

B. Dimensions: Fabricate operable panel partitions to form an assembled system of dimensions indicated and verified by field measurements.

C. STC: Not less than 50.

D. Panel Closure: Manufacturer's standard.

E. Hardware: Manufacturer's standard as required to operate operable panel partition and accessories; with decorative, protective finish.

2.4 SEALS

A. General: Provide types of acoustical seals indicated that produce operable panel partitions complying with acoustical performance requirements and the following:

1. Manufacturer's standard seals.
2. Seals made from materials and in profiles that minimize sound leakage.
3. Seals fitting tight at contact surfaces and sealing continuously between adjacent panels and between operable panel partition perimeter and adjacent surfaces, when operable panel partition is extended and closed.

B. Vertical Seals: Deep-nesting, interlocking astragals mounted on each edge of panel, with continuous PVC acoustical seal.

C. Horizontal Bottom Seals: PVC-faced, mechanical, retractable, constant-force-contact seal exerting uniform constant pressure on floor when extended, ensuring horizontal and vertical sealing and resisting panel movement.

1. Automatically Operated: Extension and retraction of bottom seal automatically operated by movement of partition, with operating range not less than 2-inches between retracted seal and floor finish.

2.5 FINISH FACING

A. General: Provide finish facings that comply with indicated fire-test-response characteristics and that are factory applied to operable panel partitions with appropriate backing, using mildew-resistant nonstaining adhesive as recommended by facing manufacturer's written instructions.

B. Vinyl-Coated Fabric Wall Covering: Manufacturer's standard mildew-resistant, washable, vinyl-coated fabric wall covering; complying with CFFA-W-101-B for type indicated; Class A.

C. Trimless Edges: Fabricate exposed panel edges so finish facing wraps uninterrupted around panel, covering edge and resulting in an installed partition with facing visible on vertical panel edges, without trim, for minimal sightlines at panel-to-panel joints.

2.6 SUSPENSION SYSTEMS

A. Suspension Tracks: Steel or aluminum adjustable steel hanger rods for overhead support, designed for type of operation, size, and weight of operable panel partition indicated. Size track to support partition operation and storage without damage to suspension system, operable panel partitions, or adjacent construction. Limit track deflection to no more than 0.10 inch between bracket supports. Provide a continuous system of track sections and accessories to accommodate configuration and layout indicated for partition operation and storage.

B. Carriers: Trolley system as required for configuration type, size, and weight of partition and for easy operation; with ball-bearing wheels.

C. Track Intersections, Switches, and Accessories: As required for type of operation, storage, track configuration, and layout indicated for operable panel partitions, and compatible with partition assembly specified. Fabricate track intersections and switches from steel or aluminum.

D. Aluminum Finish: Mill finish or manufacturer's standard, factory-applied, decorative finish, unless otherwise indicated.

E. Steel Finish: Factory-applied, corrosion-resistant, protective coating, unless otherwise indicated.

2.7 ACCESSORIES

A. Pass Doors: Fabricated to comply with recommendations in Americans with Disabilities Act (ADA), "Accessibility Guidelines for Buildings and Facilities (ADAAG)." Swinging door built into and matching panel materials, construction, acoustical qualities, finish, and thickness, complete with frames and operating hardware. Hinges finished to match other exposed hardware.

1. Single Pass Door: 36 by 80 inches with the following:

a. Door Seals: Mechanically operated floor seal on panels containing pass doors.
b. Door Hardware: Provide panic hardware, concealed door closers, and other hardware components as required and as indicated on drawings.
c. Exit Sign: Recessed, self-illuminated.
d. Lock: Key-operated lock cylinder, keyed to master key system, operable from both sides of door. Include two keys per lock.

B. Storage Pocket Door: Full height at end of partition runs to conceal stacked partition; of same materials, finish, construction, thickness, and acoustical qualities as panels; complete with operating hardware and acoustical seals at soffit, floor, and jambs. Hinges in finish to match other exposed hardware.

1. Manufacturer's standard method to secure pocket door in closed position.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine flooring, structural support, and opening, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of operable panel partitions.

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

3.2 INSTALLATION

A. General: Comply with operable panel partition manufacturer's written installation instructions.

B. Install operable panel partitions and accessories after other finishing operations, including painting, have been completed.

C. Broken, cracked, chipped, deformed, or unmatched panels are not acceptable.

3.3 ADJUSTING

A. Adjust operable panel partitions to operate smoothly, without warping or binding. Lubricate hardware, electric operator, and other moving parts.

B. Adjust pass doors and pocket doors to operate smoothly and easily, without binding or warping. Check and readjust operating hardware. Confirm that latches and locks engage accurately and securely without forcing or binding.

3.4 FIELD QUALITY CONTROL

A. Light Leakage Test: Illuminate one side of partition installation and observe vertical joints and top and bottom seals for voids; adjust partitions for acceptable fit.

B. NIC Testing: The Owner may engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

C. Testing Methodology: Perform testing of installed operable panel partition for noise isolation according to ASTM E 336, determined by ASTM E 413, and rated for not less than the NIC indicated. Adjust and fit partitions to comply with NIC test method requirements.

D. Testing Extent: Testing agency shall randomly select one operable panel partition installation(s) for testing.

E. Repair or replace operable panel partitions within areas where test results indicate partitions do not comply with requirements, and retest partitions.

F. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of repaired, replaced, or additional work with specified requirements.

3.5 CLEANING

A. Clean soiled surfaces of operable panel partitions to remove dust, loose fibers, fingerprints, adhesives, and other foreign materials according to manufacturer's written instructions.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train the Owner Project Manager's maintenance personnel to adjust, operate, and maintain operable panel partitions.

END OF SECTION

SECTION 102600

WALL AND DOOR PROTECTION

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Corner guards.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 055000 - METAL FABRICATIONS.
2. Section 087100 - DOOR HARDWARE for metal armor, kick, mop, and push plates.

1.3 SUBMITTALS

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

B. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.

1. Corner Guards: 12 inches long.

C. Maintenance Data: For each impact-resistant wall protection unit to include in maintenance manuals.

1. Include recommended methods and frequency of maintenance for maintaining optimum condition of plastic covers under anticipated traffic and use conditions. Include precautions against using cleaning materials and methods that may be detrimental to plastic finishes and performance.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain impact-resistant wall protection units from single source from single manufacturer.

B. Product Options: Drawings indicate size, profiles, and dimensional requirements of impact-resistant wall protection units and are based on the specific system indicated. Refer to Division 01 Sections.

1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store impact-resistant wall protection units in original undamaged packages and containers inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

1. Maintain room temperature within storage area at not less than 70 deg F during the period plastic materials are stored.
2. Keep plastic sheet material out of direct sunlight.
3. Store plastic wall protection components for a minimum of 72 hours, or until plastic material attains a minimum room temperature of 70 deg F.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install impact-resistant wall protection units until building is enclosed and weatherproof, wet work is complete and dry, and HVAC system is operating and maintaining temperature at 70 deg F for not less than 72 hours before beginning installation and for the remainder of the construction period.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Stainless-Steel Sheet: ASTM A 240/A 240M.

B. Fasteners: Aluminum, nonmagnetic stainless-steel, or other noncorrosive metal screws, bolts, and other fasteners compatible with items being fastened. Use security-type fasteners where exposed to view.

C. Adhesive: Type recommended by manufacturer for use with material being adhered to substrate indicated.

D. Adhesives, General: Do not use adhesives that contain urea formaldehyde.

E. VOC Limits for Installation Adhesives and Glues: Use installation adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

1. Wood Glues: 30 g/L.
2. Contact Adhesive: 80 g/L.
3. Special Purpose Contact Adhesive: 250 g/L.

2.2 CORNER GUARDS

A. Surface-Mounted, Metal Corner Guards: Fabricated from 1-piece, formed or extruded metal with formed edges; with 90- or 135-degree turn to match wall condition.

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. Balco, Inc.
    b. Boston Retail Products.
    c. Construction Specialties, Inc.
    d. IPC Door and Wall Protection Systems; Division of InPro Corporation.
    e. Korogard Wall Protection Systems; Division of RJF International Corporation.
    f. Nystrom Building Products.
    g. Pawling Corporation.

2. Material: Stainless steel, Type 304.

    a. Thickness: Minimum 0.0781 inch.
    b. Finish: Directional satin, No. 4.

3. Wing Size: Nominal 3-1/2 by 3-1/2 inches.
4. Corner Radius: 1/8 inch.
5. Mounting: Flat-head, countersunk screws through factory-drilled mounting holes.

2.3 FABRICATION

A. Fabricate impact-resistant wall protection units to comply with requirements indicated for design, dimensions, and member sizes, including thicknesses of components.

B. Assemble components in factory to greatest extent possible to minimize field assembly. Disassemble only as necessary for shipping and handling.

C. Fabricate components with tight seams and joints with exposed edges rolled. Provide surfaces free of wrinkles, chips, dents, uneven coloration, and other imperfections. Fabricate members and fittings to produce flush, smooth, and rigid hairline joints.

2.4 METAL FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Remove tool and die marks and stretch lines or blend into finish.
2. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.

B. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

C. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

2.5 STAINLESS-STEEL FINISHES

A. Remove tool and die marks and stretch lines or blend into finish.

B. Grind and polish surfaces to produce uniform, polished finish indicated, free of cross scratches.

1. Run grain of directionally textured finishes with long dimension of each piece.

C. Directional Satin Finish: No. 4 finish.

D. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and wall areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

B. Examine walls to which impact-resistant wall protection will be attached for blocking, grounds, and other solid backing that have been installed in the locations required for secure attachment of support fasteners.

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

3.2 PREPARATION

A. Complete finishing operations, including painting, before installing impact-resistant wall protection system components.

B. Before installation, clean substrate to remove dust, debris, and loose particles.

3.3 INSTALLATION

A. General: Install impact-resistant wall protection units level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.

1. Provide mounting hardware, anchors, and other accessories required for a complete installation.

3.4 CLEANING

A. Immediately after completion of installation, clean plastic covers and accessories using a low VOC, non-ammonia-, non-chlorine, and non-solvent-based, household cleaning agent.

END OF SECTION

SECTION 102800

TOILET ACCESSORIES

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Toilet accessories as scheduled on the Drawings. Coordinate with Owner for accessories provided by Owner.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 061000 - ROUGH CARPENTRY for blocking.
2. Section 088000 - GLAZING for frameless mirrors.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include the following:

1. Construction details and dimensions.
2. Anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
3. Material and finish descriptions.
4. Features that will be included for Project.
5. Manufacturer's warranty.

B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.

1. Identify locations using room designations indicated on Drawings.
2. Identify products using designations indicated on Drawings.

C. Maintenance Data: For toilet accessories to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Source Limitations: For products listed together in the same articles in Part 2, provide products of same manufacturer unless otherwise approved by Architect.

1.5 COORDINATION

A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.

B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

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. A & J Washroom Accessories, Inc.
2. American Specialties, Inc.
3. Bobrick Washroom Equipment, Inc.
4. Bradley Corporation.

2.2 MATERIALS

A. Stainless Steel: ASTM A 666, Type 304, 0.0312-inch minimum nominal thickness, unless otherwise indicated.

B. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel), 0.0359-inch (0.9-mm) minimum nominal thickness.

C. Galvanized Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.

D. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.

2.3 FABRICATION

A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.

B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to the Owner.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

B. Grab Bars: Install to withstand a downward load of at least 250 lbf, when tested according to method in ASTM F 446.

3.2 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.

B. Remove temporary labels and protective coatings.

C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

END OF SECTION

SECTION 104100

EMERGENCY ACCESS AND INFORMATION CABINETS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Fire department key vault box.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 042000 - UNIT MASONRY for substrate.
2. Section 061000 - ROUGH CARPENTRY for wood blocking.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's product data, installation instructions, use limitations and recommendations for each product and system used. Provide manufacturer's certifications stating that products and systems comply with requirements.

B. Shop Drawings: Provide large scale shop drawings for fabrication, installation and erection of all parts of the work. Provide plans, elevations, and details of anchorage, connections and accessory items. Provide installation templates for work installed by others.

C. Contractor's Review: Before commencing work, submit signed statement that Contract Documents have been reviewed with a qualified representative of supplier/manufacturer, and that selected materials and construction are proper, compatible, and adequate for application shown.

PART 2 - PRODUCTS

2.1 FIRE DEPARTMENT KEY VAULT BOX

A. Fire Department Key Vault Box: Provide at building entrance; location shall be acceptable to local Fire Department.

1. Basis of Design: Knox Company; Model 3200 Knox-Box, Recessed Mounted Type.

2. Finish: Weather resistant TGIC polyester powder coat, color as selected by local Fire Department.
3. Locking: Provide lock and keys acceptable to local Fire Department.
4. Building Alarm Interface: Provide tamper switch interface with building alarm system.
5. Accessories:

    a. Provide manufacturer's standard recessed mounting kit, for installation in specified construction.
    b. Provide alarm tamper switches, UL listed.

PART 3 - EXECUTION

3.1 INSPECTION

A. Rough-In Work: Examine installation of walls and other conditions under which work is to be installed; verify dimensions of services and substrates before fabricating work.

B. Notify Contractor of unsatisfactory locations and dimensions of other work and of unsatisfactory conditions for proper installation of equipment. Do not proceed with fabrication and installation until unsatisfactory dimensions and conditions have been corrected in manner satisfactory to Installer.

3.2 FIRE DEPARTMENT KNOX BOX INSTALLATION

A. General: Set each item of equipment securely in place, level, and adjust to correct height, 4 ft. - 0 in. AFF, unless otherwise required by local Fire Department.

B. Anchor to supporting substrate where indicated and where required for sustained operation and use without shifting or dislocation. Conceal anchorage where possible. Seal perimeter joints in accordance with Section 079200 - JOINT SEALANTS.

3.3 CLEANING

A. After completion of installation and other major work remove protective coverings, if any, and clean equipment, internally and externally. Restore exposed and semi-exposed finishes to remove abrasions and other damages; polish exposed-metal surfaces and touch-up painted surfaces. Replace work that cannot be successfully restored.

END OF SECTION

SECTION 104400

FIRE-PROTECTION SPECIALTIES

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Portable fire extinguishers.
2. Fire-protection cabinets for portable fire extinguishers.
3. Mounting brackets for fire extinguishers.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 099000 - PAINTING AND COATING for field painting fire-protection cabinets.
2. Division 21 - FIRE PROTECTION for fire hose valves and standpipes.

1.3 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each item.

1. Fire Extinguishers: Include rating and classification.
2. Fire-Protection Cabinets: Include roughing-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type, trim style, and panel style.

B. Maintenance Data: For fire extinguishers and fire-protection cabinets to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain fire extinguishers and fire-protection cabinets through one source from a single manufacturer.

B. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

C. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

D. Fire-Rated Fire-Protection Cabinets: Listed and labeled to comply with requirements of ASTM E 814 for fire-resistance rating of walls where they are installed.

1.5 COORDINATION

A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

PART 2 - PRODUCTS

2.1 PORTABLE FIRE EXTINGUISHERS

A. General: Provide fire extinguishers of type, size, and capacity for each fire-protection cabinet and mounting bracket indicated.

B. Multipurpose Dry-Chemical Type in Steel Container: UL-rated 2-A:10-B:C, 5-lb nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.

2.2 FIRE-PROTECTION CABINET

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. JL Industries, Inc.
2. Larsen's Manufacturing Company.
3. Nystrom Building Products.
4. Potter Roemer; Div. of Smith Industries, Inc.

B. Cabinet Type: Suitable for fire extinguisher.

C. Cabinet Material: Enameled-steel sheet.

D. Recessed Cabinet: Cabinet box recessed in walls of sufficient depth to suit style of trim indicated.

1. Trimless with Plaster Stop: Surface of surrounding wall finishes flush with exterior finished surface of cabinet frame and door, without overlapping trim attached to cabinet. Provide recessed flange, of same material as box, attached to box to act as plaster stop. If wall condition does not allow for trimless with plaster stop, provide flat 5/16 inch trim of same material as the cabinet box.

E. Semirecessed Cabinet: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).

1. Square-Edge Trim: 1-1/4- to 1-1/2-inch backbend depth.

F. Door Material: Steel sheet with baked enamel finish, color as selected.

G. Door Style: Vertical duo panel with frame.

H. Door Glazing: Tempered break glass.

I. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.

J. Accessories:

1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire-protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
2. Break-Glass Strike: Manufacturer's standard metal strike, complete with chain and mounting clip, secured to cabinet, or provide locking mechanism that allows for emergency access to the cabinet without the breaking of glass, simply by pulling sharply on the cabinet's handle.
3. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.

2.3 MOUNTING BRACKETS

A. Mounting Brackets: Manufacturer's standard steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.

B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.

2.4 FABRICATION

A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub), with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.

1. Weld joints and grind smooth.
2. Construct fire-rated cabinets with double walls fabricated from 0.0428-inch-thick, cold-rolled steel sheet lined with minimum 5/8-inch-thick, fire-barrier material.

a. Provide factory-drilled mounting holes.

B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles selected.

1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch thick.
2. Miter and weld perimeter door frames.

C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.5 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Finish fire-protection cabinets after assembly.

D. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls and partitions for suitable framing depth and blocking where recessed cabinets will be installed.

B. Examine fire extinguishers for proper charging and tagging. Contractor shall be responsible for fire extinguisher tagging by a certified service technician located within 75 miles of the project.

1. Remove and replace damaged, defective, or undercharged units.

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

3.2 PREPARATION

A. Prepare recesses for recessed fire-protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

A. General: Install fire-protection specialties in locations and at mounting heights indicated on the Drawings and acceptable to authorities having jurisdiction.

B. Fire-Protection Cabinets: Fasten fire-protection cabinets to structure, square and plumb.

1. Unless otherwise indicated, provide recessed fire-protection cabinets. If wall thickness is not adequate for recessed cabinets, provide semirecessed fire-protection cabinets.
2. Provide inside latch and lock for break-glass panels.
3. Fasten mounting brackets to inside surface of fire-protection cabinets, square and plumb.

C. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

D. Identification: Apply vinyl lettering at locations indicated.

3.4 INSTALLATION OF FIRE-RATED CABINETS

A. Install cabinet with not more than 1/16-inch tolerance between pipe OD and knockout OD. Center pipe within knockout.

B. Seal through penetrations with firestopping sealant as specified in Section 078410 - PENETRATION FIRESTOPPING.

3.5 ADJUSTING AND CLEANING

A. Remove temporary protective coverings and strippable films, if any, as fire-protection specialties are installed, unless otherwise indicated in manufacturer's written installation instructions.

B. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.

C. On completion of fire-protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.

D. Touch up marred finishes, or replace fire-protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire-protection cabinet manufacturer.

E. Replace fire-protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 105110

METAL LOCKERS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Metal wardrobe lockers.
2. Locker benches.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 061000 - ROUGH CARPENTRY for furring, blocking, and shims required for installing metal lockers and concealed within other construction before metal locker installation.

1.3 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of metal locker and bench.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Show base, top, trim and other accessories.
2. Include locker identification system.

C. Maintenance Data: For adjusting, repairing, and replacing locker doors and latching mechanisms to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative of metal locker manufacturer for installation and maintenance of units required for this Project.

B. Source Limitations: Obtain metal lockers and accessories through one source from a single manufacturer.

C. Regulatory Requirements: Where metal lockers are indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's

"Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)."

D. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver metal lockers until spaces to receive them are clean, dry, and ready for metal locker installation.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify the following by field measurements before fabrication and indicate measurements on Shop Drawings:

1. Concealed framing, blocking, and reinforcements that support metal lockers before they are enclosed.
2. Recessed openings.
3. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish recessed opening dimensions and proceed with fabricating metal lockers without field measurements. Coordinate wall and floor construction to ensure that actual recessed opening dimensions correspond to established dimensions.

1.7 COORDINATION

A. Coordinate size and location of bases for metal lockers.

B. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that metal lockers can be supported and installed as indicated.

PART 2 - PRODUCTS

2.1 ALL-WELDED, CORRIDOR METAL LOCKERS

A. Available Manufacturers:

1. List Industries Inc.; Marquis Protector Single-Point Latch Corridor Lockers.
2. Lyon Workspace Products; All-Welded Lockers.
3. Penco Products, Inc., Subsidiary of Vesper Corporation; All-Welded Lockers.

B. Locker Arrangement: Single tier.

C. Body: Assembled by welding body components together. Fabricate from unperforated, cold-rolled steel sheet with thicknesses as follows:

1. Tops, Bottoms, and Sides: 0.0528 inch thick.
2. Backs: 0.0428 inch thick.
3. Shelves: 0.0528 inch thick, with double bend at front and single bend at sides and back.

D. Frames: Channel formed; fabricated from 0.0528-inch-thick, cold-rolled steel sheet; lapped and factory welded at corners; with top and bottom main frames factory welded into vertical main frames. Form continuous, integral door strike full height on vertical main frames.

E. Locker Base: Structural channels, formed from 0.0528-inch-thick, cold-rolled steel sheet; welded to front and rear of side-panel frames.

F. Doors: One-piece; fabricated from 0.0677-inch-thick, cold-rolled steel sheet; formed into channel shape with double bend at vertical edges, and with right-angle single bend at horizontal edges.

1. Reinforcement: Manufacturer's standard reinforcing angles, channels, or stiffeners for doors more than 15 inches (381 mm) wide; welded to inner face of doors.
2. Door Style: Louvered vents.

G. Hinges: Self-closing; welded to door and attached to door frame with not less than 2 factory-installed rivets per hinge that are completely concealed and tamper resistant when door is closed; fabricated to swing 180 degrees.

H. Recessed Door Handle and Latch: Stainless-steel cup with integral door pull, recessed so locking device does not protrude beyond face of door; pry resistant.

I. Equipment: Equip each metal locker with identification plate and the following, unless otherwise indicated:

1. Single-Tier Units: Shelf, one double-prong ceiling hook, and two single-prong wall hooks.

J. Accessories:

1. Continuous Sloping Tops: Fabricated from minimum 0.0428-inch-thick, cold-rolled steel sheet; approximately 20-degree pitch.
2. Recess Trim: Fabricated from 0.0428-inch- thick, cold-rolled steel sheet.
3. Filler Panels: Fabricated from 0.0428-inch- (1.1-mm-) thick, cold-rolled steel sheet.
4. Boxed End Panels: Fabricated from 0.0528-inch-thick, cold-rolled steel sheet.

K. Finish: Baked enamel or powder coat, color as selected.

2.2 ALL-WELDED ATHLETIC METAL LOCKERS

A. Available Manufacturers:

1. All-Welded, Athletic Metal Lockers:

a. Lyon Workspace Products; All-Welded Expanded Metal Lockers.
b. Penco Products, Inc., Subsidiary of Vesper Corporation; All-Welded Lockers.
c. Republic Storage Systems Company; All-Welded Ventilated Lockers.

B. Locker Arrangement: Double-tier.

C. Body: Assembled by welding riveting or bolting body components together. Fabricate from unperforated, cold-rolled steel sheet with thicknesses as follows:

1. Tops and Bottoms: 0.0528 inch thick, with single bend at edges.
2. Backs: 0.0428 inch thick.
3. Shelves: 0.0528 inch thick, with double bend at front and right-angle single bend at sides and back.

D. Frames: Channel formed; fabricated from 0.0528-inch-thick, cold-rolled steel sheet or 0.0966-inch-thick steel angles; lapped and factory welded at corners; with top and bottom main frames factory welded into vertical main frames. Form continuous, integral door strike full height on vertical main frames.

E. Locker Base: Structural channels, formed from 0.0528-inch-thick, cold-rolled steel sheet; welded to front and rear of side-panel frames.

F. Perforated Doors: One-piece, fabricated from 0.0677-inch-thick, cold-rolled steel sheet with manufacturer's standard diamond perforations; formed into channel shape with double bends.

1. Reinforcement: Manufacturer's standard reinforcing angles, channels, or stiffeners for doors more than 15 inches wide; welded to inner face of doors.

G. Hinges: Self-closing; welded to door and attached to door frame with not less than 2 factory-installed rivets per hinge that are completely concealed and tamper resistant when door is closed; fabricated to swing 180 degrees.

H. Recessed Door Handle and Latch: Stainless-steel cup with integral door pull, recessed so locking device does not protrude beyond face of door; pry resistant.

1. Single-Point Latching: Nonmoving latch hook. Equip each door with 1 latch hook, fabricated from minimum 0.1116-inch-thick steel; welded midway up full-height door strike; with resilient silencer.

I. Projecting Turn-Handle and Latch: Steel handle welded to manufacturer's standard, three-point, cremone-type latch mechanism that consists of steel rods or bars that engage main locker frame at top and bottom of door, and center latch that engages strike jamb; with steel padlock loop.

J. Equipment: Equip each metal locker with identification plate and the following, unless otherwise indicated:

1. Double-Tier Units: One double-prong ceiling hook and two single-prong wall hooks.

K. Accessories:

1. Legs: Fabricated from 0.0677-inch-thick, cold-rolled steel sheet; welded to bottom of locker.
2. Continuous Base: Fabricated from 0.0677-inch-thick, cold-rolled steel sheet.
3. Continuous Sloping Tops: Fabricated from minimum 0.0428-inch-thick, cold-rolled steel sheet; approximately 20-degree pitch.
4. Recess Trim: Fabricated from 0.0428-inch-thick, cold-rolled steel sheet.
5. Filler Panels: Fabricated from 0.0428-inch- thick, cold-rolled steel sheet.

L. Finish: Baked enamel or powder coat, color as selected.

2.3 LOCKER BENCHES

A. General: Provide locker benches fabricated by same manufacturer as metal lockers.

B. Bench Tops: Manufacturer's standard 1-piece units, of the following material, minimum 9-1/2 inches wide by 1-1/4 inches thick, with rounded corners and edges:

1. Laminated maple with one coat of clear sealer on all surfaces, and one coat of clear lacquer on top and sides.

C. Fixed Pedestals: Manufacturer's standard supports, with predrilled fastener holes for attaching bench top and anchoring to floor, complete with fasteners and anchors.

2.4 FABRICATION

A. General: Fabricate metal lockers square, rigid, and without warp; with metal faces flat and free of dents or distortion. Make exposed metal edges free of sharp edges and burrs, and safe to touch.

1. Form body panels, doors, shelves, and accessories from one-piece steel sheet, unless otherwise indicated.
2. Provide fasteners, filler plates, supports, clips, and closures as required for a complete installation.

B. Unit Principle: Fabricate each metal locker with an individual door and frame; individual top, bottom, and back; and common intermediate uprights separating compartments.

C. All-Welded Construction: Factory preassemble metal lockers by welding all joints, seams, and connections, with no bolts, nuts, screws, or rivets used in assembly of main locker groups. Factory weld main locker groups into one-piece structures. Grind exposed welds flush.

D. Hooks: Manufacturer's standard ball-pointed type, aluminum or steel; zinc plated.

E. Coat Rods: Fabricated from steel; nickel plated.

F. Identification Plates: Manufacturer's standard etched, embossed, or stamped aluminum plates; with numbers and letters at least 3/8 inch (9 mm) high.

G. Continuous Base: Formed into channel or Z profile for stiffness, and fabricated in lengths as long as practicable to enclose base and base ends of metal lockers; finished to match lockers.

H. Continuous Sloping Tops: Fabricated in lengths as long as practicable, without visible fasteners at splice locations; finished to match lockers.

1. Sloped top corner fillers, mitered.

I. Recess Trim: Fabricated with minimum 2-1/2-inch (64-mm) face width and in lengths as long as practicable; finished to match lockers.

J. Filler Panels: Fabricated in an unequal leg angle shape; finished to match lockers. Provide slip joint filler angle formed to receive filler panel.

K. Boxed End Panels: Fabricated with 1-inch- (25-mm-) wide edge dimension, and designed for concealing fasteners and holes at exposed ends of nonrecessed metal lockers; finished to match lockers.

1. Provide one-piece panels for double-row (back-to-back) locker ends.

L. Finished End Panels: Designed for concealing unused penetrations and fasteners, except for perimeter fasteners, at exposed ends of nonrecessed metal lockers; finished to match lockers.

1. Provide one-piece panels for double-row (back-to-back) locker ends.

M. Center Dividers: Full-depth, vertical partitions between bottom and shelf; finished to match lockers.

2.5 STEEL SHEET FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Factory finish steel surfaces and accessories except stainless-steel and chrome-plated surfaces.

C. Surface Preparation: Clean surfaces of dirt, oil, grease, mill scale, rust, and other contaminants that could impair paint bond. Use manufacturer's standard methods.

D. Powder-Coat Finish: Immediately after cleaning and pretreating, electrostatically apply manufacturer's standard baked-polymer thermosetting powder finish. Comply with resin manufacturer's written instructions for application, baking, and minimum dry film thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls, floors, and support bases, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

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

3.2 INSTALLATION

A. General: Install level, plumb, and true; shim as required, using concealed shims.

1. Anchor locker runs at ends and at intervals recommended by manufacturer, but not more than 36 inches o.c. Install anchors through backup reinforcing plates, channels, or blocking as required to prevent metal distortion, using concealed fasteners.
2. Anchor single rows of metal lockers to walls near top of lockers and to floor.
3. Anchor back-to-back metal lockers to floor.

B. All-Welded Metal Lockers: Connect groups of all-welded metal lockers together with standard fasteners, with no exposed fasteners on face frames.

C. Equipment and Accessories: Fit exposed connections of trim, fillers, and closures accurately together to form tight, hairline joints, with concealed fasteners and splice plates.

D. Fixed Locker Benches: Provide not less than 2 pedestals for each bench, uniformly spaced not more than 72 inches apart. Securely fasten tops of pedestals to undersides of bench tops, and anchor bases to floor.

3.3 ADJUSTING, CLEANING, AND PROTECTION

A. Clean, lubricate, and adjust hardware. Adjust doors and latches to operate easily without binding. Verify that integral locking devices operate properly.

B. Protect metal lockers from damage, abuse, dust, dirt, stain, or paint. Do not permit metal locker use during construction.

C. Touch up marred finishes, or replace metal lockers that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by metal locker manufacturer.

END OF SECTION

SECTION 105500

POSTAL SPECIALTIES

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. USPS-approved mail receptacles.
2. Letter drops.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 087100 - DOOR HARDWARE for lock cylinders for postal specialties that are keyed to building keying system.

1.3 SUBMITTALS

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

1. Include construction details, material descriptions, dimensions of individual components and profiles, and factory finishes for each type of postal specialty.

B. Shop Drawings: For postal specialties. Include plans, elevations, sections, details, and attachments to other work.

1. Include identification sequence for compartments.
2. Include layout of identification text.
3. Include setting drawings, templates, and installation instructions for anchor bolts and other anchorages installed as part of the work of other Sections.

C. Samples for Verification: For each type of exposed finish required, prepared on 6-by-6-inch square Samples.

D. Product Certificates: For each type of postal specialty required to comply with USPS regulations, signed by product manufacturer.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver lock keys to Owner by registered mail or overnight package service with a record of each corresponding lock and key number.

1.5 COORDINATION

A. Coordinate layout and installation of recessed and semirecessed postal specialties with wall construction.

1. Templates: Obtain templates for installing postal specialties and distribute to parties involved.

B. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that postal specialties can be supported and installed as indicated.

1.6 EXTRA MATERIAL (ATTIC STOCK)

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Key Blanks: 10% of total locks, for each type of compartment-door lock installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Florence Manufacturing.
2. Jensen Industries.
3. Postal Products Unlimited, Inc.

2.2 MATERIALS

A. Aluminum: Manufacturer's standard alloy and temper for type of use and finish indicated, and as follows:

1. Sheet and Plate: ASTM B 209.
2. Extruded Shapes: ASTM B 221.

B. Die-Cast Aluminum: ASTM B 85, manufacturer's standard aluminum alloy.

C. Steel Anchor Bolts, Nuts, and Washers: ASTM F 1554, Grade 36 or 55, hot-dip galvanized.

D. Isolation Coating: ASTM D 1187, cold-applied asphalt emulsion, VOC compliant, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.3 USPS-APPROVED MAIL RECEPTACLES

A. USPS-Approved Mail Receptacles: Consisting of multiple compartments, enclosed within recessed wall box. Provide access to compartments for distributing incoming mail from front rear of unit as indicated. Provide access to each compartment for removing mail by swinging compartment door. Comply with USPS-STD-4C, unless indicated otherwise.

1. General: Comply with USPS-STD-4C.
2. Compartments: As indicated on Drawings.
3. Front-Loading Master Door: Fabricated from extruded aluminum and braced and framed to hold compartment doors; prepared to receive master-door lock.

    a. Master-Door Lock: Door prepared to receive lock provided by local postmaster.

4. Compartment Doors: Fabricated from extruded aluminum. Equip each with lock and tenant identification as required by cited standard.

    a. Compartment-Door Locks, USPS Delivery: Comply with USPS-L-1172C, PSIN O910, for locks and keys, or equivalent as approved by USPS; with three keys for each compartment door. Key each compartment differently.
    b. Compartment-Door Locks, Private Delivery: Five-pin tumbler, cylinder cam locks capable of at least 1000 key changes; with three keys for each compartment door. Key each compartment differently.
    c. Tenant Identification: Identification engraved into face of compartment door, four digits each door.

5. Frames: Fabricated from extruded aluminum or aluminum sheet; ganged and nested units, with cardholder and blank cards for tenant's identification within each compartment.
6. Snap-on Trim: Fabricated from same material and finish as compartment doors.
7. Concealed Components and Mounting Frames: Aluminum or steel sheet with manufacturer's standard finish.

2.4 ACCESSORIES

A. Letter Drops (Through Wall): Consisting of 11-inch-wide by 3-1/2-inch- high, top-hinged, spring-loaded flap that pivots inward, held in place by 1-inch- wide face frame. Fabricated from 1/4-inch- thick aluminum or steel, with exposed surfaces finished to match adjacent mail receptacles.

1. Sleeve: Provide steel wall sleeve for full depth of wall.
2. Finished Frame: Provide finished face frame on back side of wall opening.
3. Identification: Engrave face of swinging flap with 1-inch- high letters as directed by Owner.
4. Exposed Material and Finish: Exposed surfaces fabricated from same material and finish as adjacent mail receptacles.

2.5 FABRICATION

A. Form postal specialties to required shapes and sizes, with true lines and angles, square, rigid, and without warp, and with metal faces flat and free of dents or distortion. Make exposed metal edges and corners free of sharp edges and burrs and safe to touch. Fabricate doors of postal specialties to preclude binding, warping, or misalignment.

B. Preassemble postal specialties in shop to greatest extent possible to minimize field assembly.

C. Mill joints to a tight, hairline fit. Cope or miter corner joints. Form joints exposed to weather to exclude water penetration.

D. Drill or punch holes required for fasteners and remove burrs. Use security fasteners where fasteners are exposed. If used, seal external rivets before finishing.

E. Weld in concealed locations to greatest extent possible without distorting or discoloring exposed surfaces. Remove weld spatter and welding oxides from exposed surfaces.

F. Fabricate tubular and channel frame assemblies with manufacturer's standard welded or mechanical joints. Provide subframes and reinforcement as required for a complete system to support loads.

G. Where dissimilar metals will contact each other, protect against galvanic action by painting contact surfaces with bituminous coating or by applying other permanent separation as recommended by manufacturers of dissimilar metals.

2.6 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. Baked-Enamel or Powder-Coated Finish: Manufacturer’s standard factory-applied finish.

1. Color: To be selected by Architect from manufacturer’s full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions for compliance with requirements for roughing-in openings, clearances, and other conditions affecting performance of the Work.

B. Examine walls and other adjacent construction for suitable conditions where units will be installed.

C. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

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

3.2 INSTALLATION

A. General: Install postal specialties level and plumb, according to manufacturer's written instructions and roughing-in drawings.

1. Where dissimilar metals will be in permanent contact with each other, protect against galvanic action by painting contact surfaces with bituminous coating or by applying other permanent separation as recommended by manufacturer for this purpose.

2. Where aluminum will contact grout, concrete, masonry, or wood, protect against corrosion by painting contact surfaces with bituminous coating.
3. Comply with USPS Publications. Final acceptance of postal specialties served by USPS depends on compliance with USPS requirements.

3.3 FIELD QUALITY CONTROL

A. Arrange for USPS personnel to examine and test postal specialties served by USPS after they have been installed according to USPS regulations.

B. Obtain written final approval of postal specialties to be served by USPS. Obtain this approval from USPS postmaster that authorizes mail collection for the served installation.

3.4 ADJUSTING, CLEANING, AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as postal specialties are installed unless otherwise indicated in manufacturer's written installation instructions.

B. Adjust doors, hardware, and moving parts to function smoothly, and lubricate as recommended by manufacturer. Verify that integral locking devices operate properly.

C. Touch up marred finishes or replace postal specialties that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by postal specialty manufacturer.

D. Replace postal specialties that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

E. On completion of postal specialty installation, clean interior and exterior surfaces as recommended by manufacturer.

END OF SECTION

SECTION 105720

WIRE CLOSET AND UTILITY SHELVING

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Wire shelving at closets and utility/storage closets.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 061000 - ROUGH CARPENTY for blocking and nailers.

1.3 SUBMITTALS

A. Product Data: For each type of shelving indicated. Include installation details, materials, individual components and profiles, and finishes.

B. Samples: For each type of shelving material, 12 inches long, in specified finish.

C. Shelving Schedule: Provide complete shelving schedule, including types, locations, sizes, and other data pertinent to installation.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain shelving and accessories through one source from a single manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver storage shelving palleted, wrapped, or crated to provide protection during transit and Project-site storage.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Schulte Corporation.

B. Refer to Section 090000 - UNIT FINISH SCHEDULE.

2.2 COMPONENTS

A. Series: “Lifetime Ventilated Series 1110-1212-11 Shelf with Hanging Rod”

1. 12-inch Shelf: Model No. 1710-1212-11
2. Clip with TriLoc II Anchor Versa: Model No. 1435-6620-11
3. Sidewall Bracket with TriLoc II Anchor: Model No. 1435-6621-11
4. Support Brace: Model No. 1435-6659-11

B. ADA Series: “Series 1210-1212-11 Storage Shelf”

2.3 SHELVING

A. Wire Shelves: One (1) shelf with hanging rod to be provided. Top Shelf to be full width of closet.

1. Shelf Depth: 12 inches.

B. ADA Wire Shelves: Four (4) additional 18” wide stacked shelves located to one side of closet below top shelf with Series 1210-1212-11 Storage Shelves.

1. Storage Shelves to begin 16” from floor and stacked at 13” intervals (16”, 29”, 42”, and 55”)

C. Materials:

1. Steel Rod: Grade C 1008 cold drawn steel rod. Tensile strength of 100 ksi.
2. Front Rods and Studs: 0.306 inch diameter.
3. Back Rods: 0.243 inch diameter.
4. Cross Wires:

a. 1 Inch Spacing: 0.120 inch diameter for one inch spaced standard 20 inches shelf. 0.120 inch diameter for one inch spaced standard mesh shelf.
b. 1/2 Inch Spacing: .0915 inch diameter for one-half inch spaced tight mesh shelf.

D. Components:

1. Hanging Shelf with Open Slide: 12 inches deep by length as shown on Drawings.
2. Mounting Hardware: Manufacturer's standard components including anchor clips, end brackets, angled support braces and end caps, including the following:

a. Side Wall Bracket: As required. Shelf side wall interface.
b. Anchor Back Clips.
c. Fasteners, clips, caps and touch-up all as required.
d. Down Back Clips.

E. Finish: Electrostatic applied oven cured epoxy at all surfaces to 3 to 5 mil (0.075 to 0.127 mm) thickness.

1. Color: Pure White

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with manufacturer's written instructions for installing wire shelving.

END OF SECTION

SECTION 111300

LOADING DOCK EQUIPMENT

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Dock bumpers.
2. Elevating dock.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 033000 - CAST-IN-PLACE CONCRETE for concrete work for recessed loading dock equipment.

1.3 SUBMITTALS

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

1. Include construction details, material descriptions, rated capacities, operating characteristics, furnished specialties, accessories, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, details, and attachments to other work.

1. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Qualification Data: For Installer

1.4 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 loading dock equipment through one source from a single manufacturer.

C. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store and handle dock equipment in a manner to avoid significant or permanent damage to fabric or frame.

1. Comply with manufacturer's written instructions for minimum and maximum temperature requirements for storage.

1.6 PROJECT CONDITIONS

A. Field Measurements: Indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish heights of loading docks and proceed with fabricating loading dock equipment without field measurements. Coordinate loading dock construction to ensure that actual dimensions correspond to established dimensions.

1.7 COORDINATION

A. Coordinate installation of anchorages for loading dock equipment. 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 MATERIALS

A. Steel Plates, Shapes, and Bars: ASTM 36/A 36M.

B. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from steel plate complying with ASTM A 572/A 572M, Grade 55 (380).

C. Steel Tubing: ASTM A 500, cold formed.

D. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

E. Wood: DOC PS 20 dimension lumber, select structural grade, kiln dried.

F. Pressure-Treated Wood: DOC PS 20 dimension lumber, select structural grade, kiln dried, and pressure treated with waterborne preservatives to comply with AWPA C2.

2.2 DOCK BUMPERS

A. Manufacturers: Available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. American Floor Products (AFCO).
2. Chalfant Dock Equipment.
3. Durable Corporation.
4. 4Front Engineered Solutions.

B. Laminated-Tread Bumpers: Fabricated from multiple, uniformly thick plies cut from fabric-reinforced rubber tires. Laminate plies under pressure on not less than two 3/4-inch-diameter, steel supporting rods that are welded at one end to 1/4-inch-thick, structural-steel end angle and secured with a nut and angle at the other end. Fabricate angles with predrilled anchor holes and sized to provide not less than 1 inch of tread plies extending beyond the face of closure angles.

C. Anchorage Devices: Hot-dip galvanized steel anchor bolts, nuts, washers, bolts, sleeves, cast-in-place plates, and other anchorage devices as required to fasten bumpers securely in place and to suit installation type indicated.

2.3 ELEVATING DOCK

A. Manufacturers: Available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Advance Lifts, Inc.
2. Blue Giant Equipment Corporation.
3. Pentalift Equipment Corporation.
4. SPX Dock Products - Kelley.

B. General: Built-in, scissors-type, single-leg, hydraulic dock lift of capacity, size, and construction indicated; complete with controls, safety devices, and accessories required.

1. Basis-of-Design: Pentalift Model HED81015.

C. Standard: MH 29.1.

D. Rated Capacity: 15000 lbs.

E. Platform: Nonskid, safety-tread heavy steel deck plate.

1. Platform Size: 96 in. by 120 in.
2. Platform Guarding: Comply with requirements in MH 29.1.
3. Fixed Handrails: Equip lift with handrails on two sides of platform with a single, removable chain across each end. Provide handrails not less than 39 inches high with midrail and 4-inch-high kick plate at bottom.

F. Bridge: Nonskid, safety-tread steel plate.

G. Function: Dock lifts shall compensate for differences in height between truck bed and loading platform.

1. Vertical Travel: 59 in.
2. Low Height: 15 in.
3. Raised Height: 71 in.
4. Hinged Throw-Over Bridges Operation: Manual.

H. Hydraulic Operating System: Self-contained, electric, hydraulic power unit for raising and lowering lift; of size, type, and operation needed for capacity of lift indicated; controlled from a remotely located push-button station.

1. Remote-Control Station: Multibutton control station of the constant-pressure type with UP and DOWN push buttons. Controller shall consist of magnetic motor starter with three-pole adjustable overloads and 24-V control transformer with 4-A, fused secondary prewired to terminal strips and enclosed in NEMA ICS 6, Type 12 box.

a. Upper-Travel-Limit Switch: Equip unit with manufacturer's standard, adjustable, upper-travel-limit switch.

I. Accessories:

1. Access Chain End: Access chains for guard rails/lip post on fixed end.
2. Guard Rail: Pocket Style 42 in. high c/w mid-rail and 4 in. kick plate; Side B 120 in. long, Side D 120 in. long.
3. Lip RE: Split 84 in. wide by 24 in. long steel lip on 96 in. Side A.
4. Reinforced Platform: 40,000 lbs Roll-Over capacity. Roll-over capacity in fully lowered position only. Include uprights on frame to support platform over-hang
5. Toe Guards: Bevel Toe Guards Included In Net Price
6. Hydraulic Velocity Fuse: Prevents free fall if the hydraulic hose is severed.
7. Safety Striping: Full perimeter safety striping
8. Trip Bars: Electrically interlocked perimeter bar suspended around platform, stops downward travel of table when activated by coming into contact with an obstruction.
9. Power Unit Extra Hydraulic Hose: 10 ft of hose.
10. Primary Control Extra Cord: 10 ft of cord.

J. Construction: Fabricate lift from structural-steel shapes rigidly welded and reinforced for maximum strength, safety, and stability. Design assembly to withstand deformation during both operating and stored phases of service. Provide mounting brackets and removable lifting eyes for ease of installation.

K. Dock Lift Finish: Hot-dip galvanized.

1. Toe Guards: Paint yellow to comply with ANSI Z535.1.

2.4 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish loading dock equipment after assembly and testing.

C. Galvanizing: Hot-dip galvanize items as indicated to comply with applicable standard listed below:

1. ASTM A 123/A 123M for iron and steel loading dock equipment.
2. ASTM A 153/A 153M for iron and steel hardware for loading dock equipment.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of loading dock equipment.

B. Examine roughing-in for electrical systems for loading dock equipment to verify actual locations of connections before equipment installation.

C. Examine walls and floors of pits for suitable conditions where recessed loading dock equipment is to be installed. Pits shall be plumb and square and properly sloped for drainage from back to front of loading dock.

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

3.2 PREPARATION

A. Coordinate size and location of loading dock equipment indicated to be attached to or recessed into concrete or masonry, and furnish anchoring devices with templates, diagrams, and instructions for their installation.

3.3 INSTALLATION

A. General: Install loading dock equipment, including accessories as required for a complete installation.

B. Dock Bumpers: Attach dock bumpers to face of loading dock in a manner that complies with requirements indicated for spacing, arrangement, and position relative to top of platform and anchorage.

1. Bolted Attachment: Attach dock bumpers to preset anchor bolts embedded in concrete or to cast-in-place inserts or threaded studs welded to embedded-steel plates or angles. If preset anchor bolts, cast-in-place inserts, or threaded studs welded to embedded-steel plates or angles are not provided, attach dock bumpers by drilling and anchoring with expansion anchors and bolts.

C. Dock Lifts: Attach dock lifts securely to loading platform.

3.4 ADJUSTING AND CLEANING

A. Adjust loading dock equipment for proper, safe, efficient operation.

B. Test dock lifts for vertical travel within operating range indicated.

C. Restore marred, abraded surfaces to their original condition.

END OF SECTION

SECTION 113100

APPLIANCES

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Appliances.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Division 22 - PLUMBING for water distribution piping connections, drainage and vent piping connections, sinks, and waste disposers.
2. Division 26 - ELECTRICAL for services and connections to appliances.

1.3 SUBMITTALS

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

1. Include operating characteristics, dimensions of individual appliances, and finishes for each appliance.

B. Appliance Schedule: For appliances; use same designations indicated on Drawings.

C. Maintenance Data: For each product to include in maintenance manuals.

D. Warranties: Special warranties specified in this Section.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer for installation and maintenance of units required for this Project.

B. Source Limitations: Provide products from same manufacturer for each type of appliance required.

C. Regulatory Requirements: Comply with provisions of the following product certifications:

1. NFPA: Provide electrical appliances listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
2. UL and NEMA: Provide electrical components required as part of residential appliances that are listed and labeled by UL and that comply with applicable NEMA standards.
3. ANSI: Provide gas-burning appliances that comply with ANSI Z21 Series standards.

D. Regulatory Requirements, Accessibility: Where residential appliances are indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)."

E. Energy Ratings: Provide residential appliances that carry labels indicating energy-cost analysis (estimated annual operating costs) and efficiency information as required by the FTC Appliance Labeling Rule.

1. Provide appliances that qualify for the EPA/DOE ENERGY STAR product labeling program.

F. Switches: Provide mercury-free switches in appliances.

G. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

1.5 WARRANTY

A. Special Warranties: Manufacturer's standard form in which manufacturer of each appliance specified agrees to repair or replace residential appliances or components that fail in materials or workmanship within manufacturer's standard warranty period.

PART 2 - PRODUCTS

2.1 APPLIANCES

A. Appliance Schedule: Refer to Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

B. Examine roughing-in for piping systems to verify actual locations of piping connections before equipment installation.

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

3.2 INSTALLATION, GENERAL

A. General: Comply with manufacturer's written instructions.

1. Range Hood, Exhaust Fans, and Dryer Vents: Vent directly to the building exterior.

B. Built-in Equipment: Securely anchor units to supporting cabinets or countertops with concealed fasteners. Verify that clearances are adequate for proper functioning and rough openings are completely concealed.

C. Freestanding Equipment: Place units in final locations after finishes have been completed in each area. Verify that clearances are adequate to properly operate equipment.

D. Utilities: Refer to Division 22 - PLUMBING for plumbing requirements and Division 26 - ELECTRICAL for electrical requirements.

3.3 CLEANING AND PROTECTION

A. Test each item to verify proper operation. Make necessary adjustments.

B. Verify that accessories required have been furnished and installed.

C. Remove packing material from appliances and leave units in clean condition, ready for operation.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train the Owner’s maintenance personnel to adjust, operate, and maintain appliances.

END OF SECTION

SECTION 115210

PROJECTION SCREENS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Manually-operated projection screens.
2. Electrically-operated projection screens.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 095100 - ACOUSTICAL CEILINGS for coordination with ceiling-recessed units.
2. Division 26 - ELECTRICAL for electrical service and connections including metal device boxes for switches and conduit, where required, for low-voltage control wiring.

1.3 SUBMITTALS

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

B. Shop Drawings: Show layouts and types of projection screens. Include the following:

1. Location of screen centerline relative to ends of screen case.
2. Location of wiring connections.
3. Location of seams in viewing surfaces.
4. Drop length.
5. Connections to supporting structure for pendant- and recess-mounted screens.
6. Anchorage details.
7. Details of juncture of exposed surfaces with adjacent finishes.
8. Frame details.
9. Accessories.
10. Wiring Diagrams: For electrically operated units.

C. Maintenance Data: For projection screens to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. 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.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver projection screens until building is enclosed and other construction within spaces where screens will be installed is substantially complete and ready for screen installation.

B. Store rear-projection screens in manufacturer's protective packaging and according to manufacturer's written instructions.

1.6 COORDINATION

A. Coordinate layout and installation of projection screens with adjacent construction, including ceiling framing, light fixtures, HVAC equipment, and partitions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Bretford Manufacturing, Inc.
2. Da-Lite Screen Co., Inc
3. Draper Inc.
4. Stewart Filmscreen.

B. Basis-of-Design:

2.2 FRONT-PROJECTION SCREENS

A. Manually Operated Screens: Manufacturer's standard spring-roller-operated units, consisting of case, screen, mounting accessories, and other components necessary for a complete installation.

1. Screen Mounting: Top edge securely anchored to a 3-inch-diameter, rigid steel roller; bottom edge formed into a pocket holding a tubular metal slat, with ends of slat protected by plastic caps, and with a saddle and pull attached to slat by screws.

B. Electrically Operated Screens: Manufacturer's standard units consisting of case, screen, motor, controls, mounting accessories, and other components necessary for a complete installation. Provide units that are listed and labeled as an assembly by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.

1. Line Voltage Control: Remote, 3-position control switch installed in recessed metal device box with flush cover plate matching other electrical device cover plates in room where switch is installed.

2. Motor in Roller: Instant-reversing motor of size and capacity recommended by screen manufacturer; with permanently lubricated ball bearings, automatic thermal-overload protection, preset limit switches to automatically stop screen in up and down positions, and positive-stop action to prevent coasting. Mount motor inside roller with vibration isolators to reduce noise transmission.
3. Screen Mounting: Top edge securely anchored to rigid metal roller and bottom edge formed into a pocket holding a 3/8-inch- diameter metal rod with ends of rod protected by plastic caps.

    a. Roller for end-mounted motor supported by self-aligning bearings in brackets.
    b. Roller for motor in roller supported by vibration- and noise-absorbing supports.

C. Recessed, Electrically Operated Screens with Automatic Ceiling Closure: Motor in roller units designed and fabricated for recessed installation in ceiling; with bottom of case composed of two panels fully enclosing screen, motor, and wiring, one panel hinged and designed to open and close automatically when screen is lowered and fully raised, the other removable or openable for access to interior of case.

1. Provide screen case constructed to be installed with underside flush with ceiling.
2. Prime paint surfaces of screen case that will be exposed to view in the finished work.

D. Screen Material and Viewing Surface:

1. Matte-White Viewing Surface: Peak gain of 0.9 to 1.0, and gain of not less than 0.8 at an angle of 50 degrees from the axis of the screen surface.
2. Mildew Resistance: Rating of 0 or 1 when tested according to ASTM G 21.
3. Flame Resistance: Passes NFPA 701.
4. Seamless Construction: Provide screens, in sizes indicated, without seams.
5. Edge Treatment: Black masking borders.
6. Provide extra drop length of dimension indicated to comply with the following requirements for fabric color and location of drop length:
7. Size of Viewing Surface: As indicated on the Drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install projection screens at locations indicated to comply with screen manufacturer's written instructions.

B. Install front-projection screens with screen cases in position and in relation to adjoining construction indicated. Securely anchor to supporting substrate in a manner that produces a smoothly operating screen with vertical edges plumb and viewing surface flat when screen is lowered.

1. Install low-voltage controls according to NFPA 70 and manufacturer's written instructions.

    a. Wiring Method: Install wiring in raceway except in accessible ceiling spaces and in gypsum board partitions where unenclosed wiring method may be used. Use UL-listed plenum cable in environmental air spaces, including plenum ceilings. Conceal raceway and cables except in unfinished spaces.

2. Test electrically operated units to verify that screen controls, limit switches, closure, and other operating components are in optimum functioning condition.
3. Test manually operated units to verify that screen operating components are in optimum functioning condition.

3.2 PROTECTING AND CLEANING

A. After installation, protect projection screens from damage during construction. If damage occurs despite such protection, remove and replace damaged components or entire unit as required to provide units in their original, undamaged condition.

END OF SECTION

SECTION 118129

FACILITY FALL PROTECTION

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Tie back and lifeline anchors for fall protection, exterior maintenance, and window cleaning applications.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 051200 - STRUCTURAL STEEL FRAMING.
2. Section 053000 - STEEL DECKING.
3. Section 055000 - METAL FABRICATIONS.
4. Section 075400 - THERMOPLASTIC MEMBRANE ROOFING for roof system assembly.

1.3 DESIGN AND PERFORMANCE REQUIREMENTS

A. The equipment supplier is responsible for the design and erection of equipment and anchors and for coordination and proper relation of his work to the building structure and to the work of all trades. The equipment supplier shall verify all dimensions of the building that relate to fabrication of the equipment and shall notify the Architect of any discrepancy before the order for the equipment is finalized.

B. Design a system that complies with applicable regulatory requirements.

C. Design anchor components to provide an adequate attachment means suited to current practices and compatible with industry standard equipment.

D. Ensure that anchor components meet proper engineering principles and have been designed by a company qualified in required applications and safety.

E. Design a horizontal lifeline system which allows the worker to walk freely along without having to manipulate his lanyard in order to pass by an intermediate bracket (hand free). Include any hardware required to attach the components to the building structure.

F. The system must be designed with fall arrest capability (FAS). The system shall comply with Federal OSHA regulatory requirements for FAS limiting the total fall to 6 feet, ensure a user is

not exposed to maximum arrest force (MAF) in excess of 1800 lbs. System shall include all hardware, two safelink lanyards attached to the horizontal life line system complete with body harnesses.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's printed product data, installation instructions, use limitations and recommendations for window washing equipment and accessories specified.

1. Provide certifications stating that products comply with specified requirements.

B. Shop Drawings: Provide shop drawings for fabrication, layout, and configuration of the system, including all installation and erection of all parts of the work, and including all accessories. Shop drawings shall meet the relevant health and safety standards of all agencies having jurisdiction. Shop drawings shall identify necessary restrictive and non-restrictive working usage notes and general safety notes.

1. Provide plans, elevations, and details of anchorages, connections and accessory items. Provide installation templates for work installed by others.
2. Show the general arrangement of all components, clearances and principal dimensions, assemblies of equipment.
3. Include weights of components and maximum loads and spacings.
4. Include the seal of a qualified Professional Engineer.
5. As part of shop drawings, include a safety inspection log book for yearly inspections.
6. Submit two copies of as-built shop drawings showing anchor locations and details. This drawing shall be posted near exits onto the roof.

C. Operation and Maintenance Manuals: Submit operation and maintenance data.

D. Welding certificates.

E. Qualification Data: For professional engineer.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Firm shall be specialized in the design, fabrication, and installation of fall arrest roof anchors.

1. Equipment supplier/installer shall carry specific liability insurance, products and completed operations insurance, in an amount of not less than $2,000,000.00. This insurance shall cover the failure of the safety anchor itself.

B. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data by a qualified professional engineer.

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

D. Regulatory Requirements: Strictly comply with applicable codes, regulations, and requirements of authorities having jurisdiction, including but not limited to the following:

1. OSHA 1910.66 Subpart F, "Powered Platforms" and Subpart I "Fall Protection".
2. OSHA 1910.66 Subpart D, "Walking and Working Surfaces and Personal Protective Equipment (Fall Protection Systems).
3. 29 CFR 1910 - Occupational Safety and Health Standards and 29 CFR 1910.306 - Specific Purpose Equipment and Installations.
4. AISC Specifications.

E. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."
2. AWS D1.2, "Structural Welding Code--Aluminum."
3. AWS D1.3, "Structural Welding Code--Sheet Steel."
4. AWS D1.6, "Structural Welding Code--Stainless Steel."

1.6 DELIVERY, STORAGE, AND PROTECTION

A. Deliver equipment and accessories in accordance with manufacturer's recommendation. Store and handle in strict compliance with manufacturer's instructions and recommendations. Protect from damage.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Provide products of one of the following manufacturers that meet or exceed specified requirements, or approved equal.:

1. Guardian.
2. Hayn Enterprises, LLC.
3. Pro-Bel Enterprises, Limited.
4. Thaler Metal USA Inc.

B. Other manufacturers producing equipment meeting this specification may be submitted for Architect's review provided that proposed substitute supplier can demonstrate qualifications and experience and furnish evidence of insurance coverage.

2.2 EQUIPMENT

A. General: Provide equipment required to satisfy design requirements and proposed equipment layout.

B. Tieback Lifeline Anchors:

1. System shall resist pullout with force of 5000 pounds in any direction.
2. Safety anchoring eye, bolts and connecting hardware shall be fabricated of stainless steel.
3. Steel bases shall be fabricated of hot-dipped galvanized mild steel.

2.3 MATERIALS

A. Exposed Structural Components: Stainless steel, conforming to ASTM A 276 or A 666, Type 304, with minimum yield strength of 42 ksi.

B. Cast-In-Place Inserts: Stainless steel, conforming to ASTM A 276 or A 666, Type 304.

C. Nonexposed Steel: Steel, conforming to ASTM A 36, Type 350W with 50 ksi yield strength for HSS and 43 ksi for plate and all other sections; hot dip galvanized to ASTM A 123 or A 153.

D. Exposed Non-Structural Aluminum: Aluminum, conforming to ASTM B 221 or ASTM B 209, seamless spun type, alloy and temper as recommended by manufacturer.

E. Cold-Formed Sections: Steel tubing, conforming to ASTM A 500, yield strength 55 ksi, tensile strength 66 ksi.

2.4 FLASHINGS

A. Provide proper flashing at anchors. Coordinate with Division 07 Roofing Sections.

PART 3 - EXECUTION

3.1 ERECTION AND INSTALLATION

A. Erect and install tieback and lifeline anchor systems complete in accordance with the approved shop drawings and all applicable codes, and in accordance with manufacturer's recommendations.

3.2 ERECTION SERVICES

A. The fall arrest equipment manufacturer shall provide supervisory erection services, including the services of a registered professional engineer to oversee installation of equipment.

END OF SECTION

SECTION 118220

WASTE COMPACTORS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Waste compactors.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Division 26 - ELECTRICAL for electrical service and connections including metal device boxes for switches and conduit, where required, for low-voltage control wiring.

1.3 DEFINITIONS

A. WASTEC Rating: The volume of waste material in the charging chamber moved by the ram within the compactor in a single stroke.

1.4 SUBMITTALS

A. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories.

B. Maintenance Data: For waste compactors to include in maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Operating and maintenance instructions.
2. Parts inventory list.
3. Purchase source for operating and maintenance materials.
4. Emergency information.
5. Name, address, and telephone number of manufacturer's service representative whose location is nearest to Project site.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

B. Waste Compactor Standards: Comply with ANSI Z245.2 and with NFPA 82.

C. Waste Bin and Hopper Standard: Comply with ANSI Z245.30.

PART 2 - PRODUCTS

2.1 WASTE COMPACTORS

A. Waste Compactors: Manufacturer's standard [**vertical**] [**stationary horizontal**] [**self-contained horizontal**] [**pivoting-ram**] packaged units with components, options, and accessories needed to comply with requirements and provide complete functional systems.

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

   a. Bes-Pac; <**Insert product name or designation**>.
   b. Chicago Trashpacker Company, LLC; <**Insert product name or designation**>.
   c. Galbreath, Inc.; <**Insert product name or designation**>.
   d. GPI Division, Harmony Enterprises, Inc.; <**Insert product name or designation**>.
   e. Holt Specialty Equipment, Inc.; <**Insert product name or designation**>.
   f. J. V. Manufacturing, Inc.; <**Insert product name or designation**>.
   g. K-PAC Equipment, Division of Krause Corporation; <**Insert product name or designation**>.
   h. Marathon Equipment Company; <**Insert product name or designation**>.
   i. McClain Industries, Inc./E-Z Pack; <**Insert product name or designation**>.
   j. Philadelphia Tramrail Company; <**Insert product name or designation**>.
   k. Precision Machinery Systems, Inc.; <**Insert product name or designation**>.
   l. Rudco Products, Inc.; <**Insert product name or designation**>.
   m. Sebright Products Inc.; <**Insert product name or designation**>.
   n. SP Industries, Inc.; <**Insert product name or designation**>.
   o. Wastequip-Accurate Industries; <**Insert product name or designation**>.
   p. Wilkinson Hi-Rise, LLC; <**Insert product name or designation**>.
   q. <**Insert manufacturer's name; product name or designation.**>

2. Basis-of-Design Product: <**Insert manufacturer's name; product name or designation**> or a comparable product by one of the following:

   a. <**Insert, in separate subparagraphs, manufacturer's name.**>

3. Minimum WASTEC Rating Base Size: [**0.14 cu. yd. (0.11 cu. m)**] [**1.00 cu. yd. (0.77 cu. m)**] [**1.50 cu. yd. (1.15 cu. m)**] [**2.00 cu. yd. (1.53 cu. m)**] [**3.50 cu. yd. (2.68 cu. m)**] [**5.00 cu. yd. (3.82 cu. m)**] [**7.50 cu. yd. (5.73 cu. m)**] [**10.00 cu. yd. (7.65 cu. m)**] <**Insert volume**>.

2.2 FABRICATION

A. Fabricate waste compactors with smooth, eased exposed edges.

B. Fabricate bins, hoppers, chutes, compaction chambers, unit bodies, and similar components of steel plate with welded joints. Reinforce with structural-steel members sized and spaced to

withstand impacts and pressures of normal operations and to prevent excessive long-term development of waves and valleys.

C. Fabricate equipment with replaceable parts at points of normal wear.

D. Provide electrical devices, controls, and materials of type and quality recommended by NEMA for applications indicated. See Division 26 Sections for power characteristics and service to equipment, including disconnect switches.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances, clearance requirements, service rough-ins, and other conditions affecting performance of work.

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

3.2 INSTALLATION

A. Set waste compactors level, plumb, properly aligned, and securely in place. Anchor as required for secure operation.

B. Complete field assembly with joining methods recommended in writing by manufacturer.

3.3 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain waste compactors. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION

SECTION 122210

DRAPES

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Draperies and drapery tracks.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 061000 - ROUGH CARPENTRY for wood blocking and grounds for mounting blinds and accessories.
2. Division 26 - ELECTRICAL for wiring and connection to building management systems.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include styles, material descriptions, construction details, dimensions of individual components and profiles, features, finishes, and operating instructions.

B. Shop Drawings: Show location and extent of drapes and drapery track. Include elevations, sections, details, and dimensions not shown in Product Data. Show installation details, mountings, attachments to other Work, operational clearances, and relationship to adjoining work and wiring diagrams

C. Samples for Verification:

1. Drapery track, minimum 12 inches long.
2. Drapery fabric, minimum full width on pattern repeat.

D. Window Treatment Schedule: Include draperies and drapery tracks in schedule using same room designations indicated on Drawings.

E. Maintenance Data: For drapes and drapery tracks to include in maintenance manuals. Include the following:

1. Methods for maintaining tracks.

2. Precautions about cleaning materials and methods that could be detrimental to fabrics and performance.
3. Operating hardware.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: For draperies and tracks, fabricator of draperies.

B. Source Limitations: For draperies, obtain each color and pattern of fabric and trim from one dye lot.

C. Fire-Test-Response Characteristics: For fabrics treated with fire retardants, provide products that pass NFPA 701 as determined by testing of fabrics that were treated using treatment-application method intended for use for this Project by a testing and inspecting agency acceptable to authorities having jurisdiction.

1. Flame-Resistance Ratings: Passes NFPA 701.

D. 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.

E. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver drapes in factory packages, marked with manufacturer and product name, and location of installation using same room designations indicated on Drawings and in a window treatment schedule.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not install drapery and drapery tracks until construction and wet and dirty finish work in spaces, including painting, is complete and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Field Measurements: Where drapery tracks are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operable glazed units' operation hardware throughout the entire operating range. Notify Design Professional of discrepancies. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 - PRODUCTS

2.1 DRAPERY TRACKS

A. Manually Operated Drapery Tracks: Provide tracks #2191, hand operated, with clear anodized finish; as manufactured by Silent Gliss or approved equal from Kirsch.

1. Accessories: Provide systems complete with all necessary hardware and accessories as required for type of curtain and method of installation.

B. Motorized Track:

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

a. BTX Inc.
b. Silent Gliss USA Inc.
c. SM Automatic, Inc.
d. VIMCO Shading Systems.

2. Construction: Extruded aluminum, slotted for mounting at interval of not more than 24 inches o.c.

a. Lengths and Configurations: As indicated on Drawings.
b. Support Capability: Weight of drapery indicated mounted on track length indicated.
c. Finish: Clear anodic coating.

3. Mounting Brackets: Suitable for fastening track to surface indicated and designed to support weight of track assembly and drapery plus force applied to operate track.
4. Installation Fasteners: Sized to support track assembly and drapery, and fabricated from metal compatible with track, brackets, and supporting construction. Provide two fasteners to fasten each bracket to supporting construction.
5. Motor Operation: Low-voltage motor with built-in low-voltage interface for direct access to control systems, with thermal-overload switch; sized for weight of drapery and track length indicated; and equipped with stops to prevent overdrawing. Operation shall be tied to building systems.
6. Carriers: Rollers with hooks.

a. Master Carriers: Overlap.

2.2 DRAPERIES

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. Barjan Manufacturing Ltd.
2. Boriack Interiors Inc.
3. Contract Shading Systems.
4. County Draperies, Inc.
5. Creative Draperies Inc.
6. Dallas Drapery Contract.
7. DFB Sales.

8. Fabricut.
9. Fabtex.
10. Wesco Fabrics, Inc.

B. Drapery: Provide black-out and standard fabric as indicated on the Finish Schedule.

2.3 DRAPERY FABRICATION

A. Fabricate draperies in heading styles and fullnesses indicated. Fabricate headings to stand erect. If less than a full width of fabric is required to produce panel of specified fullness, use equal widths of not less than one-half width of fabric located at ends of panel.

1. One-Way-Stacking Draperies: Add 5 inches to overall width for returns.
2. Center-Opening Draperies: Add 10 inches to overall width for overlap.

B. Seams: Sew vertical seams with twin-needle sewing machine with selvage trimmed and overlocked. Join widths so that patterns match and vertical seams lay flat and straight without puckering. Horizontal seams are not acceptable.

C. Side Hems: Double-turned, 1-1/2-inch-wide hems consisting of three layers of fabric, and blindstitched so that stitches are not visible on face of drapery.

D. Bottom Hems: Double-turned, 4-inch-wide hems consisting of three layers of fabric, and weighted and blindstitched so that weights and stitches are not visible on face of drapery.

1. Sew in square lead weights at each seam and at panel corners.

E. Interlinings: Extend from top of drapery to within 1/2 inch of lining's bottom hem and to leading edge of side hems to produce full-shadowed appearance.

F. Linings: Equal to widths of drapery fabric and joined to drapery fabric at top by inside invisible seam, and hand stitched at side hems and shadowed with 1-1/2-inch return of face fabric.

1. Bottom Hem: Hem separately from drapery fabric.

PART 3 - EXECUTION

3.1 DRAPERY TRACK INSTALLATION

A. Install track systems according to manufacturer's written instructions, level and plumb, and at height and location in relation to adjoining openings as indicated on Drawings.

B. Isolate metal parts of tracks and brackets from concrete, masonry, and mortar to prevent galvanic action. Use tape or another method recommended in writing by track manufacturer.

3.2 DRAPERY INSTALLATION

A. Where draperies abut overhead construction, hang draperies so that clearance between headings and overhead construction is 1/4 inch.

B. Where draperies extend to floor, install so that bottom hems clear finished floor by not more than 1 inch and not less than 1/2 inch.

C. Where draperies extend to windowsill, install so that bottom hems hang above sill line and clear sill line by not more than 1/2 inch.

3.3 ADJUSTING

A. After hanging draperies, test and adjust each track to produce unencumbered, smooth operation.

B. Steam and dress down draperies as required to produce crease- and wrinkle-free installation.

C. Remove and replace draperies that are stained or soiled.

END OF SECTION

SECTION 122400

SHADES

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Roller shades with manual and motorized shade operators.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 061000 - ROUGH CARPENTRY for wood blocking and grounds for mounting roller shades and accessories.
2. Division 26 - ELECTRICAL for electrical service and connections for motor operators, controls, limit switches, and other powered devices and for system disconnect switches for motorized shade operation.

1.3 SUBMITTALS

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

1. Include styles, material descriptions, construction details, dimensions of individual components and profiles, features, finishes, and operating instructions.
2. Motorized Shade Operators: Include operating instructions.
3. Motors: Show nameplate data, ratings, characteristics, and mounting arrangements.

B. Shop Drawings: Show location and extent of roller shades. Include elevations, sections, details, and dimensions not shown in Product Data. Show installation details, mountings, attachments to other work, operational clearances, and relationship to adjoining work.

1. Motorized Shade Operators: 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, system, and control wiring.

C. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Ceiling suspension system members and attachment to building structure.

2. Ceiling-mounted or penetrating items including light fixtures, air outlets and inlets, speakers, sprinklers, recessed shades, and special moldings at walls, column penetrations, and other junctures of acoustical ceilings with adjoining construction.
3. Shade mounting assembly and attachment.
4. Size and location of access to shade operator and adjustable components.
5. Minimum Drawing Scale: 1/4 inch = 1 foot.

D. Samples for Initial Selection: For each colored component of each type of shade indicated.

1. Include similar Samples of accessories involving color selection.

E. Samples for Verification:

1. Complete, full-size operating unit not less than 16 inches wide for each type of roller shade indicated.
2. For the following products:
   a. Shade Material: Not less than 12-inch- square section of fabric, from dye lot used for the Work, with specified treatments applied. Show complete pattern repeat. Mark top and face of material.
   b. Valance: Full-size unit, not less than 12 inches long.

F. Window Treatment Schedule: For roller shades. Use same designations indicated on Drawings.

G. Product Certificates: For each type of roller shade, signed by product manufacturer.

H. Qualification Data: For Installer.

I. Product Test Reports: For each type of roller shade.

J. Maintenance Data: For roller shades to include in maintenance manuals. Include the following:

1. Methods for maintaining roller shades and finishes.
2. Precautions about cleaning materials and methods that could be detrimental to fabrics, finishes, and performance.
3. Operating hardware.
4. Motorized shade operator.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

B. Source Limitations: Obtain roller shades through one source from a single manufacturer.

C. Fire-Test-Response Characteristics: Provide roller shade band materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

1. Flame-Resistance Ratings: Passes NFPA 701.

D. 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.

E. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver shades in factory packages, marked with manufacturer and product name, fire-test-response characteristics, and location of installation using same designations indicated on Drawings and in a window treatment schedule.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not install roller shades until construction and wet and dirty finish work in spaces, including painting, is complete and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Field Measurements: Where roller shades are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operable glazed units' operation hardware throughout the entire operating range. Notify Architect of discrepancies. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.7 EXTRA MATERIALS (ATTIC STOCK)

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. Rollers Shades: Before installation begins, for each size, color, texture, and pattern indicated, full-size units equal to 5 percent of amount installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Draper Inc.
2. Hunter Douglas Contract; Nysan Shading Systems.
3. Lutron Electronics Co.
4. MechoShade Systems, Inc.

2.2 ROLLER SHADES

A. Shadecloth: Transparent (1% or greater), 100% polyester or PLA biopolymer fabric, PVC-free.

1. Basis of Design:

    a. MechoShade; EcoVeil Sheer, 6850 and 6750 Series.
    b. M+N Textiles; Revolution.
    c. Warema; SecuTex fabrics.

2. Fire-Test-Response Characteristics: Passes NFPA 701, with no chemical flame retardants.
3. Bottom Hem: Straight.
4. Colors: To be selected by Architect from manufacturer's full range.

B. Rollers: Electrogalvanized or epoxy primed steel or extruded-aluminum tube of diameter and wall thickness required to support and fit internal components of operating system and the weight and width of shade band material without sagging; designed to be easily removable from support brackets; with removable spline fitting integral channel in tube for attaching shade material.

1. Direction of Roll: Regular, from back of roller

C. Mounting Brackets: Galvanized or zinc-plated steel.

D. Fascia: L-shaped, formed-steel sheet or extruded aluminum; long edges returned or rolled; continuous panel concealing front and bottom of shade roller, brackets, and operating hardware and operators; length as indicated on Drawings removable design for access.

E. Top/Back Cover: L-shaped; material and finish to match fascia; combining with fascia and end caps to form a six-sided headbox enclosure sized to fit shade roller and operating hardware inside.

F. Pocket-Style Headbox: U-shaped, formed-steel sheet or extruded aluminum; long edges returned or rolled; with a bottom cover consisting of slot opening of minimum dimension to allow lowering and raising of shade and a removable or an openable, continuous metal access panel concealing shade roller, brackets, and operating hardware and operators within.

G. Bottom Bar: Steel or extruded aluminum. Provide concealed, by pocket of shade material, internal-type bottom bar with concealed weight bar as required for smooth, properly balanced shade operation.

H. Mounting: As indicated on Drawings, mounting permitting easy removal and replacement without damaging roller shade or adjacent surfaces and finishes.

I. Hold-Down Brackets and Hooks or Pins: Manufacturer's standard for anchoring roller shade bottom in place and keeping shade band material taut.

2.3 ROLLER SHADE FABRICATION

A. Product Description: Roller shade consisting of a roller, a means of supporting the roller, a flexible sheet or band of material carried by the roller, a means of attaching the material to the roller, a bottom bar, and an operating mechanism that lifts and lowers the shade.

B. Concealed Components: Noncorrodible or corrosion-resistant-coated materials.

1. Lifting Mechanism: With permanently lubricated moving parts.

C. Unit Sizes: Obtain units fabricated in sizes to fill window and other openings as follows, measured at 74 deg F:

1. Shade Units Installed between (Inside) Jambs: Edge of shade not more than 1/4 inch from face of jamb. Length equal to head to sill dimension of opening in which each shade is installed.
2. Shade Units Installed Outside Jambs: Width and length as indicated, with terminations between shades of end-to-end installations at centerlines of mullion or other defined vertical separations between openings.

D. Installation Brackets: Designed for easy removal and reinstallation of shade, for supporting fascia, roller, and operating hardware and for hardware position and shade mounting method indicated.

E. Installation Fasteners: No fewer than two fasteners per bracket, fabricated from metal noncorrosive to shade hardware and adjoining construction; type designed for securing to supporting substrate; and supporting shades and accessories under conditions of normal use.

F. Color-Coated Finish: For metal components exposed to view, apply manufacturer's standard baked finish complying with manufacturer's written instructions for surface preparation including pretreatment, application, baking, and minimum dry film thickness.

2.4 MANUALLY OPERATED SHADES WITH SINGLE ROLLERS

A. Chain-and-Clutch Operating Mechanisms: With continuous-loop bead chain and clutch that stops shade movement when bead chain is released; permanently adjusted and lubricated.

1. Bead Chains: Manufacturer's standard.

a. Loop Length: Full length of roller shade.
b. Limit Stops: Provide upper and lower ball stops.

2.5 MOTORIZED ROLLER SHADE OPERATORS

A. General: Provide factory-assembled motorized shade operation systems designed for lifting shades of type, size, weight, construction, use, and operation frequency indicated. Provide operation systems of size and capacity and with features, characteristics, and accessories suitable for Project conditions and recommended by shade manufacturer, complete with electric motors and factory-prewired motor controls, remote-control stations, remote-control devices, power disconnect switches, enclosures protecting controls and all operating parts, and accessories required for reliable operation without malfunction. Include wiring from motor controls to motors. Coordinate operator wiring requirements and electrical characteristics with the building electrical system.

B. Comply with NFPA 70.

C. Control Equipment: Comply with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6 with NFPA 70, Class 2 control circuit, maximum 24-V ac or dc.

D. Electric Motors: UL-approved or -recognized, totally enclosed, insulated motor, complying with NEMA MG 1, with thermal-overload protection, brake, permanently lubricated bearings, and limit switches; sized by shade manufacturer to start and operate size and weight of shade

considering service factor or considering Project's service conditions without exceeding nameplate ratings.

1. Service Factor: According to NEMA MG 1, unless otherwise indicated.
2. Motor Characteristics: Single phase, 220 V, 60 Hz.
3. Motor Mounting: Within manufacturer's standard roller enclosure.

E. Position of Motor and Electrical Connection: Right side of roller, as determined by hand of user facing shade from inside, unless otherwise indicated on Drawings.

F. Remote Controls: Electric controls with NEMA ICS 6, Type 1 enclosure for recessed or flush mounting. Provide the following devices for remote-control activation of shades:

1. Control Stations: Keyed, maintained-contact, three-position, switch-operated control station with open, close, and off functions. Provide two keys per station.
   a. Color: White.

2. Group Control Stations: Maintained-contact, three-position, rocker-style, wall switch-operated control station with open, close, and center off functions for single-switch group control.
   a. Color: White

3. Microprocessor Controls: Electronic programmable means for setting, changing, and adjusting control features. Provide unit isolated from voltage spikes and surges.

G. Limit Switches: Adjustable switches, interlocked with motor controls and set to automatically stop shade at fully raised and fully lowered positions.

H. Operating Function: Stop and hold shade at any position

I. Operating Features: Include the following:

1. Group switching with integrated switch control; single face plate for multiple switch cut-outs.
2. Capable of interface with audiovisual control system.
3. Capable of accepting input from building automation control system.
4. Override switch.
5. Backup gear and crank operator for manual operation during power failures with detachable handle, length required to make operation convenient from floor level

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, other conditions affecting performance.

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

3.2 ROLLER SHADE INSTALLATION

A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions, and located so shade band is not closer than 2 inches to interior face of glass. Allow clearances for window operation hardware.

B. Connections: Connect motorized operators to building electrical system.

3.3 ADJUSTING

A. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

3.4 CLEANING AND PROTECTION

A. Clean roller shade surfaces after installation, according to manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that roller shades are without damage or deterioration at time of Substantial Completion.

C. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner’s maintenance personnel to adjust, operate, and maintain roller shades. Refer to Division 01 Sections for contract closeout procedures.

END OF SECTION

SECTION 124810

ENTRANCE FLOOR MATS AND FRAMES

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Roll-up aluminum-tread rail floor mats with aluminum hinges.
2. Carpet-type matting.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 033000 - CAST-IN-PLACE CONCRETE for concrete work, including forming, placing, and finishing concrete floor slabs, and for concrete materials for grouting and filling around and under recessed mats and frames.

1.3 SUBMITTALS

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

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Show the following:

1. Items penetrating floor mats and frames, including door control devices.
2. Divisions between mat sections.
3. Perimeter floor moldings.

C. Samples for Verification: For each type of product indicated.

1. Floor Mat: 12-inch- square, assembled sections of floor mat.
2. Frame Members: 12-inch- long Sample of each type and color.

D. Maintenance Data: For floor mat and frames to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain floor mats and frames through one source from a single manufacturer.

B. Accessibility Requirements: Provide installed floor mats that comply with Section 4.5 in the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)".

1.5 PROJECT CONDITIONS

A. Field Measurements: Indicate measurements on Shop Drawings.

1.6 COORDINATION

A. Coordinate size and location of recesses in concrete with installation of finish floors to receive floor mats and frames.

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. Roll-up Aluminum Rail Hinged Mats:

a. AFCO-USA.
b. Balco, Inc.
c. Construction Specialties, Inc.
d. Mats Inc.
e. Nystrom.

2. Carpet-Type Matting:

a. AFCO-USA.
b. Mats Inc.
c. Milliken.
d. Nystrom.
e. Shaw Contract.
f. Tennessee Mat Company, Inc.

2.2 METAL FRAME MATERIALS

A. Extruded Aluminum: ASTM B 221 alloy 6061-T6 or alloy 6063-T5, T6, or T52 as standard with manufacturer.

2.3 CONCRETE FILL AND GROUT MATERIALS

A. Provide concrete materials complying with Section 033000 - CAST-IN-PLACE CONCRETE for grout and fill around and under recessed mats and frames that produce concrete equivalent in

strength to cast-in-place concrete slabs. For concrete fill, adjust aggregate size to not exceed one-third fill thickness.

2.4 FLOOR MATS

A. General: Provide colors, patterns, and profiles of materials, including metals and metal finishes indicated or specified. If not indicated, provide colors, patterns, and profiles selected by Architect from manufacturer's standards.

B. Roll-up Aluminum Rail Hinged Mats: Clear-anodized finish, extruded-aluminum tread rails sitting on continuous vinyl cushions with 1-1/2-inch-wide by 3/8-inch-thick, tread rail modules. Provide aluminum hinges and 28-oz./sq. yd. weight, level-cut, nylon-pile, fusion-bonded carpet tread inserts].

1. Tapered Rigid Frame: Tapered extruded-aluminum frame members, not less than 1-1/2 inches wide, with mitered corners and finish to match tread-slat extrusions.

C. Loop Filament Matting: 3M's "Nomad" loop filament vinyl material 3/8 inch thick, with solid vinyl sheet backing and built-in chemical agents to reduce fungus and mildew. Provide color specified or scheduled or, if not specified or scheduled, as selected by Architect.

1. Flexible Edging: 2-inch-minimum, vinyl edge strip in matching color, bonded to each end of mat material or backing sheet.

D. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated.

1. VOC Content: 50 g/L or less.
2. Do not use adhesives that contain urea formaldehyde.
3. Methylene chloride and perchloroethylene may not be intentionally added to adhesives and sealants.

2.5 FABRICATION

A. General: Where possible, verify sizes by field measurement before shop fabrication.

B. Floor Mats: Shop fabricate units to greatest extent possible in sizes as indicated. If not otherwise indicated, provide single unit for each mat installation; do not exceed manufacturer's recommended maximum sizes for units that are removed for maintenance and cleaning. Where joints in mats are necessary, space symmetrically and away from normal traffic lanes. Miter corner joints in framing elements with hairline joints or provide prefabricated corner units without joints.

C. Recessed Metal Mat Frames: Extruded aluminum of size and style to fit floor mat type specified, for permanent recessed installation, complete with corner pins or reinforcement and anchorage devices.

1. Fabricate edge-frame members in single lengths or, where frame dimensions exceed maximum available lengths, provide minimum number of pieces possible, with hairline joints equally spaced and pieces spliced together by straight connecting pins.

D. With manufacturer's standard protective coating, coat surfaces of aluminum frames that will contact cementitious material.

2.6 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.

2.7 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 611.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrate for compliance with requirements for location, sizes, minimum recess depth, and other conditions affecting installation of floor mats and frames.

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

3.2 INSTALLATION

A. Install recessed mat frames to comply with manufacturer's written instructions. Set mat tops at height recommended by manufacturer for most effective cleaning action; coordinate top of mat surfaces with bottom of doors that swing across mats to provide clearance between door and mat.

1. Install necessary shims, spacers, and anchorages for proper location and secure attachment of frames.
2. Install grout and fill around frames and, if required to set mat tops at proper elevations, in recesses under mats. Finish grout and fill smooth and level.

3.3 PROTECTION

A. After completing frame installation and concrete work, provide temporary filler of plywood or fiberboard in recesses and cover frames with plywood protective flooring. Maintain protection until construction traffic has ended and Project is near Substantial Completion.

B. Defer installation of floor mats until Project is near Substantial Completion.

END OF SECTION

SECTION 129300

SITE FURNISHINGS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes materials, labor, apparatus, tools, equipment, temporary construction, transportation, and services necessary for and incidental to performing the proper completion of Work for Site and Street Furnishing installations, as shown on the Contract Drawings, and as specified herein this Section.

B. Work under this Section consists of, but is not necessarily limited to, furnishing and installing or installing the following:

1. Trash and Waste Receptacle(s).
2. Pet Waste Receptacle(s).
3. Tables and Chairs (movable).
4. Tables and Chairs (anchored).
5. Bicycle Rack(s).
6. Drinking and Pet Watering Fountain(s).
7. Bollard(s).

C. Related Documents: The following Documents contain requirements of Work that relate to this Section:

1. Section 044213 “Stone Slabs, Blocks and Boulders”.
2. Section 096341 “Site Stone Paving”.
3. Section 116813 “Playground Equipment, Structures and Surfaces”
4. Section 321313 "Landscape Architectural Cement Concrete Paving".
5. Section 321316 “Decorative Cement Concrete Paving”.
6. Section 321323 "Cast-In-Place Concrete for Landscape Elements".
7. Section 321400 “Unit Paving Systems”.

1.2 SUBMITTALS

A. General: Refer to Division 01 for project submittal requirements and timelines. If provided in hardcopy submittal booklets submit each item in this Article in required copies with four (4) copies for review by Landscape Architect. Three (3) copies shall be returned (One for Client, one for Owner and one for Contractor) and one copy maintained by Landscape Architect. Provide one (1) sets of Material Samples for review by the Landscape Architect unless requested otherwise.

B. Submittal Booklets: Each Submittal Booklet under this Section shall be tabbed into specific sections, containing clearly identified (through yellow highlighter or other specific identification methods) and legible information on the following information indicated in this Article.

C. Electronic Submittals: Electronic Submittal shall be provided in a single bound file, PDF format preferred, unless otherwise noted in Division 01.

D. Product/Material Data. Submit available product/material literature (including color charts) supplied by manufacturer's, indicating that their products comply with specified requirements.

Provide manufacturing source (name, address, and telephone number), and distributor source (name, address, and telephone number) for each type of product/material.

E. Product Data: Submit manufacturer's current literature of the following items:

1. Color, finish and size for each type of furnishing.
2. Installation instructions and recommendations for general maintenance.
3. Color chips using same material as the manufactured product showing texture, color and configuration.

F. Samples:

1. Verifying Photo or actual sample of element if locally available (100 miles driving from jobsite). Required for each furnishing.
2. Material Color Chips and Samples: Required for each furnishing. Chip to be constructed using same material as the manufactured product and shall illustrate texture, color and configuration.

G. Shop Drawings: Installation and anchorage details for all manufactured items listed below.

1. Items:
   a. Trash and Waste Receptacle(s).
   b. Tables and Chairs (movable).
   c. Chairs (anchored).
   d. Bicycle Rack(s).
   e. Drinking and Pet Watering Fountain(s).
   f. Bollard(s).

2. Show plans, elevations, with dimensions, details of inserts, and reinforcements, setting methods, shims dowels or anchorage needed to install the item and comply with details on the drawings.
3. Provide detail and dimensioned drainage and irrigation access details for pots. Shop drawing to be coordinated with pot interior and paving exterior to illustrate necessary construction coordination for drainage and irrigation.

H. Submittal Schedule: All products in this section which is required for submittal shall be included in one landscape submittal package which includes all associated items required to complete the furnishing(s) installation.

1.3 QUALITY ASSURANCE AND CONTROL

A. All materials and Work shall be in accordance with the State Codes and Specifications and other criteria herein specified.

B. Single-Source Responsibility: Obtain furnishing Units from each respective single source with resources to provide products and materials of consistent quality in appearance and physical properties without delaying the Work.

C. Substitutions: Unit(s) to be considered equal to those specified herein this Section shall be reviewed and approved by the Landscape Architect, in writing, prior to the Bid Date. No substitutions shall be allowed after the Bid Date.

1.4 COORDINATION

A. Contractor shall coordinate the installation of all furnishings in this Section with all other related Work of this Contract.

B. Contractor shall be responsible for verifying the dimensions and required hardware of the furnishings prior to commencing installation Work.

C. Coordinating furnishing footings with utility locations. Note potential conflicts to the Landscape Architect.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Labeling: Furnish all materials in manufacturer's unopened, original containers, bearing original labels showing quantity, description and name of manufacturer.

B. Delivery: Deliver and unload at the site on pallets and bound in such a manner that no damage occurs to the product.

C. Storage: Store products in a manner which will preclude all damages. Damaged materials will be rejected. Remove all damaged materials from the job site immediately, and replace at no cost to Owner.

D. Handling: Furnish suitable equipment to locate all site furnishing materials carefully and efficiently. Lift materials using lifting inserts provided by manufacturer where applicable.

PART 2 - PRODUCTS

2.1 MANUFACTURERS: Refer to Contract Drawings. Alternate manufactures if requested by contractor will be required to meet or exceed the selected manufactures finish design including shape and size, color and material in every way for consideration.

2.2 CONDITION: All products are to be new and in first class condition.

2.3 WARRANTY

A. Manufacturer's Warranty: Contractor shall arrange manufacturer's warranty to the effect that all manufactured products shall carry a minimum one year manufactures warranty which shall be transferred to the owner at time of acceptance. The warranty period shall commence on the date of acceptance of the installation. Early delivery shall not limit the installed warranty period.

B. Contractors Warranty: Contractor shall warrant all workmanship in addition to the manufacturer's warranty for a period of one year from the date of acceptance.

2.4 CONCRETE FOOTINGS: Reference details in Contract Documents for requirements.

2.5 ANCHORS

A. Non-corrosive, stainless or galvanized as approved. Embed in epoxy grout or provide expansion anchors.

2.6 TRASH/WASTE RECEPTACLE(S): Per manufacturer/specification/product number noted in Contract Drawings.

2.7 PET WASTE RECEPTACLE(S): Per manufacturer/specification/product number noted in Contract Drawings.

2.8 TABLES AND CHAIRS: Per manufacturer/specification/product number noted in Contract Drawings.

2.9 BICYCLE STORAGE RACK(S): Per manufacturer/specification/product number noted in Contract Drawings.

2.10 DRINKING AND WATERING FOUNTAINS: Per manufacturer/specification/product number noted in Contract Drawings.

2.11 BOLLARD(S): Per manufacturer/specification/product number noted in Contract Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. NO WORK UNDER THIS SECTION SHALL COMMENCE UNTIL SUBMITTALS UNDER THIS SECTION HAVE BEEN REVIEWED ACCORDINGLY BY THE LANDSCAPE ARCHITECT.

B. Prior to commencing Work under this Section, Contractor shall examine previously installed Work from other trades and verify that such Work is complete and to the point where Work herein may commence properly. Do not proceed with Work until unsatisfactory conditions have been corrected.

C. Contractor shall notify the Landscape Architect, in writing, on the anticipated commencement date and length of duration of the Work installation herein this section.

3.2 GENERAL

A. Acceptance: Area will be accepted when furnishings are permanently installed in accepted positions.

B. Locations: Layout each item for approval in the general location as shown on the Drawings. Review with the Owner’s Representative or Landscape Architect to confirm exact installation locations prior to final installation.

C. Special Precautions: Guard against staining or damaging of existing pavements and plantings where site furnishings are to be installed.

D. Paint exposed installation hardware to match furnishing color.

E. Shim all furnishings to level.

F. Acceptance: Do not install site and street furnishings prior to acceptance by Landscape Architect of area to receive such materials.

G. Special Precautions: Guard against staining or damaging of existing pavements and plantings where site furnishings are to be installed.

3.3 CONCRETE PADS AND FOOTINGS

A. Layout: Accurately layout all pads and footings as called for in the Drawings.

B. Installation: Excavate and form as required and fill for pads and footings as specified in 32 13 23 "Cast-In-Place Concrete for landscape Features".

3.4 TRASH/WASTE RECEPTACLE

A. Place and anchor per manufacturer's requirements in approved locations/alignment.

B. Protect in place until work is accepted.

C. Clean.

3.5 PET WASTE RECEPTACLE

A. Place and anchor per manufacturer's requirements in approved locations/alignment.

B. Protect in place until work is accepted.

C. Clean.

3.6 TABLES/CHAIRS

A. Place in approved locations/alignment.

B. Protect in place until work is accepted.

3.7 TABLES/CHAIRS (ANCHORED)

A. Place and anchor per manufacturer's requirements in approved locations/alignment.

B. Protect in place until work is accepted.

C. Provide additional dressing and facing and any needed surfacing as requested (if any) to produce desired face appearance.

D. Clean.

3.8 BICYCLE STORAGE RACKS

A. Place and anchor per manufacturer's requirements in approved locations/alignment.

B. Protect in place until work is accepted.

C. Provide additional dressing and facing and any needed surfacing as requested (if any) to produce desired face appearance.

D. Clean.

3.9 DRINKING AND PET WATERING FOUNTAINS

A. Place and anchor per manufacturer's requirements in approved locations/alignment.

B. Connect to noted waster and water source piping lines per Contract Drawings.

C. Protect in place until work is accepted.

D. Provide additional dressing and facing and any needed surfacing as requested (if any) to produce desired face appearance.

E. Clean.

3.10 BOLLARD(S)

A. Place and anchor per manufacturer's requirements in approved locations/alignment.

B. Protect in place until work is accepted.

C. Provide additional dressing and facing and any needed surfacing as requested (if any) to produce desired face appearance.

D. Clean.

3.11 REPLACEMENTS

A. Replace all products, materials and workmanship found to be defective through the end of the warranty period.

3.12 TOUCH-UP

A. Provide Owner with manufactures touch-up paint (1 pint minimum) for each painted furnishing. Supply literature necessary for ordering touch-up paint at a later date.

3.13 DEMONSTRATION

A. Demonstrate the operation and maintenance of all equipment to the Owner. Submit final copy of all maintenance manuals at the time of demonstration.

3.14 PROTECTION

A. Maintain locked lids until acceptance by Landscape Architect. Replace all missing accessories at no cost to Owner.

B. Wrappings: Do not remove protective wrappings from furnishings until instructed by Landscape Architect.

C. Provide additional protection, coverings or barricades to insure work is not damaged and repair or replace damaged goods at no additional cost to the owner.

3.15 CLEAN UP

A. Keep all areas of work clean, neat and orderly at all times.

B. Clean up and remove all stains, packing and debris from the entire work or on any furnishing area prior to Final Acceptance.

END OF SECTION

SECTION 142100

ELECTRIC TRACTION ELEVATORS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Machine-room-less electric traction passenger elevators.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 051200 - STRUCTURAL STEEL FRAMING for the hoist beams, attachment plates, angle brackets, and other preparation of structural steel for fastening guide-rail brackets.
2. Section 055000 - METAL FABRICATIONS for miscellaneous framing and supports for hoisting machines, and for elevator door sills, cants in hoistways made from sheet steel, and elevator pit ladders.
3. Division 09 - FINISHES for floor finish requirements.
4. Division 26 - ELECTRICAL for telephone service to elevators.
5. Division 26 - ELECTRICAL for electrical service for elevators to and including disconnect switches at machine room door and telephone wiring to elevator.

1.3 DEFINITIONS

A. Definitions in ASME A17.1 apply to work of this Section.

B. Defective Elevator Work: Operation or control system failures; performances below specified ratings; excessive wear; unusual deterioration or aging of materials or finishes; unsafe conditions; the need for excessive maintenance; abnormal noise or vibration; and similar unusual, unexpected, and unsatisfactory conditions.

1.4 SUBMITTALS

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

1. Include capacities, sizes, performances, operations, safety features, finishes, and similar information. Include product data for the following:
2. Car enclosures and hoistway entrances.
3. Operation, control, and signal systems.

B. Shop Drawings: Show plans, elevations, sections, and large-scale details indicating service at each landing, equipment layout, coordination with building structure, relationships with other construction, and locations of equipment and signals. Include large-scale layout of car control station and standby power operation control panel. Indicate variations from specified requirements, maximum dynamic and static loads imposed on building structure at points of support, and maximum and average power demands.

C. Samples for Verification: For exposed finishes of cars, hoistway doors and frames, and signal equipment; 3-inch-square Samples of sheet materials; and 4-inch lengths of running trim members.

D. Manufacturer Certificates: Signed by elevator manufacturer certifying that hoistway, pit, and machine room layout and dimensions, as shown on Drawings, and electrical service, as shown and specified, are adequate for elevator system being provided.

E. Qualification Data: For Installer.

F. Operation and Maintenance Data: For elevators to include in emergency, operation, and maintenance manuals.

G. Inspection and Acceptance Certificates and Operating Permits: As required by authorities having jurisdiction for normal, unrestricted elevator use.

H. Warranty: Special warranty specified in this Section.

I. Continuing Maintenance Proposal: Service agreement specified in this Section.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Elevator manufacturer or manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

B. Source Limitations: Obtain elevators through one source from a single manufacturer.

1. Provide major elevator components, including driving machines, controllers, signal fixtures, door operators, car frames, cabs, and entrances, manufactured by a single manufacturer.

C. Regulatory Requirements: Comply with ASME A17.1.

D. Accessibility Requirements: Comply with Section 4.10 in the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA).

E. Fire-Rated Hoistway Entrance Assemblies: Door and frame assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing at as close to neutral pressure as possible according to NFPA 252.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle materials, components, and equipment in manufacturer's protective packaging.

B. Store materials, components, and equipment off of ground, under cover, and in a dry location. Handle according to manufacturer's written recommendations to prevent damage, deterioration, or soiling.

1.7 COORDINATION

A. Coordinate installation of sleeves, block outs, and items that are embedded in concrete or masonry for elevator equipment. Furnish templates and installation instructions and deliver to Project site in time for installation.

B. Coordinate sequence of elevator installation with other work to avoid delaying the Work.

C. Coordinate locations and dimensions of other work relating to traction elevators including pit ladders, sumps, and floor drains in pits; entrance subsills; and electrical service, electrical outlets, lights, and switches in pits and machine rooms.

1.8 WARRANTY

A. Special Manufacturer's Warranty: Manufacturer's standard form in which manufacturer agrees to repair, restore, or replace defective elevator work within specified warranty period.

1. Warranty Period: One year from date of Substantial Completion.

1.9 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, provide one year's full maintenance service by skilled employees of elevator Installer. Include monthly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper elevator operation at rated speed and capacity. Provide parts and supplies same as those used in the manufacture and installation of original equipment.

1. Include 24-hour-per-day, 7-day-per-week emergency callback service.

B. Continuing Maintenance Proposal: Provide a continuing maintenance proposal from Installer to Owner, in the form of a standard one-year maintenance agreement, starting on date initial maintenance service is concluded. State services, obligations, conditions, and terms for agreement period and for future renewal options.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering electric traction elevators that may be incorporated into the Work include, but are not limited to, the following:

1. Fujitec America, Inc.
2. KONE Inc.; EcoSpace Elevator
3. Otis Elevator Co.; Gen2 Stream.
4. Schindler Elevator Corp.
5. ThyssenKrupp Elevator; Endura MRL Elevator

2.2 PASSENGER ELEVATORS

A. Elevators:

1. Type: Machine-room-less (MRL), gearless traction.
2. Rated Load: 3500 lb. and 4,000 lb.
3. Rated Speed: 250 fpm.
4. Operation System: Selective collective automatic operation.
5. Auxiliary Operations:

    a. Standby power operation.
    b. Standby powered lowering.
    c. Battery-powered lowering.
    d. Independent service.
    e. Loaded-car bypass.
    f. Automatic dispatching of loaded car.
    g. Nuisance call cancel.

6. Car Enclosures: As follows:

    a. Inside Width: As indicated on the Drawings.
    b. Inside Depth: As indicated on the Drawings.
    c. Inside Height: As indicated on the Drawings.
    d. Front Walls: Satin stainless steel with integral car door frames.
    e. Car Fixtures: Satin stainless steel.
    f. Side and Rear Wall Panels: Satin stainless steel.
    g. Reveals: Satin stainless steel.
    h. Door Faces (Interior): Satin stainless steel.
    i. Door Sills: Aluminum.
    j. Ceiling: Satin stainless steel, with LED downlights.
    k. Handrails: Satin stainless steel, at side and rear walls.
    l. Floor prepared to receive carpet specified in Section 096800 - CARPETING.
    m. Floor prepared to receive resilient flooring specified in Section 096510 - RESILIENT FLOORING AND ACCESSORIES.
    n. Floor recessed and prepared to receive dimension stone tile specified in Section 093000 - TILING. Provide cementitious backer units applied over 5/8-inch underlayment grade, exterior plywood, screwed to car platform.

7. Hoistway Entrances: As follows:

    a. Width: As indicated on the Drawings
    b. Height: As indicated on the Drawings.
    c. Type: [Single-speed side sliding] [Two-speed side sliding] [Single-speed center opening] [Two-speed center opening].
    d. Frames: Satin stainless steel.
    e. Doors: Satin stainless steel.
    f. Sills: Aluminum.

8. Hall Fixtures: Satin stainless steel.
9. Additional Requirements: As follows:

a. Provide inspection certificate in each car, mounted under acrylic cover with satin stainless-steel frame.
b. Provide protective blanket hooks in all cars and two complete sets of full-height blankets.

2.3 SYSTEMS AND COMPONENTS

A. General: Provide manufacturer's standard elevator systems. Where components are not otherwise indicated, provide standard components published by manufacturer as included in standard preengineered elevator systems and as required for complete system.

B. Elevator Machines: Provide variable-voltage, variable-frequency, ac-type or variable-voltage, dc-type hoisting machines. Provide solid-state power converters.

1. Provide regenerative or nonregenerative system.
2. Limit total harmonic distortion of regenerated power to 5 percent per IEEE 519.
3. Provide means for absorbing regenerated power when elevator system is operating on standby power.
4. Provide line filters or chokes to prevent electrical peaks or spikes from feeding back into building power system.

C. Fluid for Oil Buffers: If oil buffers are used, use only fire-resistant hydraulic fluid containing antioxidant, anticorrosive, antifoaming, and metal-passivating additives.

1. Available Product: Subject to compliance with requirements, a product that may be incorporated into the Work includes, but is not limited to, "Hydro Safe (FR)" by Hydro Safe Oil Division, Inc.

D. Inserts: Furnish required concrete and masonry inserts and similar anchorage devices for installing guide rails, machinery, and other components of elevator work where installation of devices is specified in another Section.

E. Machine Beams: Provide framing to support elevator hoisting machine and deflector sheaves from the building structure. Comply with Division 05 Section "Metal Fabrications" for materials and fabrication.

F. Car Frame and Platform: Welded steel units.

G. Guides: Provide roller guides or polymer-coated, nonlubricated sliding guides at top and bottom of car and counterweight frames.

2.4 OPERATION SYSTEMS

A. General: Provide manufacturer's standard microprocessor operation system for each elevator as required to provide type of operation system indicated.

B. Single-Car Auxiliary Operations: In addition to primary operation system features, provide the following operational features for elevators where indicated:

1. Standby Power Operation: On activation of standby power, car is returned to a designated floor and parked with doors open. Car can be manually put in service on

standby power, either for return operation or for regular operation, by switches in control panel located at main lobby. Manual operation causes automatic operation to cease.

2. Nuisance Call Cancel: When car calls exceed a preset number while car load is less than a predetermined weight, all car calls are canceled. Preset number of calls and predetermined weight can be adjusted.

C. Security Features: Provide the following security features, where indicated. Security features shall not affect emergency firefighters' service.

1. Card-Reader Operation: System uses card readers at car control stations to authorize calls. Security system determines which landings and at what times calls require authorization by card reader. Provide required conductors in traveling cable and panel in machine room for interconnecting card readers, other security access system equipment, and elevator controllers. Provide stripe-swipe card reader integral with each car control station.
2. Keyswitch Operation: Push buttons are activated and deactivated by security keyswitches at car control stations. Key is removable only in deactivated position.
3. Car-to-Lobby Feature: Feature, activated by keyswitch at main lobby, that causes car to return immediately to lobby and open doors for inspection. On deactivation by keyswitch, calls registered before keyswitch activation are completed and normal operation is resumed.

2.5 DOOR REOPENING DEVICES

A. Infrared Array: Provide door reopening devices with uniform array of 36 or more microprocessor-controlled, infrared light beams projecting across car entrance. Interruption of one or more of the light beams shall cause doors to stop and reopen.

2.6 FINISH MATERIALS

A. General: Provide the following materials for exposed parts of elevator car enclosures, car doors, hoistway entrance doors and frames, and signal equipment as indicated.

B. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, commercial steel, Type B, exposed, matte finish.

C. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, commercial steel, Type B, pickled.

D. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304, satin (No. 4) finish.

1. Textured Stainless-Steel Sheet: Product with embossed texture rolled into exposed surface.

E. Stainless-Steel Tubing: ASTM A 554, Grade MT 304, satin (No. 4) finish.

F. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063.

G. Nickel Silver Extrusions: ASTM B 151/B 151M, Alloy UNS No. C74500 or No. C77600.

H. Plastic Laminate: High-pressure type complying with NEMA LD 3, Type HGS for flat applications.

2.7 CAR ENCLOSURES

A. General: Provide enameled-steel car enclosures to receive removable wall panels, with removable car roof, access doors, power door operators, and ventilation.

1. Provide standard railings complying with ASME A17.1 on car tops where required by ASME A17.1.
2. Provide finished car including materials and finishes specified below.

B. Materials and Finishes: Provide manufacturer's standards, but not less than the following:

1. Subfloor: Underlayment grade, exterior plywood, 5/8-inch nominal thickness.
2. Fabricate car with recesses and cutouts for signal equipment.
3. Fabricate car door frame integrally with front wall of car.
4. Stainless-Steel Doors: Flush, hollow-metal construction; fabricated from stainless-steel sheet.
5. Sight Guards: Provide sight guards on car doors.
6. Sills: Extruded nickel silver, with grooved surface, 1/4 inch thick.
7. Handrails: Manufacturer's standard handrails meeting code requirements, of shape, metal, and finish indicated.

2.8 HOISTWAY ENTRANCES

A. General: Provide manufacturer's standard horizontal-sliding, door-and-frame hoistway entrances complete with track systems, hardware, sills, and accessories. Provide frame size and profile to coordinate with hoistway wall construction.

1. Where gypsum board wall construction is indicated, provide self-supporting frames with reinforced head sections.

B. Materials and Fabrication: Provide manufacturer's standards, but not less than the following:

1. Stainless-Steel Frames: Formed from stainless-steel sheet.
2. Sight Guards: Provide sight guards on doors matching door edges.
3. Sills: Extruded metal, with grooved surface, 1/4 inch thick.
4. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107.

2.9 SIGNAL EQUIPMENT

A. General: Provide hall-call and car-call buttons that light when activated and remain lit until call has been fulfilled. Fabricate lighted elements with long-life incandescent lamps and acrylic or other permanent, nonyellowing translucent plastic diffusers or LEDs.

B. Car Control Stations: Provide manufacturer's standard recessed car control stations. Mount in return panel adjacent to car door, unless otherwise indicated.

C. Emergency Communication System: Provide system that complies with ASME A17.1 and the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)." On activation, system dials preprogrammed number of monitoring station and identifies elevator location to monitoring station. System provides two-way voice communication without using a handset and

provides visible signals that indicate when system has been activated and when monitoring station has responded. System is contained in flush-mounted cabinet, with identification, instructions for use, and battery backup power supply.

D. Firefighters' Two-Way Telephone Communication Service: Provide flush-mounted cabinet in each car and required conductors in traveling cable for firefighters' two-way telephone communication service specified in Division 26 - ELECTRICAL.

E. Car Position Indicator: Provide illuminated, digital-type car position indicator, located above car door or above car control station. Also provide audible signal to indicate to passengers that car is either stopping at or passing each of the floors served.

1. Include travel direction arrows if not provided in car control station.

F. Hall Push-Button Stations: Provide one hall push-button station at each landing for each single elevator or group of elevators, but not less than one station for each four elevators in a group.

G. Hall Lanterns: Units with illuminated arrows; but provide single arrow at terminal landings. Provide[one of] the following:

1. Manufacturer's standard wall-mounted units, for mounting above entrance frames.

H. Hall Annunciator: With each hall lantern, provide audible signals indicating car arrival and direction of travel. Signals sound once for up and twice for down.

1. At manufacturer's option, audible signals may be placed on each car.

I. Corridor Call Station Pictograph Signs: Provide signs matching hall push-button stations, with text and graphics as required by authorities having jurisdiction, indicating that in case of fire elevators are out of service and exits should be used instead. Provide one sign at each hall push-button station, unless otherwise indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine elevator areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance. Examine hoistways, hoistway openings, pits, and machine rooms as constructed; verify critical dimensions; and examine supporting structure and other conditions under which elevator work is to be installed.

1. For the record, prepare a written report, endorsed by Installer, listing dimensional discrepancies and conditions detrimental to performance or indicating that dimensions and conditions were found to be satisfactory.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions.

B. Welded Construction: Provide welded connections for installing elevator work where bolted connections are not required for subsequent removal or for normal operation, adjustment, inspection, maintenance, and replacement of worn parts. Comply with AWS standards for workmanship and for qualifications of welding operators.

C. Sound Isolation: Mount rotating and vibrating equipment on vibration-isolating mounts designed to minimize transmission of vibrations to structure and thereby minimize structure-borne noise from elevator system.

D. Lubricate operating parts of systems, including ropes, as recommended by manufacturers.

E. Alignment: Coordinate installation of hoistway entrances with installation of elevator guide rails for accurate alignment of entrances with car. Where possible, delay final adjustment of sills and doors until car is operable in shaft. Reduce clearances to minimum, safe, workable dimension at each landing.

F. Leveling Tolerance: 1/8 inch, up or down, regardless of load and direction of travel.

G. Set sills flush with finished floor surface at landing. Fill space under sill solidly with nonshrink, nonmetallic grout.

H. Locate hall signal equipment for elevators as follows, unless otherwise indicated:

1. For groups of elevators, locate hall push-button stations between two elevators at center of group or at location most convenient for approaching passengers.
2. Place hall lanterns either above or beside each hoistway entrance.
3. Mount hall lanterns at a minimum of 72 inches above finished floor.

3.3 FIELD QUALITY CONTROL

A. Acceptance Testing: On completion of elevator installation and before permitting use (either temporary or permanent) of elevators, perform acceptance tests as required and recommended by ASME A17.1 and by governing regulations and agencies.

B. Advise Owner, Architect, and authorities having jurisdiction in advance of dates and times tests are to be performed on elevators.

3.4 PROTECTION

A. Temporary Use: Limit temporary use for construction purposes to one elevator. Comply with the following requirements for each elevator used for construction purposes:

1. Provide car with temporary enclosure, either within finished car or in place of finished car, to protect finishes from damage.
2. Provide strippable protective film on entrance and car doors and frames.
3. Provide padded wood bumpers on entrance door frames covering jambs and frame faces.
4. Provide other protective coverings, barriers, devices, signs, and procedures as needed to protect elevator and elevator equipment.
5. Do not load elevators beyond their rated weight capacity.
6. Engage elevator Installer to provide full maintenance service. Include preventive maintenance, repair or replacement of worn or defective components, lubrication,

cleaning, and adjusting as necessary for proper elevator operation at rated speed and capacity. Provide parts and supplies same as those used in the manufacture and installation of original equipment.

7. Engage elevator Installer to restore damaged work, if any, so no evidence remains of correction. Return items that cannot be refinished in the field to the shop, make required repairs and refinish entire unit, or provide new units as required.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to operate elevator.

B. Check operation of each elevator with Owner's personnel present and before date of Substantial Completion. Determine that operation systems and devices are functioning properly.

END OF SECTION

SECTION 149101

LAUNDRY CHUTES

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Laundry chutes.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 078410 - PENETRATION FIRESTOPPING for firestopping at perimeter of chute.

1.3 SUBMITTALS

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

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

C. Operation and maintenance data.

1.4 QUALITY ASSURANCE

A. NFPA Compliance: Provide chutes complying with NFPA 82.

B. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated.

1. Test Pressure: Test at atmospheric (neutral) pressure according to NFPA 252 or UL 10B.
2. Intake Door: Class B labeled; 1-1/2-hour fire rated with 30-minute temperature rise of 250 deg F.
3. Discharge Door: Class B labeled; 1-hour fire rated with 30-minute temperature rise of 250 deg F.
4. Access Door: Class B labeled; 1 and 1-1/2-hour fire rated with 30-minute temperature rise of 250 deg F.

C. 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.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Chute Source, LLC, Western Chute, Wilkinson Chutes Canada

    a. Diameter: Unless otherwise indicated on Drawings, 24 inch diameter model, 16 Gauge Aluminized steel. (Spiral duct type not Acceptable)
    b. Intake Doors: 21 inch wide by 21 inch tall, side hinged, hand operated, UL Listed intake doors with lockable Lever Handle. All doors are keyed alike.
    c. UL listed 24 inch wide x 30 inch tall top hinged hopper style discharge door held open with UL listed 165 F degree fusible link.
    d. Hopper to be mounted on a “double” pedestal tube stand, bolted to the floor.
    e. 24 inch diameter curb mounted x 16 gauge aluminized steel roof vent with insect screen.
    f. The chute shall be supported at each floor with a steel frame. The steel frame shall be mounted on factory isolators.

2.2 DOORS

A. Chute Intake Door Assemblies: ASTM A 240/A 240M, Hand Operated, Side Hinged, Type 304 stainless-steel finish, self-closing units with positive latch and Lever handle; as required to provide fire-protection and temperature-rise ratings indicated; and with frame suitable for enclosing chase construction.

1. Handles: Lever type, ADA compliant.
2. Finish: Manufacturer's standard satin or No. 3 directional polish finish and Trim.
3. Locks: Intake doors shall be is lockable type. All intakes shall use the same key. For each door, furnish 2 keys. Doors shall not be accessible to the public.
4. UL Listed Discharge-Door Assemblies per NFPA 82: Aluminized steel doors as required to provide fire-protection and temperature-rise ratings indicated; equipped with UL Listed fusible links that cause doors to close in the event of fire. U.S. 16 gauge (1.6 mm) aluminized steel type “H” hopper discharge door with 24” inch wide x 30” inches high, top hinged, hand operated door bearing 1-1/2 hour, 250°F with 165°F. fusible link. Reinforced bottom with 12 gauge impact plate. Hopper to be supported with a double 2” inch pipe pedestal and equipped with 2” inch, IPS drain flange for connection by plumber, as required by city or building and/or fire codes.

B. ADDITIONAL REQUIREMENTS

1. Electrical Interlocks: Interlock system operated from the laundry room to automatically lock intake chute doors during shut down hours and service operations. Electrical Interlock system that is energized by opening one intake door; remaining chute doors automatically lock when system is energized. (Installation and testing of Line and Low Voltage wiring by a Licensed Electrical contractor).

2. Flushing Spray / Sanitizing Unit: NPS 3/4 disinfecting and sanitizing spray head unit located in chute above highest intake door, including 1-gal. tank and adjustable proportioning valve with bypass for manual control of sanitizing and flushing operation, ready for hot-water piping connection, and with access for head and piping maintenance. (Installation and testing of water piping and back flow preventer by Licensed Plumbing contractor).
3. Access Door Assemblies for Flushing Spray / Sanitizing Unit (if wash down is installed in shaft) Manufacturer's standard ASTM A 240/A 240M, Type 302/304 stainless-steel finished doors and trim; as required to provide fire-protection and temperature-rise ratings indicated; with frame suitable for enclosing chase construction; and in satin or No. 3 directional polish finish.

2.3 ACCESSORIES

A. Fire Sprinklers per NFPA 82: NPS 1/2 fire sprinklers ready for piping connections. (Installation and testing of piping by Licensed Fire Protection Sprinklerfitter contractor).

2.4 FABRICATION

A. General: Factory-assemble chutes to greatest extent practical with continuously welded or lock-seamed joints without bolts, rivets, or clips projecting on chute interior. Include intake-door assemblies and metal supporting framing at each floor, and chute expansion joints between each support point.

B. Fire Sprinklers: Comply with NFPA 13. Locate fire sprinklers at or above the top service opening of chute, within the chute at alternate floor levels in buildings more than two stories tall, and at the lowest service level.

C. Equipment Access: Fabricate chute with access for maintaining equipment located within the chute, such as flushing and sanitizing units, fire sprinklers, and plumbing and electrical connections.

D. Exterior Sound Coating not required for linen chutes.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Comply with NFPA 82 requirements and with chute manufacturer's written instructions. Assemble components with tight, non-leaking joints. Anchor securely to supporting structure to withstand impact and stresses on vent units. Install chute and components to maintain fire-resistive construction of chute and enclosing chase.

B. Install chute plumb, without offsets or obstructions that might prevent materials from free falling within chute.

C. Anchor chute’s roof vent counter flashing to roof curb after installation of roofing and flashing

D. Intake and Discharge Doors: Interface door units with throat sections of chute for safe, snag-resistant, sanitary depositing of materials in chute by users.

E. Electrical Interlock wiring: Comply with applicable local building regulations.

F. Test chute components after installation. Operate doors, locks, and interlock systems to demonstrate that hardware is adjusted and electrical wiring is connected correctly.

1. Complete test operations before installing chase enclosures around chute.

G. Test fire sprinklers for proper operation.

H. Operate sanitizing unit through one complete cycle of chute use and cleanup, and replenish chemicals or cleaning fluids in unit containers.

3.2 DEMONSTRATION

A. Demonstrate use of chute and equipment to Owner's personnel.

B. Demonstrate replenishment of sanitizing-unit chemicals or cleaning fluids.

END OF SECTION 149100

SECTION 210500

COMMON WORK RESULTS FOR FIRE SUPPRESSION

PART 1 - GENERAL

1.1 DESCRIPTION

A. All work specified in this Section is governed by the Common Work Results for Plumbing Section 220500.

B. This Section 210500 and the accompanying drawings cover the provisions of all labor, equipment, appliances, and materials and performing all operations in connection with the engineering, design and construction of the fire suppression systems as specified herein and as shown.

C. Attention is called to the different hazards, classes and types of fire suppression systems required within the facility. Systems shall include, but not be limited to the following:

1. Light hazard
2. Ordinary hazard

D. The work included under this Section 210500 shall include, but is not limited to, the following:

1. Risers including all check valves, indicator valves, alarms, etc.
2. Standpipes, hose connections, hose cabinets and hoses
3. Siamese connections
4. Air compressor and controls
5. Piping and sprinkler heads
6. Hydraulic design computations
7. Shop drawings and procurement of all approvals

1.2 STANDARDS AND APPROVALS

A. The standpipes and sprinkler systems shall be designed and installed in conformance with the applicable standards of NFPA 13, NFPA 14, NFPA 20, NFPA 24, NFPA 72, Underwriters Laboratories (UL), the standards of the Underwriter (IRI/FM/ISO) and local codes.

B. The hydraulic calculations, standpipes and sprinkler system design, products, materials, and installation shop drawings shall be submitted and approved by the Authority Having Jurisdiction, Owner's Insurance Underwriter, and the Fire Marshal.

C. The standpipes and sprinkler systems shall be installed by a firm which is duly licensed to install such systems in the State of South Carolina and carries a current certificate from that State’s Fire Marshal's Office.

1.3 RECORD DRAWINGS

A. Upon completion of the work, provide record as-built documentation of the fire protection systems as actually installed to the Owner. Drawings shall be to scale, and shall include all details required to accurately indicate the system as installed. Record drawings shall be produced in electronic format compatible with AUTOCAD. Furnish electronic copies of all drawings in dwg. format, and two (2) bond copies of all drawing sheets.

1.4 IDENTIFICATION

A. All control, check, drain, test and alarm valves and alarms shall be provided with identification signs of the standard design as adopted by the sprinkler industry and as recommended for the particular services. The signs shall be securely attached to each piece of equipment.

1.5 HOSE THREADS

A. Hose threads shall conform to the standards of the local Fire Department. The exact threads used shall be verified with the Fire Department before ordering materials.

1.6 FIRESTOPS

A. Where piping, conduit, etc. pass through fire partitions, fire walls and floors, a firestop shall be provided that will ensure an effective barrier against the spread of fire, smoke and gases. Firestop material shall be packed tight and completely fill gaps between the ductwork, piping, conduit, etc. and the perimeter of their rough openings.

B. All penetrations shall be in accordance with UL 1479 or ASTM E 814 listed systems, and products used shall be specifically applicable for the appropriate installation conditions. Assemblies shall provide a minimum rating equal to the construction penetrated. Products shall be by HILTI, 3M, or ProSet.

C. Installation shall be by a Qualified Installer. Installer shall be certified, licensed, or otherwise qualified by the Firestopping Manufacturer as having the necessary training to install the Manufacturer's specific product. A Manufacturer or Vendor's willingness to sell the firestopping product to the Contractor or Installer does not in itself confer qualification.

D. Installer shall have at least one of the following qualifications:

1. FM 4991 Approved Contractor
2. UL Approved Contractor
3. HILTI, 3M, or ProSet Accredited Fire Stop Specialty Contractor

E. Installing Firm shall have no less than 3 years of experience with firestop installation.

F. A Manufacturer's direct Representative (not Distributor or Agent) shall be on site during initial installation of firestop systems to train appropriate Contractor personnel in proper selection and installation procedures.

G. The Firestop Contractor or Installer shall supply As-Built documentation of each individual penetration location on the project. Documentation shall include a sequential location number, detailed description of the penetration location, size, and type, tested system number, type of assembly penetrated, and rating to be achieved. As-Built documentation shall be included with the close-out materials.

H. Identify through-penetration firestop systems with pressure-sensitive, self-adhesive, preprinted vinyl labels. Attach label permanently on both sides of penetrated construction in a visible location. The label shall include the following:

1. The words "Warning – Through Penetration Firestop System-Do Not Disturb"
2. Through Penetration firestop system designation and Manufacturer
3. Date of Installation

PART 2 - PRODUCTS

2.1 MINIMUM QUALITY LEVEL

A. All equipment and materials provided under this Section 210500 shall be new and of the best grade commercial quality, shall be of the latest design of the Manufacturer, and shall be listed and approved by UL and the Underwriter. Materials and equipment manufactured outside of the United States will not be acceptable. All components shall be suitable for the pressures indicated on the flow test.

2.2 FIRE PUMP AND ACCESSORIES

A. The fire pump, jockey pump, controllers, automatic transfer switch and all associated accessories shall be provided as shown and specified and in accordance with NFPA 20. The fire pump and accessories shall be as manufactured by Peerless, Patterson, Fairbanks-Morse, Firetrol, or an approved equal. Fire pump shall be horizontal split-case type. The controller/starter shall be Wye-Delta, closed transition type.

B. Fire pump, fire pump controller, jockey pump, and jockey pump controller shall be factory pre-piped and wired per all requirements of NFPA 20. Sensory lines will be piped to controllers and all wiring shall be complete from the controllers to the motors. A line size bypass with valves shall be provided, as well as a test loop with Venturi flow sensor with meter. Entire package shall require only suction and discharge piping connection and electrical power connections to fire jockey pump controller. Entire package shall be rated and hydrostatically tested to 200 psig.

C. A listed surge protection device shall be installed in or on the fire pump controller in accordance with the current edition of the National Electric Code. Provide a Type I surge protection device per the current edition of UL 1449; Current Technologies SL3 Series or approved equal. The unit's withstand rating shall be coordinated with Division 26 and shall comply with all UL 96A requirements for surge protection.

2.3 AIR COMPRESSOR AND TRIM

A. Air compressor shall be a Reliable Model A, minimum ¾ HP. All trim, such as, but not limited to, the following shall also be provided to accomplish a dry-pipe installation:

1. Air maintenance device
2. Dry pipe valve
3. Automatic controls

2.4 VALVES

A. All fittings shall be products of a domestic Manufacturer and made in the USA.

B. Materials shall be as follows:

1. Valves 2" and smaller: Bronze body
2. Valves over 2": Iron body with bronze trim

C. Connections shall be as follows:

1. Valves 4" and smaller: Threaded or flanged
2. Valves over 4": Flanged

D. Gate valves shall be double seat; type as follows:

1. Valves 2" and smaller: Rising stem type, except where space requires non-rising stem, solid wedge with union bonnet and replaceable seat rings
2. Valves over 2": Outside screw and yoke type with solid wedge and replaceable seat rings

E. Butterfly valves shall have bronze or ductile iron discs, stainless steel shaft and lock bolts, Buna N liner and as follows:

1. Valves through 6": Full lug type with wheel operators
2. Valves over 6": Full lug type, gear operators

F. Fire Department Connections (FDC) shall be 2 1/2" screwed, UL approved, brass hose valves for working pressure of 175 psig with 2 1/2" male hose threads, 1 1/2" removable reducer, polished brass cap and chain. Contractor shall confirm this meets the local Fire Department requirements.

G. Provide and install Test Headers of quantity, location, and type as required by the local Fire Department and AHJ.

H. Swing checks shall be gravity operated with renewable composition discs. Wafer checks shall have renewable clapper facings and non-stick coated clappers, valve shall be approved for both horizontal and vertical installation.

I. All valves shall comply with requirements of NFPA and shall be Underwriters' Laboratories, Inc. (UL) listed.

J. Working pressure of all valves shall be minimum 175 psig at 70°F water temperature.

K. All valves utilized for shut-off service shall be lockable in the open position.

L. Alarm valves shall have electrical circuit closers.

2.5 ROOF MANIFOLDS

A. Roof manifolds shall be Y-type, 4" x 2 1/2" x 2 1/2"; brass construction complete with caps and chains. Contractor shall confirm connections with the local Fire Department and AHJ.

2.6 FIRE DEPARTMENT SIAMESE CONNECTIONS

A. Provide 2-1/2" x 2-1/2" x 4", chrome plated, lettered "Standpipe & Auto-Spkr", threads to match local Fire Department, with caps and chains. Contractor shall confirm connections with the local Fire Department and AHJ.

2.7 DRAINS

A. Drains shall be provided in all risers and auxiliary drains at all low points in the system. Inspector's test drains shall be installed on each sprinkler system.

B. Pipe the main drain and test lines full size to the outside. Do not spill on walkways. Branch drain lines that are expected to be seldom used may be provided with standard size hose end connections if allowed by the local Fire Department and the AHJ.

C. Pipe small drips and drains to the outside of the building or to an indirect drain within the building.

2.8 WATER FLOW SWITCHES

A. Water flow switches with normally closed electrical contacts shall be provided in all required locations to open the electrical contacts at any time water flows in the associated riser or zone piping system.

2.9 TAMPER SWITCHES

A. Tamper switches with normally closed electrical contacts shall be provided in all required locations to open the electrical contacts at any time the associated valve is not fully open.

2.10 ALARM SYSTEM

A. Provide interlocks to the building fire alarm system to provide automatic signaling to an approved remote location with adequate dialing and communication system to alert the local fire department. Connection and leased line shall be provided by Owner.

2.11 SPRINKLER HEADS

A. All sprinkler heads shall be automatic, closed-type, quick-response, standard spray heads.

B. Sprinkler Heads in Ceilings

1. All non-guest areas with suspended ceilings, except specialty ceilings, shall have heads equal to Reliable Model G, semi-recessed type. Finish shall be as selected by the Architect.
2. All public areas shall be provided with concealed, fully recessed heads. Finish shall be as selected by the Architect.
3. All hard and specialty ceiling areas, including metal panel and plank ceilings, shall be provided with concealed, fully recessed heads. Cover finish shall be as selected by the Architect. Finish shall be by the Manufacturer and be incorporated in the manufacturing facility.

C. Sprinkler heads installed in storage, utility, mechanical equipment rooms and similar “back-of-house” areas without ceilings shall be bronze heads in the upright position unless otherwise noted.

D. Areas subject to freezing conditions with heated spaces above or adjacent to them shall be provided with dry sprinkler heads. Seal all penetrations and provide wet sprinkler piping inside the heated space with insulation.

E. All freezers and coolers shall be provided with dry sprinkler heads. Seal all penetrations per the cooler/freezer manufacturer’s recommendations. Provide wet sprinkler piping above freezers and coolers with insulation.

F. The temperature rating of the sprinkler heads shall be in accordance with applicable code and the recommendations of the Underwriter. Specific attention is called to sprinkler heads within cooking areas, generator rooms, or other areas with temperature levels over 120°F expected.

G. Sprinkler guards shall be provided for all heads within seven feet of the floor, in mechanical, electrical and storage rooms, and elsewhere as required by the Underwriter.

H. Provide to the Owner a cabinet containing two (2) head wrenches and a minimum of six (6) spare heads of each type and temperature rating used in the systems.

I. All heads installed in areas with tile ceilings shall have the heads centered in the tile.

2.12 PIPING

A. All piping shall be products of a domestic Manufacturer and made in the USA.

B. Piping shall be Schedule 40, grade A53 or A120; except that Schedule 10 piping is acceptable on pipe sizes 2 1/2" and larger where permitted by the applicable codes and standards. Schedule 10 piping shall not be threaded in the field, nor shall be cut-grooved in the field or by a Manufacturer. Couplings and fittings shall be threaded or grooved, Viking, Victaulic, or approved equal.

C. The use of light-wall threaded pipe such as Allied XL is prohibited.

D. When specifically approved by the Engineer and allowed by the Fire Marshal, and AHJ, piping and fittings shall be CPVC and comply with NFPA 13R, 13D, and 13. Piping shall be Schedule 40 up to 12", UL Listed and FM Approved for fire protection use, and shall comply with ASTM F 442. CPVC piping and fittings in return air plenums shall be ICC certified. When CPVC materials are used, the Construction Team shall be responsible for the compliance with all compatibility issues. CPVC fittings shall be UL Listed and FM Approved and joined in accordance with the listings of the pipe and fittings. Cure times shall be in accordance with manufacturer's recommendations but not less than 24 hours. CPVC piping shall only be used in system locations that do not exceed its listed maximum pressure and temperature.

1. Any piping or fittings that contacts non-compatible materials shall be replaced with new.
2. Manufacturer's material compatibility requirements or recommendations shall be posted on CPVC products in not less than 100' intervals during construction. In addition, Manufacturer's compatibility requirements shall be permanently posted in the fire service entrance, backflow preventer location, and all mechanical and utility rooms or closets as applicable, and at any transition from metal to CPVC piping. Coordinate postings with Owner.

E. At the Contractor's option, individual drops to sprinkler heads may be flexible corrugated stainless steel hose with stainless steel braid, approved by both Factory Mutual and UL Flexible hose shall be secured above the ceiling with galvanized sheetmetal brackets and clamps. Flexible hose, brackets and clamp shall be as manufactured by Flexhead Industries, Inc. or an approved equal.

F. Underground sprinkler entrance piping shall be Class 150 ductile iron pipe with mechanical joints. Underground piping shall have thrust blocks at changes in direction.

2.13 PIPE HANGERS AND SUPPORTS

A. Provide all necessary hangers, supports, bracing, accessories, etc., as required for proper installation of the work, and only approved type hangers shall be used. All sprinkler piping shall be supported from building structure; sprinkler lines under ducts shall not be supported from ductwork but shall be supported from building structure with trapeze hangers where necessary.

B. At a minimum, sprinkler piping supports shall be at intervals defined by code.

C. Piping supported from floors shall be provided with steel support bases.

2.14 ESCUTCHEONS

A. Each penetration through walls and ceilings shall be equipped with a escutcheon, finish to be selected by the Architect, at the point the pipe passes through the wall or ceiling.

PART 3 - EXECUTION

3.1 DESIGN AND INSTALLATION

A. The design and installation of the fire suppression systems shall be based on the hazards and classes required by the occupancies indicated.

B. Underground piping shall be provided with a minimum of 3'-0" of ground cover or below the frost line, whichever is deeper. Concrete thrust blocks shall be provided at all changes of direction. Provide restraining rods at all mechanical joints.

3.2 CLEANING, LUBRICATION AND ADJUSTMENT

A. The exterior surfaces of all equipment, piping, conduit, etc., shall be cleaned and free of all dirt, grease, oil, paint splatter, and other construction debris.

B. Bearings that require lubrication shall be lubricated in strict accordance with the manufacturer’s recommendations.

C. All control equipment, valves, equipment settings, pressure tanks, etc. shall be adjusted to the settings required for the performance specified.

D. All materials, equipment, etc. subject to weather, corrosion, dust, debris, water etc. to be installed or utilized for the project shall be fully protected. This is inclusive of piping and duct openings and internal fan ventilation intakes and discharges. This Division’s scope includes protection and remediation of any and all Division materials, etc. including cleaning, vacuuming, dusting, etc. required for a clean system and operation. Insulation and equipment with electrical connections subject to water shall be replaced in their entirety. Coordinate with all other trades and schedules.

3.3 PAINTING

A. Steel items exposed outside the building, such as equipment supports, uninsulated piping and hangers, which are not factory painted or galvanized, shall be cleaned and painted with one coat of rust inhibiting primer and two coats of asphaltic base aluminum paint. Insulated steel pipes outside the building shall be cleaned and painted with one coat of rust inhibiting primer before installing insulation.

B. Items in exposed ceiling areas shall be painted a colour in coordination with the Architect as allowed by code.

3.4 SUBMITTALS

A. Before preparing submittals, study all Contract Drawings and specifications in detail, obtain manufacturer's recommended instructions, and have submittals prepared based on specific equipment and material proposed for installation. An officer of the contracting firm shall sign all shop drawings (certifying conformance with plans and specifications) before submitting to the Architect or releasing to the field.

B. The submittal process shall not be utilized as an avenue to substitute products after the execution of the contract. Should an unspecified or unequal product be submitted, it will be rejected. If a second attempt at substitution is made during the resubmittal of the same product,

then no more reviews of that product will be performed without direct compensation to the Engineer being paid for the additional services required for the third review and any further reviews.

C. All submittals shall be submitted and returned electronically.

D. Submittals will not be accepted for review unless they:

1. Comply with the requirements of Division 1.
2. Include complete information pertaining to all appurtenances and accessories.
3. Are submitted as complete packages which pertain to all related items in Division 21. Separate packages shall be submitted as follows:

    a. All fire protection equipment, piping, specialties, and components

4. Are properly marked with equipment, service or function identification as related to the project and are marked with pertinent specification paragraph number.

E. Submit catalog information, factory assembly drawings, field installation drawings and certifications as required for complete explanation and description of all items of equipment. The submittal data shall provide ample, unquestionable compliance with the Contract Documents.

F. Review of submittals shall not be construed as authorizing any deviations from the plans and specifications unless such deviations are clearly identified and separately submitted in the form of a letter that is enclosed with the submittals.

G. Submittals are required on all manufactured equipment, especially energy consuming equipment. Submittals shall include, but are not limited to, the following items of equipment:

1. Piping and Piping Specialties
2. Sprinkler Heads
3. Piping Shop Drawings
4. Hydraulic Calculations
5. Fire Pump, Jockey Pump, and Controllers
6. Air Compressor

3.5 BIM AND COLLISION DETECTION

A. The Contractor shall utilize 3D modeling for coordination and collision / interference detection software simulation. This model will be used for coordination, collision detection and inference from all trades: mechanical, plumbing, electrical, fire protection, etc. Each SubContractor is responsible for preparation of a 3D/BIM model of their system for Contractor collision detection and coordination. This model shall be used for As-Built documentation for the Owner. Contractor 3D Model shall be latest version of Revit, Navisworks, or equal. BIM shall abide by the space priority requirements in this Division.

B. Upon completion of the BIM Model, provide the Engineer a full set of shop drawings for their review. Shop drawings shall meet the below requirements.

3.6 SHOP DRAWINGS

A. Shop drawings per the submittal requirements shall be submit to the Design Team with adequate time for multiple rounds of review. Shop drawings shall show “As-Built” conditions including elevations, offsets, transitions, and accessories. Shop drawings shall indicate all code

and manufacturer's recommended clearances, access, and coordinate the clearance and access requirements with all other trades.

B. Shop drawings that use keynotes direct from the Design Documents shall not be acceptable as they do not demonstrate coordinate with all other trades, necessary transitions, etc.

C. Shop drawings shall be provided as complete packages in parallel with all trades to document coordination. Floor-by-floor or otherwise piecemeal shop drawings are generally not acceptable.

3.7 FLUSHING

A. All underground lines, before connecting to the sprinkler systems, shall be flushed thoroughly in accordance with NFPA procedures.

3.8 TESTING

A. The entire sprinkler system shall be tested at not less than 200 psi for not less than 2 hours. All leaks discovered shall be repaired by tightening, replacing or re-working the leaking component or joint. Caulking or similar is not permitted.

3.9 WARRANTY

A. All work provided under this Division 21 shall be subject to a minimum one year warranty. The warranty shall include prompt repair or replacement of equipment or system failures and shall include all parts and labor. In addition, all compressors shall carry an additional four year parts-only warranty. Extended warranties shall be provided on all other equipment so specified in other Sections.

END OF SECTION

SECTION 220500

COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 DESCRIPTION

A. This Division 22 and the accompanying drawings cover the provision of all labor, equipment, appliances, and materials and performing all operations in connection with the construction of the plumbing systems as specified herein and as shown.

B. All work specified in this Section is governed by the Common Work Results for Plumbing 220500.

C. The General Provisions and Division 1, including the general, supplementary and other conditions and other Divisions, as appropriate, apply to work specified in this Division.

1.2 EXISTING CONDITIONS

A. Attention is called to the fact that some work is to be performed within an existing, operational facility. Prior to the submission of bids, each bidder shall visit the project site, thoroughly investigate and be familiar with all existing conditions which will affect their work; especially the work to be performed above the existing ceilings.

B. Connect new work to existing work in a neat and workmanlike manner. Where an existing structure must be cut or existing utilities interfere, such obstructions shall be bypassed, removed, replaced or relocated, patched and repaired. Work disturbed or damaged shall be replaced or repaired to its prior condition.

1.3 INTENT OF DRAWINGS AND SPECIFICATIONS

A. The implied and stated intent of the drawings and specifications is to establish minimum acceptable standards for materials, equipment and workmanship, and to provide operable plumbing systems complete in every respect.

B. The engineering drawings are diagrammatic, intended to show general arrangement and sizes of system components, and shall not be scaled. Rather, the architectural and structural drawings shall govern space constraints, dimensions and finishes. All offsets and fittings which will be necessary to accomplish the finished installation shall be provided at no additional cost or increase in the Contract.

1.4 SPACE PRIORITY

A. Ensure optimum use of available space for materials and equipment installed above ceilings. Allocate space in the order of priority as listed below except as otherwise detailed. Items are listed in the order of priority, with items of equal importance listed under a single priority number.

1. Gravity flow piping systems
2. Vent piping systems
3. Recessed lighting fixtures
4. Concealed HVAC terminals and equipment
5. Air duct systems

6. Sprinkler piping systems
7. Pressurized piping systems
8. Electrical conduit, wiring, control air tubing

B. Order of space priority does not dictate installation sequence. Installation sequence shall be as required to install all affected trades.

C. The work of this Division 22 shall not obstruct access for installation, operation and maintenance of the work of any other Division.

D. All major items of equipment shall be arranged so as to provide a minimum of 28" clear aisle space. Additional space shall be provided between and around equipment for maintenance and proper operation as shown in the Equipment Manufacturer's literature.

1.5 COORDINATION

A. Coordinate all work under this Division 22 with work under all other Divisions, providing adjustment as necessary.

B. Coordination of space requirements with respect to Division 26 shall be performed such that:

1. No equipment, piping or ductwork, other than electrical, shall be installed within 42" of switchboards or panelboards.
2. No piping or ductwork which ever operates at a temperature in excess of 120°F shall be installed within 3" of any electrical conductor.

C. All items mounted in or below the ceiling, and all items penetrating the ceiling, shall be coordinated with the architectural reflected ceiling plans. If any items are not shown on these plans, or any items need to be relocated for coordination purposes, prepare a reflected ceiling plan and submit it to the Architect for approval.

1.6 CODE COMPLIANCE

A. All workmanship and materials provided under this Division 22 shall comply with all laws, ordinances, codes and regulations of all Federal, State and Local Authorities Having Jurisdiction.

B. All fire suppression, plumbing, heating, ventilating, and air conditioning materials and workmanship shall comply with all local, state, and federal codes and the following standards as minimum requirements:

1. NFPA 70, National Electrical Code, 2017 Edition
2. Life Safety Code (NFPA 101) – 2015 Edition
3. All other NFPA Codes and Standards – Applicable Editions
4. ASME A17.1 Safety Code for Elevators and Escalators – 2013 Edition
5. American with Disabilities Act, January 26, 1992
6. American National Standard Handicapped Code, A117.1 - 1986 Edition

C. Secure and pay all fees associated with all permits and licenses required for execution of the Contract. Arrange for all inspections required by City, County, State and other Authorities Having Jurisdiction, and deliver certificates of approval to the Architect.

D. The code requirements are strictly a minimum and shall be met without incurring additions to the Contract. Where requirements of the drawings or specifications exceed the code

requirements, the work shall be provided in accordance with these drawings or specifications. In the event of conflict or ambiguity between the various codes, the most stringent requirement shall govern.

1.7 ELECTRICAL REQUIREMENTS AND INTERFACE

A. All electrical equipment and wiring provided under this Division 22 shall comply with the electrical system characteristics indicated on the electrical drawings and specified in Division 26.

B. Electric controls, contactors, starters, pilot lights, push buttons, etc., shall be provided complete as part of the motor, heater or other equipment which it operates. All electrical components shall be in conformance with the requirements of the National Electrical Code and Division 26. Starters shall be wye-delta, closed transition type. Reference Division 26 and the electrical engineering drawings for those motor starters provided under that Division 26. All starters not shown shall be provided under this Division 22. Unless specified otherwise under other individual equipment Sections, motor starters shall conform to the following minimum requirements:

1. Starters for motors 1/3 horsepower or smaller shall be manual unless remote or automatic starting is required, in which case the starters shall be magnetic, full voltage, non-reversing, single-speed, unless otherwise indicated. All other starters shall be magnetic.
2. Each starter for a three-phase motor shall be furnished with three (3) overload relays sized for the full load running current of the motor actually provided. Provide an external "HAND-OFF-AUTO" selector switch with red "RUNNING" light. Provide a green pilot light to indicate motor "STOPPED". Each pilot light shall have a legend plate indicating reason for signal.
3. Each overload relay shall have a normally open alarm contact which will close only when actuated by an overload (not to be confused with N.O. or N.C. auxiliary contacts). These contacts shall be properly wired to their respective blue pilot light provided on the starter front cover and having a "TRIPPED" legend plate.
4. Individually mounted motor starters shall be in a NEMA Type 1 general purpose enclosure in unfinished areas and shall be flush mounted in all finished areas. All starters mounted in exterior areas shall have a NEMA 3R enclosure. Each starter shall have a laminated nameplate to indicate equipment unit number, function and circuit number.
5. All motor starters, push buttons and pilot lights shall be of the same manufacturer as the switchboard and shall be General Electric, Square D, Siemens I.T.E., or Westinghouse.

C. Motor starters for the following equipment shall be provided under this Division 22 by the Manufacturer of the equipment:

1. Packaged booster pump systems
2. Pumps without VFDs
3. Other equipment hereinafter specified in other Sections to be provided with integral starters

D. Unless otherwise noted or specified in individual Sections, all 3-phase motors shall be standard NEMA continuous duty "B" type, with Class B insulation, open drip-proof frame for indoor service, TEFC for outdoor service and a service factor of 1.15. All motors 5 HP and larger shall be U.S. Motors Hi-Efficiency Model or Reliance XE Hi-Efficiency Model.

E. All power wiring and final connections to equipment shall be provided under Division 26.

F. Control components, all interlocks (control valves, leak sensors, etc.) and control wiring (120 volt, single phase and less) shall be provided under this Division 22 as required to achieve the specified control sequences.

G. All control wiring over 30 volts shall be installed by a Licensed Electrician working under this Division 22.

1.8 SLEEVES, SEALS AND ESCUTCHEONS

A. Sleeves shall be provided through all pipe penetrations of concrete or masonry walls, elevated floors and roofs, except those plumbing piping penetrations for fixtures, vents, etc.

B. Sleeves shall be fabricated from Schedule 40 steel pipe through 10" and Standard Wall steel pipe for sleeve sizes 12" and larger. All sleeves penetrating exterior walls, underground walls, pit or vault walls shall be provided with a 3" x 3/8" thick waterstop ring welded completely to the midpoint of the sleeve.

C. All sleeves penetrating exterior walls, underground walls, pit or vault walls and elevated floors shall be packed and sealed watertight.

D. Sleeves through roofs shall extend above the roof surface and be flashed watertight.

E. Sleeves through walls shall be cut and finished flush with each surface of the wall in which they are installed.

F. Sleeves through elevated floors shall extend at least ½” above the finished floor and be sealed waterproof between the sleeve and slab.

G. Sleeves shall be sized to provide a minimum of 1/2" clearance between the inside surface of the sleeve and the outside finished surface of the pipe plus any insulation specified.

H. Fire-stops shall be provided as specified herein. All annular spaces between piping and sleeves which do not require fire-stops shall be packed with mineral wool and caulked.

I. Fire-stopping or packing at elevated floor penetrations shall be level with or above the elevation of the top of sleeve to prevent any water ponding on top of the sleeve.

J. Provide round, chrome-plated escutcheons on all exposed piping penetrations passing through walls, floors, partitions and ceilings.

K. All penetrations through rated slabs, walls, etc. shall be in accordance with UL listed systems. Provide rated box-out, fire caulking, etc. as needed to ensure fire rating is maintained in compliance with UL listed systems.

1.9 FIRESTOPS

A. Where piping, conduit, etc. pass through fire partitions, fire walls and floors, a firestop shall be provided that will ensure an effective barrier against the spread of fire, smoke and gases. Firestop material shall be packed tight and completely fill gaps between the ductwork, piping, conduit, etc. and the perimeter of their rough openings.

B. All penetrations shall be in accordance with UL 1479 or ASTM E 814 listed systems, and products used shall be specifically applicable for the appropriate installation conditions.

Assemblies shall provide a minimum rating equal to the construction penetrated. Products shall be by HILTI, 3M, or ProSet.

C. Installation shall be by a Qualified Installer. Installer shall be certified, licensed, or otherwise qualified by the Firestopping Manufacturer as having the necessary training to install the Manufacturer's specific product. A Manufacturer or Vendor's willingness to sell the firestopping product to the Contractor or Installer does not in itself confer qualification.

D. Installer shall have at least one of the following qualifications:

1. FM 4991 Approved Contractor
2. UL Approved Contractor
3. HILTI, 3M, or ProSet Accredited Fire Stop Specialty Contractor

E. Installing Firm shall have no less than 3 years of experience with firestop installation.

F. A Manufacturer's direct Representative (not Distributor or Agent) shall be on site during initial installation of firestop systems to train appropriate Contractor personnel in proper selection and installation procedures.

G. The firestop Contractor or Installer shall supply As-Built documentation of each individual penetration location on the project. Documentation shall include a sequential location number, detailed description of the penetration location, size, and type, tested system number, type of assembly penetrated, and rating to be achieved. As-Built documentation shall be included with the close-out materials.

H. Identify through-penetration firestop systems with pressure-sensitive, self-adhesive, preprinted vinyl labels. Attach label permanently on both sides of penetrated construction in a visible location. The label shall include the following:

1. The words "Warning – Through Penetration Firestop System-Do Not Disturb"
2. Through Penetration firestop system designation and Manufacturer
3. Date of Installation

1.10 CORE DRILLING

A. Cutting of holes through concrete and masonry shall be by diamond core or concrete saw. Pneumatic hammer, impact electric and hand or manual hammer type drills will not be allowed, except as permitted by the Architect where required by limited working space. Locate holes such that they will not affect structural sections such as ribs or beams. Holes shall be laid out well in advance of the installation. These layout locations shall be approved by the Architect prior to drilling.

1.11 IDENTIFICATION OF PIPING

A. All aboveground plumbing systems piping and valves sized 3/4" and larger which are installed in accessible locations (including piping above removable ceilings and behind access panels) shall be identified in strict conformance with the "Scheme for the Identification of Piping Systems" (ANSI A13.1-2015)

B. Piping labels in exposed areas shall be oriented and located in coordination with the Architect.

C. System names shall, at minimum, uniquely identify the system and performance category - i.e. 140°F Hot Water Supply, High Pressure Cold Water, etc.

D. Specialized piping (grease waste, acid waste, fuel piping, etc.) installed underground shall be labeled. The label shall be corrosion resistant or shall be permanently marked.

E. Each identification marker shall include the following:

1. Proper color-coded background
2. Proper color of legend in relation to background color
3. Proper legend letter size
4. Proper marker length
5. Direction of flow arrow shall be included on each marker

F. Locations for pipe markers shall be as follows:

1. Adjacent to each valve and fitting
2. At each branch and riser take off
3. At each pipe passage through walls, floors and ceilings
4. On all straight pipe runs every 25 feet except that piping underground required to be labeled shall be labeled every 10 feet or more often as required by the AHJ

G. Identification markers may be stenciled or shall be Setmark Pipe Markers, as manufactured by Seton Name Plate Corporation.

H. All valves shall be identified with the appropriate service designation and valve number brass valve tags. Each valve tag shall be 19 gauge brass with 1/4" black-filled letters over 1/2" black-filled numbers. Tags shall be fastened to valves with brass "S" hooks or brass jack chain. Brass tags and fasteners shall be as manufactured by Seton Name Plate Corporation.

I. Provide charts of all valves. Valve charts shall include the following items:

1. Valve identification Number
2. Location
3. Purpose/Material

PART 2 - PRODUCTS

2.1 BID BASIS AND SUBSTITUTION PROCEDURES

A. Manufacturer names, series and model numbers, as noted or specified, are for the purpose of describing type, capacity, and quality of equipment, materials and products to be used. Unless "or equal" is specifically stated, bids shall be based only on the specified "basis of design" Manufacturer. The listing of a particular manufacturer as an "equal" or "acceptable substitute" manufacturer shall not be misconstrued as approving, nor allowing the substitution of, that Manufacturer's standard product in place of the basis of design. No consideration will be given to a product which would require dimensional, spatial or aesthetic changes to the project. "Acceptable substitute" and "equal" manufacturers shall only bid those products which exactly match the size and other characteristics of the specified basis of design. Any changes to other disciplines and trades of work required by an "or equal" or "substitute" product shall be duly considered and priced accordingly prior to bidding or pricing. The decision as to whether or not a proposed substitute or "equal" product is actually equal to that specified shall rest solely with the Architect.

B. Requests to provide "equal" products in lieu of those specified shall be submitted to the Architect in writing at least ten (10) days prior to final pricing and execution of the Contract. No

consideration will be given to substitute products after final pricing and execution of the Contract.

C. Any "or equal" product or proposed product substitution which will cause a change in the appearance, dimensions or design of any part of the building, structure, electrical system, or any other engineered systems shall be accompanied by a scaled drawing and written description of the required change(s) for approval by the Architect. If deemed necessary by the Architect, design changes shall be signed and sealed by a registered Professional Engineer, currently licensed in this State. This shall be performed under the Contractor selecting the substitution's scope.

D. Any and all changes due to a substitution of basis of design equipment including but not limited to electrical connection, physical size, access, piping connections, controls, etc. shall be solely the responsibility of Contractor selecting the substitution.

2.2 MINIMUM STANDARDS

A. Every piece of energy consuming equipment, all fire suppression products and life safety equipment shall comply with the following standards as applicable; especially in regard to prevailing codes:

1. Factory Mutual Laboratories (FM)
2. Industrial Risk Insurers (IRI)
3. Underwriters Laboratories, Inc. (UL)
4. ADC: Air Diffusion Council
5. AGA: American Gas Association
6. AMCA: Air Moving and Conditioning Association, Inc.
7. ANSI: American National Standards Institute
8. API: American Petroleum Institute
9. AHRI: Air Conditioning, Heating, and Refrigeration Institute
10. ASHRAE: American Society of Heating, Refrigerating and Air Conditioning Engineers
11. ASME: American Society of Mechanical Engineers
12. ASTM: American Society of Testing and Materials
13. AWWA: American Water Works Association
14. IBR: Institute of Boiler and Radiator Manufacturers
15. MSS: Manufacturers Standardization Society
16. NBBPVI: National Board of Boiler and Pressure Vessel Inspectors
17. NEMA: National Electrical Manufacturer's Association
18. OSHA: Occupational Safety & Health Administration
19. PDI: Plumbing Drainage Institute
20. PPI: Plastic Pipe Institute
21. CISPI: Cast Iron Soil Piping Institute

2.3 PIPE HANGERS AND SUPPORTS

A. Pipe hangers, hanger rods, trapeze type hangers, upper attachments and other supports shall be selected based on pipe size (plus insulation of pipes specified to be insulated) and the weight of the medium being transported or the medium used for testing, whichever is greater. Provide all hangers and rods, turnbuckles, angles, channels, and other structural supports to support the piping systems. Rods for pipe hangers shall be full size of the Hanger Manufacturer's catalog listed rod size for each type hanger specified. Hangers and supports shall be Michigan, ITT Grinnell or B-Line.

B. All material utilized for the hanging and support of the piping systems shall be manufactured products which are specifically intended for the purpose of hanging piping systems. The use of wire, steel straps, plastic ties, etc. is strictly prohibited.

C. Pipe hangers selected for supporting horizontal insulated piping shall be sized to fit around the outside of the pipe insulation. Insulated piping shall be supported on galvanized shields.

1. Shields shall be as follows:

a. Pipes 2" and smaller: 18 gauge x 12" long
b. Pipes 2 1/2" and larger: 16 gauge x 18" long

2. Shields shall be 180 degrees around the lower half of the pipe at all pipe hangers, except that on trapeze hangers, pipe racks and floor supported horizontal pipes, shields shall be 360 degrees around the entire pipe.

D. Pipe hangers touching copper piping shall be copper plated or the piping shall be dielectrically isolated from any steel hangers or clamps that are used. Note the requirement for domestic water piping requires the hangers to be installed over the insulation.

E. Steel rods, framing and clamps shall be plated or primed to prevent rust formation.

PART 3 - EXECUTION

3.1 GENERAL

A. All piping, valves, and fittings shall be products of a domestic Manufacturer and made in the USA.

B. Flexible piping connections shall be provided and installed at all suction and discharge connections of packaged booster pumps and at any pump 2.0 HP and above. Flexible piping connections shall be suitable for 150 psi working pressure or the system pressure at the installation location, whichever is greater, and be suitable for the temperature of the system. Flexible connections shall be stainless steel braided hose type, with a length not less than their pipe diameter. Provide and install restraining rods if recommended by the Manufacturer for the installation location and application.

C. Provide and install shut-off valves at any and all equipment including water heaters, domestic booster pumps, recirculation pumps, storage and pressure tanks, etc. and at any locations required by code, such as branch lines from risers serving more than one fixture. Shut-offs shall be in addition to those specifically shown or noted in the Contract Documents.

3.2 SUBMITTALS

A. Before preparing submittals, study all Contract Drawings and specifications in detail, obtain manufacturer's recommended instructions, and have submittals prepared based on specific equipment and material proposed for installation. An officer of the contracting firm shall sign all shop drawings (certifying conformance with plans and specifications) before submitting to the Architect or releasing to the field.

B. The submittal process shall not be utilized as an avenue to substitute products after the execution of the contract. Should an unspecified or unequal product be submitted, it will be rejected. If a second attempt at substitution is made during the resubmittal of the same product, then no more reviews of that product will be performed without direct compensation to the

Engineer being paid for the additional services required for the third review and any further reviews.

C. All submittals shall be submitted and returned electronically.

D. Submittals will not be accepted for review unless they:

1. Comply with the requirements of Division 1.
2. Include complete information pertaining to all appurtenances and accessories.
3. Are submitted as complete packages which pertain to all related items in Division 22. Separate packages shall be submitted as follows:

    a. All plumbing equipment, piping, specialties, and components
    b. All plumbing fixtures

4. Are properly marked with equipment, service or function identification as related to the project and are marked with pertinent specification paragraph number.

E. Submit catalog information, factory assembly drawings, field installation drawings and certifications as required for complete explanation and description of all items of equipment. The submittal data shall provide ample, unquestionable compliance with the Contract Documents.

F. Review of submittals shall not be construed as authorizing any deviations from the plans and specifications unless such deviations are clearly identified and separately submitted in the form of a letter that is enclosed with the submittals.

G. Submittals are required on all manufactured equipment, especially energy consuming equipment. Submittals shall include, but are not limited to, the following items of equipment:

1. Piping and Piping Specialties
2. Insulation
3. Heat Tracing
4. Water Heaters
5. Boilers
6. Water Storage, Pressure, Etc. Tanks
7. Pumps
8. Plumbing Fixtures
9. Piping Shop Drawings
10. Generators
11. Remote Fuel Fill Stations for Generators
12. Firestopping Products and Applicable UL Firestop Details

3.3 EXCAVATION, TRENCHING AND BACKFILLING

A. Perform all excavation, trenching and backfilling for underground work under this Division 22. During excavation, the excavated material shall be piled back from the banks of the trench to avoid overloading, slides or cave-ins. Do not exceed the angle of repose unless written approval is obtained in advance from the Architect for shoring, bracing or other alternate excavation methods. All excavated material not used for backfilling shall be removed from the building and disposed of as indicated or directed by the Architect. Take measures to prevent surface water from flowing into trenches and other excavations and any water accumulating therein shall be removed by pumping. All excavation shall be made by open cut. Tunneling shall not be allowed.

B. The bottom of all trenches shall be evenly graded to provide firm support and an even bearing surface. Pipe shall be laid on firm soil, laid in straight lines and on uniform grades. Provide bell holes so that the barrel of the pipe rests evenly on the bottom of the trench along the entire length of the pipe.

C. Pipe shall be inspected and tested prior to backfilling. Trench shall be handfilled to a minimum of 12" above the top of pipe with suitable earth (free of rocks, trash, large clods and organic material) and compacted to a minimum 95% proctor. After the first layer is completed, subsequent layers shall be filled and compacted the same as the first layer. Settling the backfill with water shall not be permitted.

3.4 INSTALLATION REQUIREMENTS

A. All equipment shall be installed in strict conformance with the recommendations of the Equipment Manufacturer, as indicated on the Drawings, and as specified.

B. Provide installation manuals for each piece of equipment. Submit in separately bound volumes after review of submittals.

C. Provide supplementary steel framing and welded steel equipment support stands as required for proper hanging and support of the plumbing systems. Steel angles, channels and tubing utilized for such framing shall be selected for a maximum deflection of 1/360th of the span.

D. All roof curbs shall be a minimum of 12" high and selected for the various roof pitches. Curbs installed on roofs having pitches of not more than 1/4" per foot may be standard curbs shimmed level with steel channels or Zs to provide suitable support and flashing surfaces.

3.5 CLEANING, LUBRICATION AND ADJUSTMENT

A. The exterior surfaces of all plumbing equipment, piping, conduit, etc., shall be cleaned and free of all dirt, grease, oil, paint splatter, and other construction debris.

B. Bearings that require lubrication shall be lubricated in strict accordance with the manufacturer’s recommendations.

C. All control equipment, valves, equipment settings, pressure tanks, etc. shall be adjusted to the settings required for the performance specified.

D. All materials, equipment, etc. subject to weather, corrosion, dust, debris, water etc. to be installed or utilized for the project shall be fully protected. This is inclusive of piping and duct openings and internal fan ventilation intakes and discharges. This Division’s scope includes protection and remediation of any and all Division materials, etc. including cleaning, vacuuming, dusting, etc. required for a clean system and operation. Insulation and equipment with electrical connections subject to water shall be replaced in their entirety. Coordinate with all other trades and schedules.

3.6 PAINTING

A. All uncoated and uninsulated steel surfaces exposed to sight inside the building, such as piping, equipment hangers and supports, which are not provided with factory prime coat or galvanizing, shall be cleaned and painted with one coat of rust inhibiting primer. In addition, all surfaces in finished spaces shall also be painted with two coats of finish paint in a color selected by the Architect.

B. Steel items exposed outside the building, such as equipment supports, uninsulated piping and hangers which are not factory painted or galvanized shall be cleaned and painted with one coat of rust inhibiting primer and two coats of asphaltic base aluminum paint. Insulated steel pipes outside the building shall be cleaned and painted with one coat of rust inhibiting primer before installing insulation.

C. Factory painted equipment that has been scratched or marred shall be repainted to match the original factory color.

3.7 PIPING LEAK TESTING

A. Sanitary, waste, storm, and vent piping shall be tested with water before installing fixtures. Water test shall be applied to the system either in its entirety or to the individual sections. Each opening except the highest opening of the section under test shall be plugged, and the section shall be filled with water and tested with a head of water of at least ten (10) feet above the highest point in the system. The water shall be kept in the portion under test, for at least thirty (30) minutes; no drop in the water level will be acceptable.

B. The water piping systems shall be tested at a minimum pressure of 125 psi, or 1.5 times the system operating conditions, whichever is greater, and proved tight at this pressure for not less than thirty (30) minutes or longer if required to permit inspection of all joints. No loss in pressure will be permitted.

C. All compressed air piping shall be tested pneumatically and proved tight at a pressure of not less than 100 psi for a period of not less than two (2) hours. No loss in pressure will be permitted.

D. All leaks shall be repaired by tightening, remaking joints, or replacing pipe and fittings. Caulking of joints shall not be permitted.

E. See specification section 231123 for testing requirements of natural gas and liquid propane gas piping. System shall be part of Division 22 scope unless otherwise arranged within the Contract. Coordinate with Division 23.

3.8 RECORD (AS-BUILT) DRAWINGS

A. At the completion of the project, provide a set of reproducible prints to the Architect which reflects all changes, deviations and revisions made to the original design documents. Locations of all underground piping and utilities shall be clearly shown and dimensioned from permanent reference points such as building column lines. Record drawings shall be produced in electronic format compatible with AUTOCAD. Furnish electronic copies of all drawings in dwg. format, and two (2) bond copies of all drawing sheets. As-Builts for electronic incorporation by the Design Team, as applicable, shall be redline mark-ups of the Construction Documents.

3.9 OPERATING AND MAINTENANCE MANUALS AND INSTRUCTIONS

A. Complete operating and maintenance manuals shall be provided to the Owner. Four copies shall be provided. Each copy shall be bound in a separate 3-ring, loose leaf notebook. Operating instructions shall be provided for each plumbing system, and shall each include a brief system description, a simple schematic and a sequence of operation. Operating and maintenance instructions shall be provided for each piece of equipment. A control system wiring diagram shall be included in each operating and maintenance manual.

B. Prior to final acceptance or beneficial occupancy, provide the services of a Competent Technician for not less than one (1) day to instruct the Owner in the operation of the plumbing systems.

3.10 MINIMUM HANGER SPACING

A. Pipe hangers or supports shall be provided within 18" of each horizontal fitting, equipment connection, valve, etc. and within 18” of the centerline of horizontal or vertical changes in direction summing to 90° or more. Specific attention is called to turns into vertical risers.

B. Piping supports shall be provided, at a minimum, in accordance with the greater of the below or code minimum. Where the below or code does not address support for specific piping, supports shall be in accordance with manufacturer’s requirements.

Piping Material	Max. Horz. Spacing	Max. Vert. Spacing
Cast-iron pipe	5’	15’
Copper pipe	12’	10’
Copper tubing ≤ 1-1/4” dia.	6’	10’
Copper tubing ≥ 1-1/2” dia.	10’	10’
CPVC pipe ≤ 1” diameter	3’	10’*
CPVC pipe ≥ 1-1/4” dia. 4’		10’*
PVC pipe	4’	10’*
PEX	32”	10’*

*Midstory guide required for piping 2” diameter and smaller

C. Riser clamps shall be provided at each floor penetration. For pressurized piping systems, provide vibration isolation at all riser clamps with two (2) pad-type mountings consisting of a minimum 3/8" thick ribbed or waffled elastomeric pads bonded between minimum 16-gauge galvanized steel separator plates. Pads shall be sized for a deflection of 0.12" to 0.16". Pads shall be minimum 3"x3" square.

3.11 WARRANTY

A. All work provided under this Division 22 shall be subject to a minimum one year warranty. The warranty shall include prompt repair or replacement of equipment or system failures and shall include all parts and labor. In addition, all compressors shall carry an additional four year parts-only warranty. Extended warranties shall be provided on all other equipment so specified in other Sections.

3.12 BIM MODELING AND COLLISION DETECTION

A. The Contractor shall utilize 3D modeling for coordination and collision / interference detection software simulation. This model will be used for coordination, collision detection and inference from all trades: mechanical, plumbing, electrical, fire protection, etc. Each SubContractor is responsible for preparation of a 3D/BIM model of their system for Contractor collision detection and coordination. This model shall be used for as-built documentation for the Owner. Contractor 3D Model shall be latest version of Revit, Navisworks, or equal.

B. Upon completion of the BIM Model, provide the Engineer a full set of shop drawings for their review. Shop drawings shall meet the below requirements.

3.13 SHOP DRAWINGS

A. Shop drawings per the submittal requirements shall be submit to the Design Team with adequate time for multiple rounds of review. Shop drawings shall show “As-Built” conditions

including elevations, offsets, transitions, and accessories. Shop drawings shall indicate all code and manufacturer's recommended clearances, access, and coordinate the clearance and access requirements with all other trades.

B. Shop drawings that use keynotes direct from the Design Documents shall not be acceptable as they do not demonstrate coordination with all other trades, necessary transitions, etc.

C. Shop drawings shall be provided as complete packages in parallel with all trades to document coordination. Floor-by-floor or otherwise piecemeal shop drawings are generally not acceptable.

3.14 OWNER TRAINING

A. Owner training shall be provided for all systems and equipment and shall include the following:

1. 8-hours of training for each type of equipment
2. 16-hours for overall system operational training

B. A training summary and schedule shall be submitted to the Architect for approval within ninety (90) days of the date of substantial completion.

C. Training timing will vary and shall be assumed to include multiple sessions as required by the Owner.

3.15 BID REQUIREMENTS

A. The Contractor shall include all systems, equipment and accessories shown on the plans and specifications.

B. The Contractor is responsible for providing all Contract Documents to all SubContractors. All systems, equipment and accessories shall be included in the bid, whether shown on the SubContractor applicable plans or other design documents.

C. Should any discrepancy occur in the Contract Documents, the Contractor shall provide a request for clarification prior to bid or note the discrepancy in the bid and provide an appropriate cost allowance in the bid.

D. The Contractor shall acknowledge that the Contract Documents are diagrammatic and shall provide all systems, equipment and accessories required for a complete facility. Any areas that appear to be void of systems or inappropriate systems shall be noted in the bid. No post bid change order shall be considered for areas or discrepancies not noted in the bid.

E. All installation coordination and means and methods and labor and materials required for proper system installation shall be included.

F. These requirements are in addition to bid procedures and requirements of the RFP or general specifications.

END OF SECTION

SECTION 220700

PLUMBING INSULATION

PART 1 - GENERAL

1.1 DESCRIPTION

A. All work specified in this Section is governed by the Common Work Results for Plumbing Section 220500.

B. This Section 220700 and the accompanying drawings cover the provision of all labor, equipment, appliances, and materials and performing all operations in connection with the insulation of the plumbing systems as specified herein and as shown. These systems include, but are not limited to, the following:

1. Sanitary waste and vent systems
2. Domestic water systems
3. Storm drainage systems

1.2 INTENT

A. It is the intent of this Section of the specifications to provide complete and operable plumbing systems complete with insulation, which are free of unreasonable noise, vibration and sweating, and fabricated so as to fit the space allotted.

B. The word "piping" is defined to mean all piping, fittings, joints, hangers, coatings, valves, cocks, insulation and accessories necessary for the plumbing systems described, shown and specified.

1.3 ACCEPTABLE MANUFACTURERS

A. Insulation products shall be as manufactured by Owens Corning, Knauf, Manville, Certainteed, Dow, Armacell, or Armstrong.

PART 2 - PRODUCTS

2.1 PLUMBING INSULATION

A. All pipe insulation products shall have a permanent composite insulation, jacket and adhesive fire and smoke hazard rating as tested by procedure ASTM-84, NFPA 255 and UL 723 not exceeding Flame Spread 25 or Smoke Developed 50.

B. Blanket-type insulation on storm drains shall have an average thermal conductivity (k-value) not to exceed 0.27 BTU per inch/h·ft^2·°F at a mean temperature of 75°F. Insulation shall have a minimum density of 1 lb/cu.ft. and shall be 2" thick.

C. Preformed insulation for all domestic hot water piping shall be minimum 1-1/2" thick for piping less than or equal to 1-1/2” diameter, 2” thick for piping above 1-1/2” in diameter, preformed fiberglass pipe insulation with white all-service jacket. All longitudinal joints shall be lapped, self-sticking type with all butt joints, tears, etc. sealed with a matching white vapor barrier tape. Elbows shall be mitered or may be Zeston covers filled with equivalent fiberglass insulation. The maximum conductivity (k-value) of the insulation shall be 0.23 BTU per inch/h·ft^2·°F at 75°F.

D. Preformed insulation for all domestic cold water piping, except trap primer piping underground, shall be minimum 1" thick, preformed fiberglass pipe insulation with white all-service jacket. All longitudinal joints shall be lapped, self-sticking type with all butt joints, tears, etc. sealed with a matching white vapor barrier tape. Elbows shall be mitered or may be Zeston covers filled with equivalent fiberglass insulation. The maximum conductivity (k-value) of the insulation shall be 0.23 BTU per inch/h·ft^2·°F at 75°F.

E. Insulation shall be continuous over all valve bodies, fittings, and wall and floor penetrations. Do not insulate unions on hot water piping; nor instruments, gauges, valve handwheels, etc. on any piping.

F. All piping insulation covering water-carrying piping which is exposed to the weather and subject to bursting from freezing temperatures shall have oversized insulation to accommodate heating cable. See specification 230533.

G. Piping installed outside the building and exposed to weather shall have polyisocyanurate insulation in accordance with specification 230719. Provide a continuous watertight aluminum jacket and fitting covers for all polyisocyanurate insulation piping exposed to the weather.

H. Closed-cell insulation shall be provided over all piping called to have insulation that is installed below ground. Closed-cell piping insulation shall match the thicknesses for above ground piping, 25/50 Armaflex or Rubatex. All glues and coatings shall be products of the same manufacturer as the insulation. The insulation shall be installed by the slip-on method; slitting of the insulation is prohibited and shall be cause for rejection.

PART 3 - EXECUTION

3.1 ARRANGEMENT

A. Follow the general piping layout, arrangement, schematics and details. Provide all offsets, vents, drains and connections necessary to accomplish the installation. Fabricate piping accurately to measurements established at the project site to avoid interference with ductwork, other piping, equipment, openings, electrical conduits and light fixtures. Make suitable provision for expansion and contraction with expansion loops and offsets.

3.2 INSULATION INSTALLATION

A. Provide blanket insulation over all horizontal roof drain piping which is within the building and including the vertical risers to the roof drains and the underbody of the roof drains.

1. Blanket insulation shall be wrapped around the piping and underbodies of roof drains. Ends of insulation shall overlap at least 2" and bottom of insulation shall overlap pipe insulation at pipe connection to roof drain at least 3". Adhere insulation to roof drain underbodies with 100% coverage of fire retardant adhesive and tape all joints with 3" wide foil reinforced kraft tape.

B. Provide insulation over all above ground hot and cold water piping, except that no insulation is required on cold water lines installed inside interior plumbing chases (those chases with no exterior wall). In addition, no insulation is required for cold water piping outside the building vapor barrier and designed to be drained down for freeze-protection, such as parking deck hose bibbs for washdown.

1. All joints and tears shall be sealed with matching white vapor barrier tape

C. See specification 230719 for HVAC piping insulation requirements.

END OF SECTION

SECTION 221000

PLUMBING PIPING

PART 1 - GENERAL

1.1 DESCRIPTION

A. All work specified in this Section is governed by the Common Work Results for Plumbing Section 220500.

B. This Section 221000 and the accompanying drawings cover the provision of all labor, equipment, appliances, and materials and performing all operations in connection with the construction of the plumbing systems as specified herein and as shown. These systems include, but are not limited to, the following:

1. Sanitary, waste, and vent systems
2. Domestic water systems
3. Storm drainage systems

C. Provide all final plumbing connections to all equipment furnished by Owner.

D. Provide isolation valve and reduced pressure backflow preventer or vacuum breaker at the service entrance and at those connections (especially to kitchen equipment) required by local plumbing code.

E. Note: See specification Section 231123 for natural gas piping. Natural gas piping shall be part of this Division’s scope unless otherwise coordinated. Coordinate with all trades.

1.2 INTENT

A. It is the intent of this Section of the specifications to provide complete and operable plumbing systems as shown and specified which are free of leaks, properly vented, free of unreasonable noise, vibration and sweating, and fabricated so as to fit the space allotted and to exhibit a minimum resistance to fluid flow.

B. The word "piping" is defined to mean all piping, fittings, joints, hangers, coatings, valves, cocks, insulation and accessories necessary for the plumbing systems described, shown and specified.

1.3 GENERAL REQUIREMENTS

A. Provide all reducing fittings, flanges, couplings and unions of the size and type of material to match the piping connections at each fixture, piece of equipment, valve and accessory.

B. Union joints, couplings or flanges shall be provided in each pipe line connected to each piece of equipment, fixture and elsewhere as indicated and specified. Unions shall match the piping system in which they are installed.

C. Unions or flanges shall be provided between all copper to steel connections. These unions shall be dielectric, insulating type.

D. All changes in direction and branches shall be made with manufactured fittings.

E. The use of offset-type reducers is strictly prohibited in any piping system.

F. In all water piping systems, changes in horizontal pipe line sizes shall be made with eccentric reducers installed flat on top for proper air venting. Reducing tees, reducing elbows and concentric reducers shall only be allowed in water piping systems for changing pipe sizes in vertical risers and for making connections to equipment and accessories from vertical risers.

G. All pipe joints shall be cut square and all burrs shall be removed.

H. Open ends of pipe lines not currently being handled shall be plugged during installation to keep dirt, water and foreign material out of the system.

I. Sanitary waste and storm drainage piping shall slope down in the direction of flow as shown on the drawings or as prescribed by Code, but not less than 1 percent.

J. All vents through roof (VTRs) shall be offset just below the roof such that their termination points are at least 15 ft from any outside air intake of any HVAC unit; special attention is called to packaged rooftop and dedicated make-up air units.

K. Trap primers shall be provided at all floor drains, floor sinks, trench drains, and hub drains except trap primers may be omitted where drain routes to the storm system. Route water piping from nearest cold water line and as allowed by code.

L. All piping, valves, and fittings shall be provided by a domestic Manufacturer and manufactured in the USA.

PART 2 - PRODUCTS

2.1 SANITARY WASTE AND VENT SYSTEMS

A. All underground sanitary waste and vent piping shall be PVC, DWV Solid Wall Schedule 40 with socket-type, solvent welded joints in sizes up to 12"; 14” and larger piping shall be PVC, DWV Solid Wall Schedule 80 with socket-type, solvent welded joints. All PVC piping shall be installed in accordance to ASTM D2321.

B. All aboveground sanitary, waste, and vent piping shall be hubless cast iron soil pipe. All cast iron soil pipe and fittings shall bear the collective trademark of the Cast Iron Soil Pipe Institute and shall be listed by NSF International or receive prior approval by the **Architect/Engineer. All hubless cast iron pipe shall conform to ASTM A 888 and CISPI Standard 301.

1. Vent piping less than or equal to 2.5” may be copper DWV. Piping shall meet ASTM B 75, B 88, B 251, and B 306.
2. Drain piping from equipment with high temperature discharge, such as kitchen warewashers, pot sinks, etc. shall be Type L hard drawn copper tubing with wrought copper fittings and soldered joints.

C. Joints on hubless cast iron soil pipe shall be made with neoprene couplings and stainless steel clamps. Gaskets shall conform to ASTM C 564. Couplings and gaskets shall be produced by the same manufacturer and shall be installed in accordance with the manufacturer’s recommendations, including band tightening sequence and torque. All couplings shall be manufactured to the CISPI 310 standard, ASTM C 1277, ASTM C 150, FM Standard 1680 Class I and certified by NSF International. Coupling shall be as follows:

1. 1 ½” to 3” - Two (2) stainless steel bands

2. 4” to 8” - Four (4) stainless steel bands
3. 10” to 15” - Heavy duty coupling with six (6) stainless steel bands. Heavy duty couplings shall conform to ASTM C 1540.

D. All offsets on 8” pipe and larger shall have metal restraining straps by Holdrite or approved equal.

E. Cleanouts shall be provided at the locations indicated and, as a minimum, where required by Code. Floor cleanouts shall be a minimum of 4" and shall be complete with a flush plug and removable, scoriated bronze floor plate. Provide carpet buttons in carpeted areas. Wall cleanouts shall be threaded cleanout tees and plugs with polished stainless steel coverplate with centerset screw.

F. All cleanouts located in areas that are subject to vehicular traffic shall be heavy duty, traffic rated, JR Smith Model 4253, with bronze cover or equal product by Josam or Zurn.

G. Floor drains in toilets and finished areas shall be JR Smith 2000 Series with 6" Type B square adjustable strainers finished in satin nickel bronze; or equal products by Josam or Zurn. Provide vandalproof secured tops.

H. Floor drains in mechanical rooms and unfinished concrete floors shall be JR Smith 2131 Series with round 11 3/4" cast iron grate, sediment bucket and deep-seal P-trap; or equal products by Josam or Zurn. Provide vandalproof secured tops.

I. Hub drains (HD) shall be made with a reducer fitting with opening at least one nominal size larger than the connected piping as scheduled. HDs shall be sized to receive all discharges without splashing.

J. Trench drains shall be 3.75” interior width, minimum 5” deep, 100% polypropylene, with integral rebar support, radiused bottom, channel with built-in slope, JR Smith 9930 Series or approved equal. Each drain length shall have an inline catch basin with sediment bucket and stainless steel overlay rails, and full coverage Load Class A slotted galvanized steel grate, JR Smith 9870-420-G or approved equal. Grate shall be subject to approval by Owner.

K. Trench drains (TD-1) located in driveways, parking spaces, and all other areas with vehicular traffic shall be precast polyester concrete with integral ductile iron edge rail and shall have bottom outlet, ADA compliant grate, 14” width, and Class C rating or better. Grate shall be secured to drain body. Trench drains shall be JR Smith 9807 or approved equal.

L. Trench drains (TD-2) located in walkways, terraces, and all other areas subject to solely pedestrian traffic shall be type 304 stainless steel with integral internal sloping and shall have bottom outlet, ADA compliant grate, 6” width, and class A rating or better. Trench drains shall be JR Smith 9660 or equal by Aco, Josam, or Zurn.

M. Type "K" floor drains in kitchens and food service areas shall be JR Smith 2000 Series with sediment bucket and 8" type "B" square adjustable strainer finished in nickel bronze; or equal products by Josam or Zurn. Provide vandalproof secured tops.

N. Type "R" floor drains in kitchens and food service areas shall be JR Smith 2000 Series with sediment bucket and 7" type F37 round extended rim strainer finished in nickel bronze; or equal products by Josam or Zurn. Provide vandalproof secured tops.

O. Floor sinks (FS) in kitchens and food service areas shall be JR Smith 3007-NB Series with 6" deep type 304 stainless steel body, removable stainless steel sediment bucket, 12 1/2" square

nickel bronze top and non-puncturing flashing clamps or equal products by Aco, Josam, or Zurn. Grate configuration shall be coordinated with Kitchen Equipment Consultant to ensure proper opening for equipment served; otherwise provide a full grate with openings cut out for equipment served.

2.2 STORM PIPING SYSTEMS

A. Storm piping systems shall be of the same materials specified above in 2.01 for the sanitary, waste and vent systems; note that all aboveground storm piping located within plenums shall be hubless cast iron soil pipe. All cast iron soil pipe and fittings shall bear the collective trademark of the Cast Iron Soil Pipe Institute or receive prior approval by the Architect.

B. Joints on hubless cast iron soil pipe shall be made with neoprene couplings and stainless steel clamps. All couplings shall be manufactured to the CISPI 310 standard, ASTM C 1277, ASTM C 150, FM Standard 1680 Class I and certified by NSF International. Coupling shall be as follows:

1. 1 ½" to 3" - Two (2) stainless steel bands
2. 4" to 8" - Four (4) stainless steel bands
3. 10" to 15" - Heavy duty coupling with six (6) stainless steel bands

C. All offsets on 8" pipe and larger shall have metal restraining straps by Holdrite or approved equal.

D. Wall cleanouts shall be threaded cleanout tees and plugs with polished stainless steel coverplate with centerset screw.

E. The roof drains shall be selected for the insulated roof decks indicated. The roof drain bodies and receivers shall be of cast iron construction; domes shall be cast iron or aluminum and the roof drains shall be complete with flashing clamps having integral gravel stops, deck clamps, gaskets and trim. Roof drains shall be JR Smith 1010 or 1015 Series or approved equal products as manufactured by Josam, Zurn.

F. Emergency overflow roof drains shall be similar to the roof drains except they shall be water dam type. JR Smith 1080 or approved equal.

G. Emergency overflow piping termination shall have stainless steel flapper with perforated, hinged face, JR Smith 1775. Finish shall be chrome-plated bronze, subject to approval by the Architect.

H. Light Duty* Area drains (AD-1) shall be JR Smith Series 1400 Promenade Deck Drains with square top, seepage holes, clamps and extensions selected for the roof/deck/paver construction assembly. The top of the drain shall be flush with the top of the paver/deck system except that it may be installed below the paver/deck system if the system has free flow of water into the drain. Coordinate with the paver/deck system.

I. Promenade emergency overflow drains shall be similar except shall be equipped with a water dam when installed under the top of the paver/deck system (free flow of water to under paver/deck system only) and upslope of the primary drain when installed flush with the top of the paver/deck system (when free flow is not available).

J. Light Duty Area drains (AD-2) shall be coated cast iron with integral wide deck flange, bottom outlet, inside caulk connection, 13" round, anti-tilt, loose-set grate and deck clamp. ** Size 3" through 8" for core-drilled decks**. Area drains shall be JR Smith DX-2566-2-97 Series or an

approved equal by Josam or Zurn.

K. Traffic Rated Area drains (AD-3) located in driveways, parking spaces, and all other areas with vehicular traffic shall be coated cast iron with heavy duty wide flange flashing collar, bottom outlet, inside caulk connection, 14” round heavy duty tractor rated grate and removable sediment bucket strainer. Area drains shall be JR Smith 2624 Series or an approved equal by Josam or Zurn.

L. Planter drains (PD) shall be JR Smith 2680 with perforated standpipe, standpipe cap, and standpipe stainless steel mesh screen for drain sizes up to 3”, and JR Smith 1910 with perforated standpipe, standpipe cap, standpipe stainless steel mesh screen, 9-3/4” secured bronze dome, and dome stainless steel mesh screen above 3” up to 6”. Finishes shall be subject to approval by the Architect. Standpipe height and installation shall be coordinated with the planter design.

2.3 DOMESTIC WATER SYSTEM

A. Underground domestic water service entrance piping 3" and smaller in size shall be Type K hard drawn copper tubing with wrought copper fittings. All joints shall be brazed.

B. Underground domestic water service entrance piping above 3" in size shall be Class 150 ductile iron pipe with mechanical joints.

C. All underground copper branch lines (1/2" and 3/4" only) shall be continuous lengths of soft Type K copper tubing with no joints allowed underground.

D. Aboveground domestic water system piping 3" in size and smaller shall be Type L hard drawn copper tubing with wrought copper fittings and soldered joints.

E. Alternatively, aboveground domestic water system piping 2-3” in size shall be Type L hard drawn copper tubing with grooved mechanical joints. Fittings shall be wrought copper conforming to ANSI B16.22, Victaulic or approved equal. Couplings shall be ductile-iron housing and Grade “P” fluoroelastomer gasket rated for 0°F to 180°F with nuts and bolts; Victaulic Style 607.

F. Alternatively, Aboveground domestic water system piping 3” in size and smaller shall be as above or Type L hard drawn copper tubing with press-connect fittings with EPDM sealing elements and un-pressed fitting identification feature. Piping 2.5” and 3” shall have stainless steel grip ring, separator ring, and EPDM sealing element.

1. Fittings shall be by Viega, Victaulic, or Nibco.
2. Fittings shall be installed with a tool from the Fitting Manufacturer, or a method approved by the Manufacturer.
3. Fittings and tubes shall be appropriate for installation in a return air plenum.
4. Fittings and tubes shall be rated in accordance with ASME B31, B16.51, ASTM B88, NSF 61/372, and IAPMO PS 117.

G. Aboveground domestic water piping 4” and larger shall be Type L hard drawn copper tubing with rolled grooved joints and fittings. Installation ready copper fittings shall meet the same gasket material specifications as couplings. Fittings shall be as follows, or equal, and shall be provided by the Manufacturer with the gasket included in the coupler assembly:

1. Coupling: Rigid, Victaulic style 607 (8” and smaller)
2. Gaskets: Grade EHP EPDM (8” and smaller)

H. All valves in potable water systems shall be “lead-free” type.

I. All valves ¾” and smaller shall be “full-port” type, and greater than ¾” may be “reduced-port” type.

J. Gate valves (water entrances only) shall be constructed with a gray iron, non-rising stem, outside screw and yoke (OS&Y), full port. Stem to be adjustable graphite packing, ANSI 372 Lead Free, bronze mounted seat rings, solid wedge, back seat protection, with malleable iron handwheels. Valve shall meet MSS-SP70, Apollo Valves 611F or approved equals by Hammond/ Milwaukee, Nibco, or Stockham.

K. Ball valves:

1. Valves 2 inch and smaller shall be two piece bronze body, full port with solid, smooth bore chrome plated brass ball, meeting MSS-SP110 and rated for no less than 300 psi. Seats shall be reinforced TFE with Teflon packing ring and threaded adjustable packing nut. Valves on insulated lines will be provided with stem extensions to provide clearance for two inches of pipe insulation. Valves to be Apollo Valves 77C, Hammond/Milwaukee UP8301, or Watts B-6080.
2. Valves larger than 2 inch and up to 4 inch shall be two piece bronze body, standard port with solid, smooth bore chrome plated brass ball, meeting MSS-SP110, and rated for no less than 300 psi. Seats shall be reinforced TFE (or TFM for 4”) with Teflon packing ring and threaded adjustable packing nut. Valves on insulated lines will be provided with stem extensions to provide clearance for two inches of pipe insulation. Valves to be Apollo Valves 70-100, Hammond/Milwaukee UP8501, or Watts B-6000.

L. Balancing valves:

1. Valves shall be NSF/ANSI 61/372 certified and suitable for potable water applications. Valve shall be suitable for the greater of 125 psig pressure and 40°F to 250°F temperature or the system’s operating conditions. Valve shall provide positive shut-off and be rated for 300 psig. Each balancing valve shall be equipped with two gauge taps with check valves and drip caps. Provide preformed insulation to encase valve assembly in insulated piping.
2. Valves up to 3” shall have lead-free brass body, full-port ball constructed of 304 stainless steel, and shall have calibrated nameplate with memory stop. Balancing valves shall be Bell and Gossett Circuit-Setter Plus or equal by Nexus, FlowDesign, or Watts. After the test and balance is complete, provide to the Owner a differential pressure gauge to match the balancing valves. Autoflow valves are acceptable as a substitution provided the flow cartridge is replaceable and the flowrate is clearly and permanently labeled.
3. In grooved piping systems, balancing valves may be lead-free brass body, full-port ball constructed of 304 stainless steel, and shall have calibrated nameplate with memory stop; Victaulic 78BL. After the test and balance is complete, provide to the Owner a differential pressure gauge to match the balancing valves. Autoflow valves are acceptable as a substitution provided the flow cartridge is replaceable and the flowrate is clearly and permanently labeled.

M. Check valves:

1. Valves in water systems shall be NSF/ANSI 61/372 certified and suitable for potable water applications. Valve shall be swing-type, brass body, bronze seat, Apollo Valves 161S-LF up to 200 psi CWP, or equal by Milwaukee UP968 or Hammond.
2. In grooved piping systems, check valves may be stainless steel body, disc shaft and spring, Grade P fluoroelastomer seat, 300 psi CWP; Victaulic 816 or equal.

3. Valves in waste systems below ground shall match the material of the piping. Valves shall be cast iron with gasketed bolted cover or PVC ANSI 14 with inner riser assembly. Valves shall have hinged flappers.
4. Valves in waste systems above ground, such as elevator sump pump discharges, shall be non-slam type with iron body, globe-type silent checks with bronze trim, stainless steel spring and flanged end connections. Flow area through the valve shall exceed the cross sectional area of the pipe in which the valve is installed by not less than 10%. Valves shall be Apollo Valves 910F up to 200 psi or 2" and under, 169T up to 600 psi or equal by Mueller Co., APCO, Metraflex Globe Style Silent Check Valve, Hammond IR 9354, or Milwaukee 1800. In grooved piping systems, valves shall be Victaulic 716, 779, or W715 as appropriate.
5. All check valves on pump discharges shall be non-slam type.
6. All check valves shall be installed in an orientation allowed by the manufacturer's recommendations.
7. All check valves installed in insulated piping systems shall have the check valve location explicitly labeled on the outside of the insulation.

N. Non-freeze wall hydrants (NFWH) shall be non-freeze, bronze box type with vacuum breaker, loose key and wall clamp. Finish shall be rough bronze subject to approval by the Architect. Wall hydrants shall be JR Smith 5509QT or approved equal by Josam, Watts, or Zurn.

O. Backflow preventer at water service entrance shall be Watts Series LF009 or LF909 reduced pressure zone (RPZ) principle backflow preventer complete with strainer and shut-off valves. RPZ air gap drain shall be sized for the larger of the manufacturer's recommendation or the requirements of the AHJ and shall be piped outside of building to a concrete splashblock unless otherwise indicated.

P. Backflow preventers at carbonated beverage machines shall meet ASSE 1022 UON and all other appliances shall meet ASSE 1024. Backflow preventers shall be approved by the AHJ. ASSE 1022 ports shall be piped with copper tubing to an indirect drain location. Backflow preventers at dishwashers shall meet ASSE 1020 unless otherwise noted. Other equipment and appliances shall be protected from backflow as required by Code and/or manufacturer's requirements.

Q. Water connections to appliances shall be made with flexible copper tubing or commercial grade double-reinforced stainless steel braided hose, no less than 3/8" in size, or the connections size of the appliance, whichever is greater.

R. Water pressure reducing valves (PRV) shall be the self-contained direct operating type with brass or iron body, stainless steel seat, stainless steel spring, and sealed spring cage. The strainer shall have bronze body with 20 mesh stainless steel screen. Strainer shall be attached with a bronze nipple. The unit shall be constructed in accordance with ASSE 1003 and shall bear the seal of approval. The capacities shall be based on maximum reduced pressure fall-off, as defined in ASSE 1003, of 10 psi. Pressure regulators shall be Watts Regulator LF223S or approved equal. PRV shall be appropriate for the discharge pressure as noted on the plans. Confirm with product pressure ranges.

S. Central mixing valves shall be Leonard Model No. TM-186 Series, High-Low Thermostatic Mixing Valve Assembly, or an approved equal, with the piping arranged in accordance with manufacturer's recommendations based on recirculating flowrate. Mixing valve shall be sized by the Manufacturer for the fixture(s) served. Secure the assembly to the adjacent wall. Mixing valve assemblies in public or employee spaces, such as in kitchens, shall be provided with lockable enclosure.

T. Water heater mixing valve shall be Leonard 210-LF or an approved equal with lead-free construction, vandal resistant adjustment cap, and integral inlet check valves. Mixing valve shall be sized by the Manufacturer for the fixture(s) serve.

U. Point of use mixing valves shall be Leonard 170-LF or an approved equal with lead-free construction, vandal resistant adjustment cap, and integral inlet check valves. Mixing valve shall be ASSE 1070 rated. Mixing valve shall be sized by the Manufacturer for the fixture(s) served. Mixing valve shall have no more than 0.25 gpm minimum flowrate required.

V. All water hammer arresters (WHA) shall be PDI Certified, Size A, B, C, D, E or F, as indicated for the fixture units served; Josam, JR Smith, Watts, or Zurn. WHAs that are not PDI Certified are disallowed. WHAs in potable water applications shall be lead-free.

W. The hose bibbs (HB) shall be complete with vacuum breaker and **v**andal resistant handle; Watts, Apollo Valves, JR Smith, or Zurn.

X. Soldered joints shall be made with tin-antimony/silver solder. Solder containing lead shall not be permitted.

Y. Saddle valves and “T” fittings that rely on puncturing the piping main are disallowed.

Z. Thermometers and pressure gauges shall be products of Trerice, Weksler, or Weiss. Select all devices to operate within 20% of the midpoint of their scales under normal operating conditions. Gauges provided on pumps shall be compound type.

AA. Pressure and temperature (P&T) test plugs shall be constructed of brass with two (2) self-closing Nordel cores and be complete with cap and gasket. Plugs shall be as manufactured by Peterson or Lancaster. Provide a complete test kit to the Owner at the time of final inspection. Test kit shall be complete with pressure gauge, thermometer, probes and carrying case.

PART 3- EXECUTION

3.1 ARRANGEMENT

A. Follow the general piping layout, arrangement, schematics and details. Provide all offsets, vents, drains and connections necessary to accomplish the installation. Fabricate piping accurately to measurements established at the project site to avoid interference with ductwork, other piping, equipment, openings, electrical conduits and light fixtures. Make suitable provision for expansion and contraction with expansion loops and offsets.

B. Water hammer arresters shall be installed at the top of each riser and on each fixture branch in accordance with Plumbing and Drainage Institute Standard WH201. WHAs shall also be installed at all water service to appliances with quick-closing valves, such as clothes washers, kitchen warewashers, icemakers, etc.

C. Cleanouts shall be provided at the base of all sanitary and storm risers and as required by code.

D. Fittings, unions, joints, couplings (including no-hub couplings), etc. shall not be within slabs.

E. All potable domestic water connections to equipment shall be provided with backflow prevention as required by the specification section and code.

F. Pressure gauges and thermometers called to be permanently installed shall be easily visible

from a standing position on the ground.

3.2 UNDERGROUND WATER PIPING

A. All domestic water piping shall have a minimum cover of 3'-0", or below the frost line, whichever is deeper, except piping at least 20’ from any exterior wall may be installed 3” or more below the bottom of the slab.

B. For water piping 2” and above, provide concrete thrust blocks at all changes of direction and secure all mechanical joints with restraining rods.

C. All copper water lines, or other material subject to corrosion, shall be protected from corrosion with a continuous plastic sheathing or coating and wrapping. This sheathing or coating and wrapping shall be extended 6" to 12" above finished floor. The protection shall be installed on the outside of any insulation required.

3.3 PIPE GROOVING AND INSPECTION

A. Grooved Pipe Joint Construction: Square cut pipe ends and roll groove ends of pipe in accordance to manufacturer’s specifications. Gaskets shall be verified as suitable for the intended service and shall be coated on the lips with a thin uniform coat of lubricant in accordance with the manufacturer's published instructions. For installation-ready coupling, housing shall engage both grooves, otherwise the housing shall be assembled over the gasket and shall engage both grooves. The nuts shall be uniformly tightened until the housing pads are firmly together, metal to metal allowing visual inspection, or until properly tightened per manufacturer’s specifications and instructions. A factory trained Representative shall provide on-site training for Contractor's field personnel in the use of grooving tools and installation of grooved joint products. The representative shall periodically visit the jobsite and ensure Contractor is following best recommended practices in grooved product installation including visual inspection of installation. A Distributor's Representative is not considered qualified to conduct the training or jobsite visit(s). To assure uniformity and compatibility of piping components in grooved end piping systems, all grooved products and grooving tools utilized shall be supplied by a single manufacturer with smart tools recommended. Groove depths shall be measured using a Victaulic Go-No-Go tape or 5200i tool to verify compliance with groove specifications.

3.4 PIPING INSTALLATION ABOVE CEILINGS

A. All domestic hot and cold water piping installed above the insulated ceilings shall be installed just above (within 2") of the top of the finished ceiling with the building insulation over the piping to avoid freeze-up.

3.5 DISINFECTION

A. All domestic water piping installed under this Division shall be disinfected with chlorine before it is placed into operation. The chlorinating material shall be liquid chlorine conforming to Federal Specification BB-C-120 and shall be introduced to the system by experienced operators only. The chlorine solution applied to the piping sections or system shall contain at least fifty parts per million of available chlorine and shall remain in the sections or system for a period of not less than sixteen (16) hours. During the disinfection period, all valves shall be opened and closed at least four times. After the disinfection period, the chlorinated water shall be flushed from the system with clear water until the residual chlorine content is not greater than two-tenths parts per million (0.2 PPM). Submit certification to the Architect that the system was disinfected.

END OF SECTION

SECTION 223000

PLUMBING EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION

A. All work specified in this Section is governed by the Common Work Results for Plumbing Section 220500.

B. This Section 223000 and the accompanying drawings cover the provisions of all labor, equipment, appliances, and materials and performing all operations in connection with the construction of the water heating systems as specified herein and as shown. These systems include, but are not limited to, the following:

1. Water Heaters
2. Hot Water Circulator
3. Elevator Sump Pump

1.2 GENERAL REQUIREMENTS

A. All plumbing equipment installed in locations with a water hardness of 25 grains per gallon or more, shall be resistant to corrosion. Where copper materials are in the water stream, it shall be Cupro-Nickel of not more than 90% copper.

B. All water heaters shall be NSF/ANSI 61 certified “lead free” for potable water service.

C. All water heaters shall have ASME rated temperature and pressure relief valve(s). Valve(s) shall be provided by the Manufacturer and sized for the discharge location noted in the plans.

D. All water heaters and tanks shall be glass-lined, 1600°F fired, with a working pressure of 150 psi, a test pressure of 300 psi, or the system pressure at the installation location, whichever is greater, and shall have magnesium anodes for electrolytic protection. Separate storage tanks may also be cement-lined. Tanks shall be ASTM stamped.

E. All water heaters shall meet or exceed the energy efficiency requirements of the latest version of ASHRAE 90.1.

F. All water heaters and pumps shall be UL approved and labeled, and be AGA certified where applicable.

G. All water heaters and pumps shall be NEMA rated appropriate for the installation location in which they are installed.

H. Water heater controls shall include an operating thermostat and manual reset high limit control for each heating element or burner. The safety high limit control shall prevent over heating in the event of a thermostat failure.

I. All controls shall be factory-wired and require no external power source.

J. Water heaters and tanks shall have drain with external access and hose end connection.

K. All water heater condensate lines shall be protected from freezing or shall be heat traced in accordance with specification 230593.

L. See specification section 233100 for combustion air and flue ductwork as applicable. Specific attention is called to coordination of scope with Division 23. Combustion air and flue system shop drawings, including any fans required, shall be submit for review and must be coordinated with Division 26.

M. The water heater shall be certified by an independent laboratory for Oxides of Nitrogen (NOx) of less than 10 ppm corrected to 3% O2 or better as required by the AHJ.

N. Where classified as a boiler by the Department of Labour, AHJ, or applicable codes, the system shall additionally meet all requirements. An emergency power off (EPO) switch shall be provided at locations required by the AHJ. The EPO(s) shall be accessible, clearly labeled, and shall shut-off all power to the boilers and cause the equipment to be disengaged. EPO(s) shall be coordinated with controls and Division 26, and shall be installed and wired under this scope.

PART 2 - PRODUCTS

2.1 INSTANTANEOUS WATER HEATER SMALL GAS AND ELECTRIC

A. The instantaneous water heaters shall be as scheduled. Acceptable substitute manufacturers are (electric) Stiebel Eltron and Chronomite and (gas), AO Smith, Rinnai, Lochinvar, and Noritz, subject to substitution requirements.

B. The heater shall be fitted with an electronic, solid state temperature control system adjustable from 100°F to 140°F; set at 105°F.

C. The heating and control system shall be enclosed in an impact resistant and shockproof case of Cycolac KJW flame-retardant thermoplastic.

D. The water heaters shall be UL approved and labeled without the need for a T&P relief valve, or a T&P valve shall be provided and installed.

2.2 WATER HEATER COMMERCIAL GAS

A. The water heater shall be as scheduled. Acceptable substitute manufacturers are AO Smith, Lochinvar, Raypak, Rheem, and Bradford White, subject to substitution requirements.

B. Water heater shall be gas-fired with full modulation firing down to 20% of rated input with a turn down ratio of 5:1. The tank shall have two or more magnesium anodes to provide electrolytic protection.

C. Controls shall include an operating thermostat, automatic reset high limit, secondary overheat control, and gas valve with 100% safety pilot feature.

D. Water heater shall be provided with handhole cleanouts and slide-out burner tray for ease of inspection, cleaning and servicing.

E. Where applicable, the water heater shall have a replaceable combustion air filter.

2.3 HOT WATER CIRCULATOR

A. Hot water circulator shall be as scheduled. Acceptable substitute manufacturers are B&G, Goulds, and Grundfos, subject to substitution requirements.

B. Hot water circulators used in potable water system shall be lead-free.

2.4 ELEVATOR SUMP PUMP

A. Sump pump shall be as scheduled. Acceptable manufacturers are B&G, Liberty, Zoeller, Little Giant, and Stancor.

B. Sump pump shall be provided as a complete package including alarm/control panel, float switches, oil detection system, and EMS interlock.

C. Alarm/control panel shall be powered from a dedicated, separate, circuit from the sump pump. Alarm/control panel shall have audible and visible alarm. Coordinate installation location with Architect and Owner. Panel shall not be located in the hoistway.

D. Where serving Fire Service elevators, associated sump pumps and panels shall be served by emergency power.

PART 3 - EXECUTION

3.1 INSTALLATION

A. The water heaters and accessories shall be installed in strict accordance with the manufacturer's recommendations and the Contract Documents.

B. All temperature and pressure relief valves shall be piped full size to an indirect waste such as the nearest floor drain, service sink, sink tailpiece, etc. Piping shall be in accordance with specification 221000 for DWV services. Size shall be in accordance with manufacturer’s requirements.

C. All water heaters shall have internal heat traps or shall have heat traps installed in the cold water and hot water piping. Instantaneous water heaters shall be provided with heat traps unless manufacturer documentation specifically allows exclusion.

D. Water heaters shall be completely encased in high density insulation of sufficient value to meet the energy efficiency standards of latest version of ASHRAE 90.1, or shall be factory insulated with non-CFC polyurethane closed-cell foam insulation. Provide removable insulation panels to maintain access to all required components.

E. All water heaters or boilers subject to condensing under normal steady-state operating conditions shall be provided and installed with accessory condensate neutralization kits.

F. Specific attention is called to confirm minimum instantaneous water heater flowrate does not exceed minimum fixture use flowrate.

3.2 WARRANTY

A. Provide 5-year limited warranty on all tanks and heat exchangers, and 1-year limited warranty on parts unless otherwise noted.

END OF SECTION

SECTION 224000

PLUMBING FIXTURES

PART 1 - GENERAL

1.1 DESCRIPTION

A. All work specified in this section is governed by the Common Work Results for Plumbing Section 220500.

B. This Section 224000 and the accompanying drawings cover the provisions of all labor, fixtures, equipment, appliances and materials, and performing all operations in connection with the construction and installation of the plumbing fixtures and trim as specified herein and as shown.

C. All finishes shall be as selected by the Architect. Where the Architect does not have a preference, finishes shall be in accordance with this specification.

D. All exposed piping, valves, stops, P-traps, etc. shall be chrome-plated. Also, all exposed piping penetrations through walls, floors or ceilings shall be provided with chrome-plated cast brass escutcheons.

E. All P-traps shall be minimum 17-gauge brass.

F. All exposed P-traps subject to contact, such as those below wall-mounted lavatories, shall be provided with insulated covers as required.

G. Flush valves shall have non-hold open feature, vacuum breakers and cover cap on angle-type stop.

H. Provide all final connections to all equipment and fixtures furnished by Owner.

I. Unless otherwise specified in an individual fixture description, all enameled cast-iron and porcelain fixtures shall be white.

J. All lavatories and other hand-washing fixtures shall be provided and installed with ASSE 1070 point-of-use mixing valve on the hot water connection. Mixing valve shall be set to provide no more than 110°F hot water.

1.2 INTENT

A. It is the intent of this Section of the specifications to provide complete, operable, adjusted, clean plumbing fixtures as shown and specified, which are free of leaks, noise, air, vibration and waterflow fluctuations.

1.3 BASIS OF DESIGN

A. The basis of design is as outlined for each fixture in the 2.0 PRODUCTS subsection. Any proposed substitutions shall be proven equal in all respects to the equipment specified as the basis of design.

1.4 ACCEPTABLE MANUFACTURERS

A. Acceptable fixture manufacturers for each type of fixture is as follows:

1. Water Closets – American Standard, Kohler, Sloan, and Zurn
2. Urinals – American Standard, Kohler, Sloan, and Zurn
3. Manual Flushvalves – American Standard, Kohler, Sloan, and Zurn
4. Automatic Flushvalves – American Standard, Kohler, Sloan, TOTO, and Zurn
5. Lavatories – American Standard, Bradley, Crane, Kohler, Sloan, and Zurn.
6. Lavatory Faucets – American Standard, Bradley, Chicago, Delany, Grohe, Kohler, Sloan, TOTO, and Zurn
7. Breakroom/Kitchen/Pantry/Etc. Sinks – American Standard, Elkay, Grohe, Just, and Kohler
8. Breakroom/Kitchen/Pantry/Etc. Faucets – American Standard, Chicago, Delta, Elkay, Just, Kohler, and Zurn
9. Water Coolers and Water Fountains – Acorn, Elkay, Halsey Taylor, and Oasis
10. Service and Laundry Sinks – Fiat, Kohler, Mustee, ProFlo, and Stern-Williams
11. Service and Laundry Faucets – American Standard, Delta, Elkay, Fiat, Kohler, T&S Brass, Speakman, and Stern-Williams
12. Shower Stalls – American Standard, Aquatic Bath, Freedom, and Kohler
13. Shower Fittings – Acorn, American Standard, Bradley, Chicago, Delta, Kohler, Speakman, and Zurn
14. Emergency Shower and Eyewash – Acorn, Bradley, and Guardian

PART 2 - PRODUCTS

Refer to the architectural and/or interior design plans for all fixtures.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Units shall be installed as indicated and in conformance with the manufacturer's recommendations. Coordinate the actual units to be provided with all trades.

B. All plumbing fixtures shall be free of leaks, provided completely finished, trimmed, adjusted, cleaned and ready for use. They shall be properly secured to the structure by the use of thru-bolting, backplates, carriers, expansion shields (for floor mounting only) or toggle bolts.

C. Wall hung fixtures supported on chair carriers shall be bolted to the floor slab. Carefully coordinate space requirements and fixture mounting height requirements with supports being furnished.

D. Fixtures supported with wall hangers on masonry chase walls shall be fastened to the wall with not less than 3/8" bolts which shall pass through the wall and through a 1/4" x 4" wide steel backplate on the unfinished chase wall side.

E. Where fixtures are hung on single masonry walls without a pipe chase behind, they shall be mounted with 3/8" toggle bolts.

F. Fixtures on steel stud walls shall have a 1/4" x 4" wide steel backplate wired with 1/16" steel wire to the studs. Bolts not less than 3/8" shall secure the fixtures through the fixture hanger and the backplate.

G. All mounting holes provided in fixtures shall be used for support. In addition to the main hangers, 1/4" toggle bolts shall secure the bottom of all wall hung fixtures at each drilling provided for this purpose.

H. Mount wall-hung fixtures at the heights indicated on the Architectural Drawings or as prescribed by local code. Special attention is called to the installation requirements of the ANSI Handicap Code.

3.2 CLEANING AND ADJUSTMENT

A. The units shall be cleaned, tested and field-adjusted to provide optimum flow and drainage. Specific attention is called to adjustment of automatic flush valves and faucets for empirical conditions.

B. All flush valves, diaphragms, strainers, aerators, etc. shall be fully cleaned after all piping and fixture flushing.

END OF SECTION

SECTION 230500

COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 DESCRIPTION

A. This Division 23 and the accompanying drawings cover the provision of all labor, equipment, appliances, and materials and performing all operations in connection with the construction of the air conditioning, ventilating, heating, fire suppression and plumbing systems as specified herein and as shown.

B. The General Provisions and Division 01, including the general, supplementary and other conditions and other Divisions, as appropriate, apply to work specified in this Division.

1.2 EXISTING CONDITIONS

A. Attention is called to the fact that some work is to be performed within an existing, operational facility. Prior to the submission of bids, each bidder shall visit the project site, thoroughly investigate and be familiar with all existing conditions which will affect their work; especially the work to be performed above the existing ceilings.

B. Connect new work to existing work in a neat and workmanlike manner. Where an existing structure must be cut or existing utilities interfere, such obstructions shall be bypassed, removed, replaced or relocated, patched and repaired. Work disturbed or damaged shall be replaced or repaired to its prior condition.

1.3 INTENT OF DRAWINGS AND SPECIFICATIONS

A. The implied and stated intent of the drawings and specifications is to establish minimum acceptable standards for materials, equipment and workmanship, and to provide operable mechanical systems complete in every respect.

B. The engineering drawings are diagrammatic, intended to show general arrangement and sizes of system components, and shall not be scaled. Rather, the architectural and structural drawings shall govern space constraints, dimensions and finishes. All offsets and fittings which will be necessary to accomplish the finished installation shall be provided at no additional cost or increase in the Contract.

1.4 SPACE PRIORITY

A. Ensure optimum use of available space for materials and equipment installed above ceilings. Allocate space in the order of priority as listed below except as otherwise detailed. Items are listed in the order of priority, with items of equal importance listed under a single priority number.

1. Gravity flow piping systems
2. Vent piping systems
3. Recessed lighting fixtures
4. Concealed HVAC terminals and equipment
5. Air duct systems
6. Sprinkler piping systems
7. Pressurized piping systems

8. Electrical conduit, wiring, control air tubing

B. Order of space priority does not dictate installation sequence. Installation sequence shall be as required to install all affected trades.

C. The work of this Division 23 shall not obstruct access for installation, operation and maintenance of the work of any other Division.

D. All major items of equipment shall be arranged so as to provide a minimum of 28" clear aisle space. Additional space shall be provided between and around equipment for maintenance and proper operation as shown in the Equipment Manufacturer's literature.

1.5 COORDINATION

A. Coordinate all work under this Division 23 with work under all other Divisions, providing adjustment as necessary.

B. Coordination of space requirements with respect to Division 26 shall be performed such that:

1. No equipment, piping or ductwork, other than electrical, shall be installed within 42" of switchboards or panelboards.
2. No piping or ductwork which ever operates at a temperature in excess of 120°F shall be installed within 3" of any electrical conductor.

C. All items mounted in or below the ceiling, and all items penetrating the ceiling, shall be coordinated with the architectural reflected ceiling plans. If any items are not shown on these plans, or any items need to be relocated for coordination purposes, prepare a reflected ceiling plan and submit it to the Architect for approval.

D. Variable-Frequency Drives shall be provided under Division 23 and installed by Division 26. See specification 262923 Variable – Frequency Motor Controllers.

E. Fused disconnects shall be provided under this Division 23 for all equipment connected directly to bus duct, and rating shall match bus duct rating. Coordinate with Division 26.

1.6 CODE COMPLIANCE

A. All workmanship and materials provided under this Division 23 shall comply with all laws, ordinances, codes and regulations of all Federal, State and Local Authorities Having Jurisdiction.

B. All fire suppression, plumbing, heating, ventilating, and air conditioning materials and workmanship shall comply with the current codes and following standards as minimum requirements:

1. NFPA 70, National Electrical Code, 2017 Edition
2. Life Safety Code (NFPA 101) – 2015 Edition
3. All other NFPA Codes and Standards – Applicable Editions
4. American with Disabilities Act, January 26, 1992
5. American National Standard Handicapped Code, A117.1 - 1986 Edition
6. ASME A17.1 Safety Code Elevators and Escalators, 2013 Edition

C. Secure and pay all fees associated with all permits and licenses required for execution of the Contract. Arrange for all inspections required by City, County, State and other Authorities

Having Jurisdiction, and deliver certificates of approval to the Architect.

D. The code requirements are strictly a minimum and shall be met without incurring additions to the Contract. Where requirements of the drawings or specifications exceed the code requirements, the work shall be provided in accordance with these drawings or specifications. In the event of conflict or ambiguity between the various codes, the most stringent requirement shall govern.

1.7 ELECTRICAL REQUIREMENTS AND INTERFACE

A. All electrical equipment and wiring provided under this Division 23 shall comply with the electrical system characteristics indicated on the electrical drawings and specified in Division 26.

B. Electric controls, contactors, starters, pilot lights, push buttons, etc., shall be provided complete as part of the motor, heater or other equipment which it operates. All electrical components shall be in conformance with the requirements of the National Electrical Code and Division 26. Starters shall be wye-delta, closed transition type. Reference Division 26 and the electrical engineering drawings for those motor starters provided under that Division 26. All starters not shown shall be provided under this Division 23. Unless specified otherwise under other individual equipment Sections, motor starters shall conform to the following minimum requirements:

1. Starters for motors 1/3 horsepower or smaller shall be manual unless remote or automatic starting is required, in which case the starters shall be magnetic, full voltage, non-reversing, single-speed, unless otherwise indicated. All other starters shall be magnetic.
2. Each starter for a three-phase motor shall be furnished with three (3) overload relays sized for the full load running current of the motor actually provided. Provide an external "HAND-OFF-AUTO" selector switch with red "RUNNING" light. Provide a green pilot light to indicate motor "STOPPED". Each pilot light shall have a legend plate indicating reason for signal.
3. Each overload relay shall have a normally open alarm contact which will close only when actuated by an overload (not to be confused with N.O. or N.C. auxiliary contacts). These contacts shall be properly wired to their respective blue pilot light provided on the starter front cover and having a "TRIPPED" legend plate.
4. Individually mounted motor starters shall be in a NEMA Type 1 general purpose enclosure in unfinished areas and shall be flush mounted in all finished areas. All starters mounted in exterior areas shall have a NEMA 3R enclosure. Each starter shall have a laminated nameplate to indicate equipment unit number, function and circuit number.
5. All motor starters, push buttons and pilot lights shall be of the same Manufacturer as the switchboard and shall be General Electric, Square D, Siemens I.T.E., or Westinghouse.

C. Motor starters for the following equipment shall be provided under this Division 23 by the Manufacturer of the equipment:

1. Packaged air conditioning equipment
2. Water chillers
3. Other equipment hereinafter specified in other Sections to be provided with integral starters

D. Unless otherwise noted or specified in individual Sections, all 3-phase motors shall be standard NEMA continuous duty "B" type, with Class B insulation, open drip-proof frame for indoor service, TEFC for outdoor service and a service factor of 1.15. All motors 5 HP and larger shall

be U.S. Motors Hi-Efficiency Model or Reliance XE Hi-Efficiency Model.

E. All power wiring and final connections to equipment shall be provided under Division 26.

F. Control components, all interlocks, (VAVs, actuators, smoke dampers, fire/smoke dampers, motor-operated dampers, fire alarm motors, etc.) and control wiring (277 volt, single phase and less) shall be provided under this Division 23 as required to achieve the specified control sequences. All electrical connections shall be specifically coordinated with Division 26 and any necessary scope included as part of Division 23.

G. All control wiring over 30 volts shall be installed by a licensed Electrician working under this Division 23.

1.8 SLEEVES, SEALS AND ESCUTCHEONS

A. Sleeves shall be provided through all pipe and ductwork penetrations of concrete or masonry walls, elevated floors and roofs, except those piping penetrations for equipment, etc.

B. Sleeves shall be fabricated from Schedule 40 steel pipe through 10" and Standard Wall steel pipe for sleeve sizes 12" and larger. All sleeves penetrating exterior walls, underground walls, pit or vault walls shall be provided with a 3" x 3/8" thick waterstop ring welded completely to the midpoint of the sleeve.

C. All sleeves penetrating exterior walls, underground walls, pit or vault walls and elevated floors shall be packed and sealed watertight.

D. Sleeves through roofs shall extend above the roof surface and be flashed watertight.

E. Sleeves through walls shall be cut and finished flush with each surface of the wall in which they are installed.

F. Sleeves through floors in mechanical rooms or other back of house spaces shall be installed with the top no less than 1/2” above the finished floor to allow for leak protection. Space between the top of the fire-stopping and top of the sleeve shall be packed with mineral wool and caulked to not allow water ponding within the sleeve.

G. Sleeves shall be sized to provide a minimum of 1/2" clearance between the inside surface of the sleeve and the outside finished surface of the pipe plus any insulation specified.

H. Fire-stops shall be provided as specified herein. All annular spaces between piping and sleeves, which do not require fire-stops, shall be packed with mineral wool and caulked.

I. Provide round, chrome-plated escutcheons on all exposed piping and ductwork penetrations passing through walls, floors, partitions and ceilings. Escutcheons shall be painted and caulked in coordination with Architect. Note that escutcheons should be only attached to the wall as piping and ductwork may move slightly during operation.

1.9 FIRESTOPS

A. Where piping, conduit, etc. pass through fire partitions, fire walls and floors, a firestop shall be provided that will ensure an effective barrier against the spread of fire, smoke and gases. Firestop material shall be packed tight and completely fill gaps between the ductwork, piping, conduit, etc. and the perimeter of their rough openings.

B. All penetrations shall be in accordance with UL 1479 or ASTM E 814 listed systems, and products used shall be specifically applicable for the appropriate installation conditions. Assemblies shall provide a minimum rating equal to the construction penetrated. Products shall be by HILTI, 3M, or ProSet.

C. Installation shall be by a Qualified Installer. Installer shall be certified, licensed, or otherwise qualified by the Firestopping Manufacturer as having the necessary training to install the Manufacturer's specific product. A Manufacturer or Vendor's willingness to sell the firestopping product to the Contractor or Installer does not in itself confer qualification.

D. Installer shall have at least one of the following qualifications:

1. FM 4991 Approved Contractor
2. UL Approved Contractor
3. HILTI, 3M, or ProSet Accredited Fire Stop Specialty Contractor

E. Installing Firm shall have no less than 3 years of experience with firestop installation.

F. A Manufacturer's direct Representative (not Distributor or Agent) shall be on site during initial installation of firestop systems to train appropriate Contractor personnel in proper selection and installation procedures.

G. The firestop Contractor or Installer shall supply As-Built documentation of each individual penetration location on the project. Documentation shall include a sequential location number, detailed description of the penetration location, size, and type, tested system number, type of assembly penetrated, and rating to be achieved. As-Built documentation shall be included with the close-out materials.

H. Identify through-penetration firestop systems with pressure-sensitive, self-adhesive, preprinted vinyl labels. Attach label permanently on both sides of penetrated construction in a visible location. The label shall include the following:

1. The words "Warning – Through Penetration Firestop System-Do Not Disturb"
2. Through Penetration firestop system designation and Manufacturer
3. Date of Installation

1.10 CORE DRILLING

A. Cutting of holes through concrete and masonry shall be by diamond core or concrete saw. Pneumatic hammer, impact electric and hand or manual hammer type drills will not be allowed, except as permitted by the Architect where required by limited working space. Locate holes such that they will not affect structural sections such as ribs or beams. Holes shall be laid out well in advance of the installation. These layout locations shall be approved by the Architect prior to drilling.

1.11 IDENTIFICATION OF PIPING

A. All aboveground HVAC piping sized 3/4" and larger which is installed in accessible locations (including piping above removable ceilings and behind access panels) shall be identified in strict conformance with the "Scheme for the Identification of Piping Systems" (ANSI A13.1-2015).

B. Piping labels in exposed areas shall be oriented and located in coordination with the Architect.

C. Specific system names shall be subject to Owner approval. System names shall, at minimum, uniquely identify the system and performance category - i.e. Base Building Condenser Water Supply, Cooling Tower Make-up, etc.

D. Each identification marker shall include to the following:

1. Proper color-coded background
2. Proper color of legend in relation to background color
3. Proper legend letter size
4. Proper marker length
5. Direction of flow arrows shall be included on each marker

E. Locations for pipe markers shall be as follows:

1. Adjacent to each valve and fitting
2. At each branch and riser take off
3. At each pipe passage through walls, floors or ceilings
4. On all straight pipe runs every 25 feet

F. Identification markers may be stenciled or shall be Setmark Pipe Markers, as manufactured by Seton Name Plate Corporation.

G. All valves shall be identified with the appropriate service designation and valve number with brass valve tags. Each valve tag shall be 19 gauge brass with 1/4" black-filled letters over 1/2" black-filled numbers. Tags shall be fastened to valves with brass "S" hooks or brass jack chain. Brass tags and fasteners shall be as manufactured by Seton Name Plate Corporation.

H. Provide charts of all valves. Valve charts shall include the following items:

1. Valve identification Number
2. Location
3. Purpose/Material

PART 2 - PRODUCTS

2.1 BID BASIS AND SUBSTITUTION PROCEDURES

A. Manufacturer names, series and model numbers, as noted or specified, are for the purpose of describing type, capacity, and quality of equipment, materials and products to be used. Unless "or equal" is specifically stated, bids shall be based only on the specified "basis of design" Manufacturer. The listing of a particular manufacturer as an "equal" or "acceptable substitute" manufacturer shall not be misconstrued as approving nor allowing the substitution of that Manufacturer's standard product in place of the basis of design. No consideration will be given to a product, which would require dimensional, spatial or aesthetic changes to the project. "Acceptable substitute" and "equal" manufacturers shall only bid those products, which exactly match the size and other characteristics of the specified basis of design. Any changes to other disciplines and trades of work required by an "or equal" or "substitute" product shall be duly considered and priced accordingly prior to bidding or pricing. The decision as to whether or not a proposed substitute or "equal" product is actually equal to that specified shall rest solely with the Architect.

B. Requests to provide "equal" products in lieu of those specified shall be submitted to the Architect in writing at least ten (10) days prior to final pricing and execution of the Contract. No consideration will be given to substitute products after final pricing and execution of the

Contract.

C. Any "or equal" product or proposed product substitution which will cause a change in the appearance, dimensions or design of any part of the building, it structure, electrical system or any other engineered systems shall be accompanied by a scaled drawing and written description of the required change(s) for approval by the Architect. If deemed necessary by the Architect, Owner, or AHJ, design changes shall be signed and sealed by a registered Professional Engineer, currently licensed in this State. This shall be performed under the Contractor's scope who selects the substitution.

D. Any and all changes due to a substitution of basis of design equipment including but not limited to electrical connection, physical size, access, duct or piping connections, controls, etc. shall be solely the responsibility of substituting Contractor.

2.2 MINIMUM STANDARDS

A. Every piece of energy consuming equipment, all fire suppression products and life safety equipment shall comply with the following standards as applicable; especially in regard to prevailing codes:

1. Factory Mutual Laboratories (FM)
2. Industrial Risk Insurers (IRI)
3. Underwriters Laboratories, Inc. (UL)
4. ADC: Air Diffusion Council
5. AGA: American Gas Association
6. AMCA: Air Moving and Conditioning Association, Inc.
7. ANSI: American National Standards Institute
8. API: American Petroleum Institute
9. AHRI: Air Conditioning, Heating, and Refrigeration Institute
10. ASHRAE: American Society of Heating, Refrigerating and Air Conditioning Engineers
11. ASME: American Society of Mechanical Engineers
12. ASTM: American Society of Testing and Materials
13. AWWA: American Water Works Association
14. IBR: Institute of Boiler and Radiator Manufacturers
15. MSS: Manufacturers Standardization Society
16. NBBPVI: National Board of Boiler and Pressure Vessel Inspectors
17. NEMA: National Electrical Manufacturer's Association
18. OSHA: Occupational Safety & Health Administration
19. PDI: Plumbing Drainage Institute
20. PPI: Plastic Pipe Institute
21. SMACNA: Sheet Metal and Air Conditioning Contractors National Association, Inc.

2.3 PIPE HANGERS AND SUPPORTS

A. Pipe hangers, trapeze hangers, upper attachments, rods and other supports shall be selected based on pipe size and material contained therein. Provide all hangers, rods, turnbuckles, angles, channels and other supports to securely support the piping systems from the building structure.

B. All materials utilized for the hanging and support of the piping systems shall be manufactured products, which are specifically intended for the purpose of hanging piping systems. The use of wire, steel straps, plastic ties, etc. is strictly prohibited.

C. Supports and hangers shall be selected to fit around the pipe (and insulation unless otherwise

specified herein) and provide adequate movement for expansion of the piping systems. Anchors shall be provided to restrict and control such movement within offsets and expansion loops.

D. All hangers and supports shall be selected at a minimum factor of safety of five based on the ultimate tensile strength of the material.

E. Intermediate pipe supports shall be provided between building structural members so as not to exceed maximum support spacing specified and shall be structural steel angles (minimum 2 1/2" x 2 1/2" x 1/4"). In steel construction, intermediate supports shall be securely clamped to steel beams and to steel joists, and in no case shall supports be attached to roof decks.

F. For suspending pipes from concrete beams, upper attachments shall be side beam bracket utilizing bolts in sleeves set in top portions of the beams. Where sleeves are not used, provide expansion shields or power-actuated fasteners.

G. Hanger rods for pipe hangers shall be as follows:

1. 3/8” hanger rod – 2” nominal pipe and smaller
2. 1/2” hanger rod – 2 ½” and 3” nominal pipe
3. 5/8” hanger rod – 4” and 5” nominal pipe
4. 3/4” hanger rod – 6” nominal pipe
5. 7/8” hanger rod – 8” through 16” nominal pipe

H. Pipe hangers selected for supporting horizontal insulated piping shall be sized to fit around the outside of the pipe insulation except for the following services, which shall be sized to fit around the pipe and under the insulation:

1. Hot water supply and return piping, steam, condensate return and related piping sized 2" and smaller.

I. Provide pipe saddles, inserts and shields on all insulated piping as outlined below:

1. Hot water supply and return piping and associated steam and condensate return piping over 2" shall be supported by steel saddles welded to pipe. Insulation shall be continuous through the saddle.
2. All other insulated piping shall be supported on Foamglas insulation inserts and galvanized shields, except that no inserts are required on piping sized less than 2". Foamglas inserts shall extend at least 2" past each end of the pipe shields.

a. Shields shall be as follows:

1) Pipes 2" and smaller: 18 gauge x 12" long
2) Pipes 2 1/2" and larger: 16 gauge x 18" long

b. Shields and inserts shall be 180 degrees around the lower half of the pipe at all pipe hangers, except that on trapeze hangers, pipe racks and floor supported horizontal pipes, shields shall be 360 degrees around the entire pipe.

PART 3 - EXECUTION

3.1 SUBMITTALS

A. Before preparing submittals, study all Contract Drawings and specifications in detail, obtain

manufacturer's recommended instructions, and have submittals prepared based on specific equipment and material proposed for installation. An officer of the Contracting Firm shall sign all shop drawings (certifying conformance with plans and specifications) before submitting to the Architect or releasing to the field.

B. The submittal process shall not be utilized as an avenue to substitute products after the execution of the contract. Should an unspecified or unequal product be submitted, it will be rejected. If a second attempt at substitution is made during the resubmittal of the same product, then no more reviews of that product will be performed without direct compensation to the Engineer being paid for the additional services required for the third review and any further reviews.

C. All submittals shall be submitted and returned electronically.

D. Submittals will not be accepted for review unless they:

1. Comply with the requirements of Division 1
2. Include complete information pertaining to all appurtenances and accessories
3. Are submitted as complete packages which pertain to all related items in Division 23. Separate packages shall be submitted as follows:

    a. All HVAC equipment and components
    b. The automatic controls and EMS

4. Are properly marked with equipment, service, or function identification as related to the project and are marked with pertinent specification paragraph number

E. Submit catalog information, factory assembly drawings, field installation drawings and certifications as required for complete explanation and description of all items of equipment. The submittal data shall provide ample, unquestionable compliance with the Contract Documents.

F. Review of submittals shall not be construed as authorizing any deviations from the plans and specifications unless such deviations are clearly identified and separately submitted in the form of a letter that is enclosed with the submittals.

G. Submittals are required on all manufactured equipment, especially energy consuming equipment. Submittals shall include, but are not limited to, the following items of equipment:

1. Piping and Piping Specialties
2. Ductwork and Piping Insulation
3. Pumps
4. Heat Tracing
5. Terminal Units
6. Split Systems
7. Packaged Rooftop Units including proposed controller and points list
8. Air Distribution Devices
9. Ductwork Accessories (Including All Dampers)
10. Fans
11. Unit, Wall, Ceiling, Duct, Etc. Heaters
12. Variable Frequency Motor Controllers
13. Make-Up Air, Dedicated Outdoor Air, and Energy Recovery Units including proposed controller and points list
14. Kitchen Hoods (for coordination)

15. Louvers and Hoods
16. T&B Company Certifications and Final Report
17. Control Diagrams, System, and Components
18. Ductwork and Piping Shop Drawings
19. Elevator Hoistway and Controller / Equipment Room (for heat rejection coordination)
20. Generators with Ducted Intake and/or Exhaust
21. Firestopping Products and Applicable UL Firestop Details

3.2 EXCAVATION, TRENCHING AND BACKFILLING

A. Perform all excavation, trenching and backfilling for underground work under this Division 23. During excavation, the excavated material shall be piled back from the banks of the trench to avoid overloading, slides or cave-ins. Do not exceed the angle of repose unless written approval is obtained in advance from the Architect for shoring, bracing or other alternate excavation methods. All excavated material not used for backfilling shall be removed from the building and disposed of as indicated or directed by the Architect. Take measures to prevent surface water from flowing into trenches and other excavations and any water accumulating therein shall be removed by pumping. All excavation shall be made by open cut. Tunneling shall not be allowed.

B. The bottom of all trenches shall be evenly graded to provide firm support and an even bearing surface. Pipe shall be laid on firm soil, laid in straight lines and on uniform grades. Provide bell holes so that the barrel of the pipe rests evenly on the bottom of the trench along the entire length of the pipe.

C. Pipe shall be inspected and tested prior to backfilling. Trench shall be handfilled to a minimum of 12" above the top of pipe with suitable earth (free of rocks, trash, large clods and organic material) and compacted to a minimum 95% proctor. After the first layer is completed, subsequent layers shall be filled and compacted the same as the first layer. Settling the backfill with water shall not be permitted.

3.3 INSTALLATION REQUIREMENTS

A. All equipment shall be installed in strict conformance with the recommendations of the Equipment Manufacturer, as indicated on the Drawings and as specified.

B. Provide installation manuals for each piece of equipment. Submit in separately bound volumes after review of submittals.

C. Provide supplementary steel framing and welded steel equipment support stands as required for proper hanging and support of the mechanical systems. Steel angles, channels and tubing utilized for such framing shall be selected for a maximum deflection of 1/360th of the span.

D. All roof curbs shall be a minimum of 12" high and selected for the various roof pitches. Curbs installed on roofs having pitches of not more than 1/4" per foot may be standard curbs shimmed level with steel channels or Zs to provide suitable support and flashing surfaces.

3.4 CLEANING, LUBRICATION AND ADJUSTMENT

A. The exterior surfaces of all mechanical equipment, piping, ductwork, conduit, etc., shall be cleaned and free of all dirt, grease, oil, paint splatter, and other construction debris.

B. Ducts, plenums, and air unit casings shall be cleaned of all debris and either vacuumed or blown free of all rubbish, dirt, and dust before installing grilles, registers or diffusers.

C. Bearings that require lubrication shall be lubricated in strict accordance with the manufacturer's recommendations.

D. All control equipment shall be adjusted to the settings required for the performance specified.

E. Fans shall be adjusted to the speed indicated by the Manufacturer to meet the installed final system pressure at the airflows indicated. Any additional sheaves and belts required for final adjustments shall be provided with no increase in the Contract amount.

F. Any fans operated during construction shall have temporary filters. Temporary filters shall be changed regularly to minimize contamination of the equipment and duct systems. Permanent filters shall be installed prior to final inspection.

G. All coils shall be thoroughly cleaned and combed prior to final inspection.

H. All materials, equipment, etc. subject to weather, corrosion, dust, debris, water etc. to be installed or utilized for the project shall be fully protected. This is inclusive of piping and duct openings and internal fan ventilation intakes and discharges. This Division's scope includes protection and remediation of any and all Division materials, etc. including cleaning, vacuuming, dusting, etc. required for a clean system and operation. Insulation and equipment with electrical connections subject to water shall be replaced in their entirety. Coordinate with all other trades and schedules.

3.5 PAINTING

A. All uncoated and uninsulated steel surfaces exposed to sight inside the building, such as piping, equipment hangers and supports which are not provided with factory prime coat or galvanizing, shall be cleaned and painted with one coat of rust inhibiting primer. In addition, all surfaces in finished spaces shall also be painted with two coats of finish paint in a colour selected by the Architect.

B. All ductwork surfaces, piping, supports, etc. visible through grilles, registers and diffusers in finished areas shall be painted flat black. All ductwork, equipment, piping, supports, air distribution, etc. visible in exposed finished areas shall be painted a colour selected by the Architect, except that nameplates shall not be painted.

C. Steel items exposed outside the building, such as equipment supports, uninsulated piping and hangers, which are not factory painted or galvanized, shall be cleaned and painted with one coat of rust inhibiting primer and two coats of asphaltic base aluminum paint. Insulated steel pipes outside the building shall be cleaned and painted with one coat of rust inhibiting primer before installing insulation.

D. Factory painted equipment that has been scratched or marred shall be repainted to match the original factory color.

3.6 DUCTWORK AND PIPING LEAK TESTING

A. Insulated, underground, and concealed ductwork and piping shall be tested for leaks in place before backfilling, concealing or covering. Tests shall be conducted in the presence of the Architect or their designated Representative.

B. All low pressure ductwork (design operating pressure of 1.0" WC ESP or less) shall be tested by the operation of the system to which it is connected.

C. All medium and high pressure ductwork (operating pressure of more than 1.0" WC ESP) shall be tested at 1.5 times the design operating pressure of the system to which it is connected, or at the total fan pressure at shut-off, whichever is greater, up to the maximum pressure classification of the associated ductwork system.

D. All visible and audible air leaks from the ductwork systems shall be repaired.

E. See specification section 231123 for testing requirements of natural gas piping. System shall be part of Division 22 scope unless otherwise arranged within the Contract. Coordinate with Division 22.

F. All refrigerant piping shall be 100% tested with the applicable ASHRAE standard – latest version.

G. All leaks shall be repaired by tightening, remaking joints, or replacing pipe and fittings. Caulking of joints shall not be permitted.

3.7 RECORD (AS-BUILT) DRAWINGS

A. At the completion of the project, provide a set of reproducible prints to the Architect which reflects all changes, deviations and revisions made to the original design documents. Locations of all underground piping and utilities shall be clearly shown and dimensioned from permanent reference points such as building column lines. Record drawings shall be produced in electronic format compatible with AUTOCAD. Furnish electronic copies of all drawings in dwg. format, and two (2) bond copies of all drawing sheets.

3.8 OPERATING AND MAINTENANCE MANUALS AND INSTRUCTIONS

A. Complete operating and maintenance manuals shall be provided to the Owner. Four copies shall be provided. Each copy shall be bound in a separate 3-ring, loose-leaf notebook. Operating instructions shall be provided for each mechanical system, and shall each include a brief system description, a simple schematic and a sequence of operation. Operating and maintenance instructions shall be provided for each piece of equipment. A control system wiring diagram shall be included in each operating and maintenance manual.

B. Prior to final acceptance or beneficial occupancy, provide the services of a Competent Technician for not less than two (2) days to instruct the Owner in the operation of the mechanical systems.

3.9 TESTING AND BALANCING

A. Testing and balancing of the HVAC system shall be performed as specified in Section 230593. Note that this work is to be performed under a separate Contract directly under the General Contractor. Submit four (4) copies of the test and balance report directly to the Architect.

3.10 PIPING SUPPORTS

A. Pipe hangers or supports shall be provided within 18" of each horizontal fitting, equipment connection, valve, etc. and within 18” of the centerline of horizontal or vertical changes in direction summing to 90° or more. Specific attention is called to vertical turns into risers.

B. Piping supports shall be provided, at a minimum, in accordance with the greater of the below or at code minimum. Where the below or code does not address support for specific piping,

supports shall be in accordance with manufacturer's requirements.

Piping Material	Max. Horz. Spacing	Max. Vert. Spacing
Cast-iron pipe	5'	15'
Copper pipe	12'	10'
Copper tubing ≤ 1-1/4" dia.	6'	10'
Copper tubing ≥ 1-1/2" dia.	10'	10'
PVC pipe	4'	10'*

*Midstory guide required for piping 2" diameter and smaller

C. Riser clamps shall be provided at each floor penetration. For pressurized piping systems except refrigerant suction and liquid service, provide vibration isolation at all riser clamps with two (2) pad-type mountings consisting of a minimum 3/8" thick ribbed or waffled elastomeric pads bonded between minimum 16-gauge galvanized steel separator plates. Pads shall be sized for a deflection of 0.12" to 0.16". Pads shall be minimum 3" x 3" square.

3.11 WARRANTY

A. All work provided under this Division 23 shall be subject to a minimum one year warranty. The warranty shall include prompt repair or replacement of equipment or system failures and shall include all parts, refrigerant, and labor. In addition, all compressors shall carry an additional four year parts-only warranty. Extended warranties shall be provided on all other equipment so specified in other Sections.

3.12 BIM MODELING AND COLLISION DETECTION

A. The Contractor shall utilize 3D modeling for coordination and collision / interference detection software simulation. This model will be used for coordination, collision detection and inference from all trades: mechanical, plumbing, electrical, fire protection, etc. BW&A will provide 2D plans of the mechanical, plumbing and electrical as well as 3D models of major system infrastructure prepared during the project design phases. The extent of modeling varies and is not to be used for shop drawings or to replace required Contractor coordination. Each SubContractor is responsible for preparation of a 3D/BIM model of their system for Contractor collision detection and coordination. This model shall be used for As-Built documentation for the Owner. Contractor 3D Model shall be the latest version of Revit, Navisworks, or equal.

B. Upon completion of the BIM Model, provide the Engineer a full set of shop drawings for their review. Shop drawings shall meet the below requirements.

3.13 SHOP DRAWINGS

A. Shop drawings per the submittal requirements shall be submit to the Design Team with adequate time for multiple rounds of review. Shop drawings shall show "As-Built" conditions including elevations, offsets, transitions, and accessories. Shop drawings shall indicate all code and manufacturer's recommended clearances, access, and coordinate the clearance and access requirements with all other trades.

B. Shop drawings that use keynotes direct from the Design Documents shall not be acceptable as they do not demonstrate coordination with all other trades, necessary transitions, etc.

C. Shop drawings shall be provided as complete packages in parallel with all trades to document coordination. Floor-by-floor or otherwise piecemeal shop drawings are generally not acceptable.

3.14 OWNER TRAINING

A. Owner training shall be provided for all systems and equipment and shall include the following:

1. 8-hours of training for each type of equipment
2. 24-hours of training for HVAC controls
3. 16-hours for overall system operational training

B. A training summary and schedule shall be submitted to the Architect for approval within ninety (90) days of the date of substantial completion.

C. Training timing will vary and shall be assumed to include multiple sessions as required by the Owner.

3.15 BID REQUIREMENTS

A. The Contractor shall include all systems, equipment and accessories shown on the plans and specifications.

B. The Contractor is responsible for providing all design documents to all SubContractors. All systems, equipment and accessories shall be included in the bid, whether shown on the SubContractor applicable plans or other design documents.

C. Should any discrepancy occur in the Design Documents, the Contractor shall provide a request for clarification prior to bid or note the discrepancy in the bid and provide an appropriate cost allowance in the bid.

D. The Contractor shall acknowledge that the Design Documents are diagrammatic and shall provide all systems, equipment and accessories required for a complete facility. Any areas that appear to be void of systems or inappropriate systems shall be noted in the bid. No post bid change order shall be considered for areas or discrepancies not noted in the bid.

E. All installation coordination and means and methods and labor and materials required for proper system installation shall be included.

F. These requirements are in addition to bid procedures and requirements of the RFP or general specifications.

END OF SECTION

SECTION 230593

TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 DESCRIPTION

A. All work specified in this Section is governed by the Common Work Results for HVAC Section 230500.

B. This Section 230593 and the accompanying drawings cover the provision of all labor, equipment, appliances, and materials and performing all operations in connection with the testing and balancing (T&B) of the heating, ventilating and air conditioning (HVAC) systems as specified herein and as shown. These systems include, but are not limited to, the following:

1. Supply distribution systems
2. Return and exhaust air systems
3. Heating, ventilating and air conditioning equipment (all scheduled equipment as a minimum)

1.2 INTENT

A. It is the intent of this Section of the specifications to provide a complete operable and balanced HVAC system as shown and specified which is reasonably airtight, comfortable and free of objectionable noise and vibration.

1.3 SCOPE OF WORK

A. HVAC test and balance shall be performed by an Independent Agency certified by the Associated Air Balance Council (AABC) or National Environmental Balancing Bureau (NEBB) under direct contract to the General Contractor. All work performed by this Agency shall be performed by qualified Technicians under the direct supervision of an AABC or NEBB Certified Test and Balance Engineer. The Agency shall be independent and shall not be associated in any way with the installing HVAC SubContractor.

1. Palmetto Air and Water Balance -
   Allen Tew
   Phone: (919) 460-7730
   atew@palmettoairbalance.com
2. Research Air Flo
   Contact: Joel Shannon (770) 452-8292
   Contact: (919) 387-5788 (Raleigh)
   Contact: (704) 321-0491 (Charlotte)
   joel@researchairflo.com

B. HVAC Test and Balance shall be performed in accordance with the 7th edition of the AABC National Standards, 2016 for Total System Balance or the NEBB Procedural Standards for TAB of Environmental Systems, 8th Edition, 2015 together with the NEBB TAB Manual for Technicians, 2nd Edition.

C. The final Test and Balance report shall serve to substantiate compliance with the intent of the Contract Documents, specifically the HVAC systems.

D. HVAC Test and Balance shall not begin until the systems are substantially complete.

E. Upon the completion of the Test and Balance work, the Agency shall submit four (4) copies of the complete HVAC Test and Balance Report directly to the Architect.

F. The Agency, as a part of its contract with the General Contractor, shall act as an Authorized Inspection Agency, responsible to the General Contractor and the Architect and shall, during the test and balance, list those items which require correction or have not been installed in accordance with the Contract Documents.

G. The Agency shall plainly mark the settings of all valves, dampers and other adjustable devices. If a balancing device is provided with a memory stop, it shall be set, locked and marked.

H. The Agency shall record all of the final set points on all variable speed drives.

1.4 SUBMITTALS

A. The name and certification of the Agency, along with the name and certification of the Certified Test and Balance Engineer, shall be submitted to the Architect for review within 30 days after the award of the General Contract.

B. The selected Agency shall submit to the Owner:

1. Procedural Manual
2. Report Forms
3. AABC or NEBB Performance Guaranty
4. Instrument List and Calibration Dates
5. Schedule
6. Floorplans as Needed to Uniquely Identify Device Locations

C. A reviewed copy of each of the above shall be returned to the Agency before the HVAC Test and Balance begins.

D. If a complete submittal in accordance with these requirements is not received within 60 days from award of the General Contract, then the Architect reserves the right to select the Agency.

PART 2 - PRODUCTS

2.1 (Not applicable).

PART 3 - EXECUTION

3.1 GENERAL CONTRACTOR'S DUTIES

A. The General Contractor shall provide the following, within 10 days after his receipt, to the Agency:

1. Contract Drawings
2. Contract applicable specification Division 23 (others as applicable)
3. Addenda
4. Change orders
5. Reviewed submittals

B. The General Contractor shall start-up and maintain the HVAC systems and shall continue the

operation of the HVAC systems during each day of testing and balancing. Start-up and operation shall include, as a minimum, the following:

1. All equipment operable and in safe condition.
2. Temperature control system complete.
3. Proper thermal overload protection in place for electrical equipment.
4. Ductwork leakage rates not exceeding those specified and all duct systems clean of debris.
5. Air transfer systems shall have:

    a. Correct fan rotation and RPM.
    b. Coil fins cleaned and combed.
    c. Filters clean and in place.
    d. Access doors closed.
    e. All dampers in place and open.
    f. All grilles, registers and diffusers installed.

C. Provide sufficient time before final completion date so that testing and balancing can be accomplished. Coordinate the submitted T&B schedule.

D. Provide immediate labor and tools to make required corrections and repairs without undue delay.

E. The General Contractor and his SubContractors shall cooperate fully with the Agency to provide the following:

1. Access to HVAC system components.
2. The right to adjust the systems.

F. Any conditions which prevent a proper HVAC Test and Balance shall be reported by the Agency to the General Contractor and Architect within 7 days of their discovery.

G. If it is determined by the Agency and confirmed by the Architect that drive changes or additional balancing dampers are required, the Contractor shall obtain and install all necessary components.

H. The Agency shall cooperate with the Architect and the Contractor and all his SubContractors to perform the work in such a manner as to meet the job schedule.

I. The Agency shall verify that all system components are in place and in proper working order prior to leaving the project.

J. All reported and recorded data shall represent true measured conditions.

K. Where equipment uses variable speed drives, and where feasible, VFDs shall be used as the primary balancing method prior to adjustment or balancing of valves, dampers, etc.

END OF SECTION

SECTION 230713

DUCT INSULATION

PART 1 - GENERAL

1.1 DESCRIPTION

A. All work specified in this Section is governed by the Common Work Results for HVAC Section 230500.

B. This Section 230713 and the accompanying drawings cover the provisions of all labor, equipment, appliances, and materials and performing all operations in connection with the construction of the ductwork systems as specified herein and as shown. These systems include, but are not limited to, the following:

1. Insulation for typical ductwork
2. Duct liner
3. Insulation for ductwork outside
4. Insulation for grease exhaust ductwork
5. Insulation for generator exhaust pipe

1.2 INTENT

A. It is the intent of this Section of the specifications to provide a complete operable duct system as shown and specified which is reasonably airtight, free of noise, vibration and sweating, and fabricated so as to fit into the space allotted and to exhibit a minimum resistance to airflow.

PART 2 - PRODUCTS

2.1 DUCT LINER

A. Duct liner shall be one inch thick, 1 ½ lb. density (3 lb. density on medium- and high-pressure supply air systems except that 1 ½ lb. density is acceptable if the liner is at least R ≥ 4.2 and NRC ≥ 0.65) fibrous glass with one face coated with a black fire retardant compound. The permanent composite fire and smoke hazard rating of the liner shall be stenciled on the liner face and shall be:

1. Maximum Flame Spread 25
2. Maximum Smoke Developed 50

2.2 TYPICAL DUCT INSULATION

A. Duct insulation shall be 2" thick, minimum 3/4 lb. density fiberglass with an FSKL 0.00035" thick aluminum foil jacket, reinforced with fiberglass scrim. Thermal conductivity shall be a maximum of K = 0.29 at 75°F mean temperature, or a maximum of K=0.27 at 25% compression.

B. Insulation adhesive shall be Benjamin Foster 85-20. Tape shall be aluminum foil and shall be SMACNA listed and labeled.

C. The composite NFPA 90A and 90B, ASTM E84, UL rating of the installed insulation shall not exceed 25/50.

D. The grease exhaust ductwork shall have zero-clearance to combustibles wrap from the hood

connection to discharge termination. Coordinate the insulation with all required access panels, drains, etc. as required by NFPA 96.

2.3 INSULATION FOR DUCTWORK OUTSIDE

A. See specification 233100 for duct construction installed outside the building and exposed to weather. Note requirement for soldered or welded duct. Ductwork installed outside shall be shall be provided with a cover as noted below with water-proof coating and seams. Seams shall be located so as to not be subject to water flow. Cover shall be painted a light colour as selected by the Owner. All ductwork installed outside shall be constructed with sloped top “watershed” design with a slope of not less than 2% to avoid ponding water. Any ductwork supports connected directly to the ductwork shall also abide by the insulation requirements below.

1. Ductwork conveying conditioned air shall, in addition, have minimum R-12 insulation of one of following options:

    a. 3” thick, 3 PCF density rigid fiberglass board insulation with foil-kraft facing with Venture Clad, or equal, vinyl cover.
    b. 3” thick, 3 PCF density rigid fiberglass board insulation with foil-kraft facing with Polyguard, or equal, self-adhesive, self-healing membrane with 180% elongation factor.
    c. 2” thick polyisocyanurate board insulation with vinyl cover or membrane per the options above.

2. As an alternate to single wall duct and exterior insulation, ductwork installed outside may be double-walled meeting SMACNA requirements, R-12 insulation between walls, and the exterior wall shall be corrosion-coated for outside installation. Ductwork shall be weathertight.
3. Grease ductwork installed outside shall be a zero-clearance product or shall have zero-clearance wrap per Section 233100. Exterior of insulation shall be protected with a weatherproof cover per a. or b., above.
4. Ductwork installed outside but not exposed to weather, such as in covered loading docks and parking decks more than 15’ from exterior openings, and conveying unconditioned air, shall not be required to be covered or insulated. See Section 233100 for coating required for seacoast area installations.
5. Access into ductwork installed outside shall be located inside the building where feasible. Where outside access is required, access shall be through removable cover and insulation to match the above requirements. Removable areas shall be permanently labeled on the outside and shall be insulated to minimize exposure to water infiltration.

2.4 INSULATION FOR GREASE EXHAUST DUCTWORK

A. Grease exhaust ductwork insulation shall be fire-wrap, 3M, FyreWrap, or equal, as necessary to reduce the maximum ductwork surface temperature to 120°F or less or as required by the clearances to combustibles, limited-combustibles, and non-combustibles.

B. Ductwork and insulation may be provided as part of a complete zero-clearance to combustibles system, Ampco, Metal-Fab, Zero-Clear, Schebler, Captive-Aire, or approved equal and shall be listed and labeled in accordance with UL 2221. Coordinate all access hatches, drains, etc. as required by NFPA 96. System shall be complete with drains, access hatches, flanged sections rated for passing through rated walls, etc. as required by NFPA 96.

2.5 INSULATION FOR GENERATOR EXHAUST PIPE

A. Generator exhaust pipe including muffler or silencer, exclusive of corrugated ductwork at the generator exhaust connection, shall be insulated with two layers of Calcium Silicate insulation, with staggered joints. Each layer shall be bound by 302 stainless steel wire strap at 9” centers. The insulation shall be covered by 304 stainless steel cladding with a minimum of 2” overlap in the axial and horizontal directions. The cladding shall be secured by 0.5” wide, 0.015” thick 302 stainless steel bands at 9” centers. The insulation thickness shall be a required to limit the cladding surface temperature to 120°F or lower at the Generator Manufacturer’s maximum flue discharge temperature. Insulation shall be manufactured by Manville, Owens-Corning, or PABC. Flexible piping connections shall be insulated as required to limit cladding surface temperature to 120°F or lower.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Ductwork shall be installed in strict accordance with SMACNA, UL, and NFPA standards.

B. Duct liner shall be provided throughout all return air, transfer and plenums. Duct liner shall also be provided for the following minimum distances, through the first elbow(s), or as otherwise indicated on the drawings, whichever is greater, downstream of each unit indicated below:

1. Packaged rooftop unit – 25 ft
2. Split system air handling unit – 5 ft
3. Terminal unit – 5 ft

C. Straight runs only shall be factored into the above distance requirements. Elbows, etc. within the length shall be lined but shall not count towards the length requirement.

D. Duct liner shall not be installed within six inches of a damper, including fire and/or smoke dampers. Metal nosings are required on the downstream side of the exposed insulation. Where lining has been interrupted, external insulation is required.

E. Duct liner shall be cut to provide overlapped and compressed longitudinal corner joints. Liner shall be installed with the coated surface facing the air stream. Duct liner shall be adhered to the ductwork with a 100% coverage of the sheet metal surfaces using a fire retardant adhesive applied by spraying. Coat all exposed leading edges and all transverse joints with fire retardant adhesive. The liner shall be additionally secured using metal pins welded to the duct and speed washers. All leading edges shall be secured with sheet metal airfoils.

F. Inside the vapor barrier of the building all supply air ductwork which is not lined shall be insulated. All outside air ductwork shall be insulated. Insulation shall be cut slightly longer than circumference of duct to insure full thickness at corners. All insulation shall be applied with edges tightly banded. Insulation shall be adhered to duct with fire resistant adhesive. Adhesive shall be applied so that insulation conforms to duct surfaces uniformly and firmly. In addition to the adhesive, the insulation shall be additionally secured to the bottom of all ducts 18" or wider by means of welded pins and speed clips. The protruding end of the pins shall be cut off flush after the speed clips have been applied. The vapor barrier facing shall be thoroughly sealed with tape where the pins have pierced through. All joints shall be sealed with 2" wide SMACNA tape. Any cuts or tears shall be sealed with SMACNA tape.

G. All grease exhaust shall be insulated.

H. Dishwasher ductwork above ceilings shall be externally insulated similar to supply ductwork.

I. Combustion air ductwork located in conditioned spaces, to gas-fired appliances, shall be externally insulated similar to supply ductwork.

J. All outside air ductwork located in conditioned or semi-conditioned spaces shall be externally insulated similar to supply ductwork.

K. All conditioned air ductwork, including partially conditioned energy recovery ventilator outside air supply to the building and exhaust ductwork, installed in spaces that are ventilated only, i.e. penthouses, shall be insulated.

END OF SECTION

SECTION 230719

HVAC PIPING INSULATION

PART 1 - GENERAL

1.1 DESCRIPTION

A. All work specified in this Section is governed by the Common Work Results for HVAC Section 230500.

B. This Section 230719 and the accompanying drawings cover the provisions of all labor, equipment, appliances, and materials and performing all operations in connection with the insulation of the HVAC piping systems as specified herein and as shown for the heating, ventilating and air conditioning (HVAC) systems. These insulated piping systems include, but are not limited to, the following:

1. Refrigerant suction and liquid (RS&L)
2. Condensate drains (indoors only)

C. All insulation products installed indoors shall meet NFPA 90A, 90B and 255 requirements for Flame Spread Rating 25 and Smoke Developed Rating 50.

D. Inserts for all piping which is specified to have hangers outside the insulation shall be provided at such hangers and supports for all piping 2" and larger. Inserts shall be Foamglas insulation, and shall be at least 2" longer than the length of the associated pipe shields.

1.2 INTENT

A. It is the intent of this Section of the specifications to provide a complete piping insulation system which is free of gaps and tears, properly fitted and finished, free of sweating, and fabricated so as to fit the space allotted and to exhibit a negligible heat transfer.

B. The word "piping" is defined to mean all piping, fittings, joints, hangers, coatings, valves, cocks, test and sensor wells and accessories necessary for the HVAC piping systems described, shown and specified.

1.3 ACCEPTABLE MANUFACTURERS

A. Insulation products shall be as manufactured by Owens Corning, Knauf, Manville, Certainteed, Dow, Armacell, or Armstrong.

PART 2 - PRODUCTS

2.1 PIPING INSULATION

A. Closed-cell insulation shall be provided over all refrigerant piping and other services as specified or noted. Closed-cell piping insulation shall be 1-1/2" thick 25/50 Armaflex or Rubatex. All glues and coatings shall be products of the same Manufacturer as the insulation.

B. Insulation shall be continuous over all valve bodies, fittings, and wall and floor penetrations. Do not insulate unions on hot water piping; nor instruments, gauges, valve handwheels, etc. on any piping.

PART 3 - EXECUTION

3.1 CLOSED-CELL PIPING INSULATION INSTALLATION

A. Insulation shall be provided on all refrigerant suction and indoor cooling coil condensate drain lines. The insulation shall be installed by the slip-on method; slitting of the insulation is prohibited and shall be cause for rejection. All elbows shall be mitered and all such joints and butt joints shall be tightly made and glued.

B. All insulation installed outdoors shall be coated with a glossy white, ultraviolet protective coating applied in two coats.

3.2 MISCELLANEOUS REQUIREMENTS

A. Where insulation is installed over pipe hangers, supports, etc., seal vapor barrier at all penetrations. Also seal all end joints at unions and points of termination by bevel cutting the end and drawing jacket over until secured at the pipe. Apply white mastic to all end seals over jacket.

END OF SECTION

SECTION 231123

NATURAL GAS PIPING

PART 1 - GENERAL

1.1 DESCRIPTION

A. All work specified in this Section is governed by the Common Work Results for Plumbing Section 220500.

B. This Section 231123 and the accompanying drawings cover the provision of all labor, equipment, appliances, and materials and performing all operations in connection with the construction of the systems as specified herein and as shown. These systems include, but are not limited to, the following:

1. Natural gas systems

1.2 INTENT

A. It is the intent of this Section of the specifications to provide complete and operable system as shown and specified which is free of leaks, properly vented, free of unreasonable noise, vibration, and fabricated so as to fit the space allotted.

B. The word "piping" is defined to mean all piping, fittings, joints, hangers, coatings, valves, cocks, and accessories necessary for the system described, shown, and specified.

1.3 GENERAL REQUIREMENTS

A. Provide all reducing fittings, flanges, couplings and unions of the size and type of material to match the piping connections at each fixture, piece of equipment, valve, and accessory.

B. All pipe and fittings shall be products of a domestic Manufacturer.

C. Union joints, couplings or flanges shall be provided in each pipe line connected to each piece of equipment, fixture and elsewhere as indicated and specified. Unions shall match the piping system in which they are installed.

1. Unions or flanges shall be provided between all copper to steel connections. These unions shall be dielectric, insulating type.

D. All changes in direction and branches shall be made with manufactured fittings.

E. All pipe joints shall be cut square and all burrs shall be removed.

F. Open ends of pipe lines not currently being handled shall be plugged during installation to keep dirt, water, and foreign material out of the system.

G. This scope shall be part of Division 22 scope unless otherwise arranged within the Contract. Coordinate with Division 22.

1.4 IDENTIFICATION OF PIPING

A. See specification Section 220500 for all requirements.

B. In addition, the natural gas piping shall be painted yellow, in accordance with ANSI standards, with paint suitable for the piping location. Paint shall be corrosion-resistant and continuous through all supports, penetrations, sleeves, etc.

PART 2 - PRODUCTS

2.1 NATURAL GAS PIPING

A. Piping shall be Schedule 40 black steel complying with ANSI B36.10 or ASTM A 53. Fittings shall be steel or malleable iron. Joints shall be threaded or welded.

B. Gas cocks shall meet ANSI B16.33.

C. Piping installed underground outside may be medium density polypropylene. Coordinate selection with all installation location and connection requirements. Connections to equipment shall be made with piping per the materials listed in this specification. Provide and install transitions as required.

D. For Seismic Design Category C or D, all natural gas piping shall be seismically restrained in accordance with code requirements. Restraints shall be by Mason or approved equal. Submit shop drawings on seismic restraint systems.

2.2 PIPE HANGERS AND SUPPORTS

A. See specification Section 220500 for all requirements.

2.3 REGULATORS

A. Regulators shall be appropriate for the installation in which they are installed, including weather-rated as appropriate. Provide and install all accessories as necessary.

B. Regulators installed inside or within 15’ of any outside air intake, including doors and operable windows, shall be ventless. Where ventless regulators are not available, regulator shall have vent piped to outside in accordance with manufacturer’s recommendations. Route and size shall be in accordance with manufacturer’s recommendations.

PART 3 - EXECUTION

3.1 ARRANGEMENT

A. Follow the general piping layout, arrangement, schematics and details. Provide all offsets, vents, drains and connections necessary to accomplish the installation. Fabricate piping accurately to measurements established at the project site to avoid interference with ductwork, other piping, equipment, openings, electrical conduits and light fixtures. Make suitable provision for expansion and contraction with expansion loops and offsets.

3.2 MINIMUM HANGER SPACING

A. See specification 220500 for all requirements.

3.3 INSTALLATION

A. Piping installed outside the building and underground shall be installed in a PVC sleeve to

prevent corrosive ground contact with piping. Piping shall enter the building above grade.

B. Piping not subject to corrosion (i.e. polypropylene) does not require a PVC sleeve.

C. Piping installed outside the building and underground shall be buried a minimum of 36” below grade or below the frost line, whichever is deeper.

D. Piping installed outside shall be elevated above grade a minimum of 3.5” and shall be securely supported.

E. Piping penetrating floor slabs, walls, etc. shall be protected from damage and corrosion as required by Code.

F. For non-metallic underground gas lines, a yellow insulated copper traces wire or other approved conductor shall be installed with underground nonmetallic piping. Access shall be provided to the tracer wire or the tracer wire shall terminate aboveground at the end of the nonmetallic piping or not less than 3” above ground, whichever is greater. The tracer wire size shall not be less than 18 AWG and the insulation type shall be suitable for direct burial.

G. Regulators shall be provided under this scope for each gas-fired equipment without appropriate regulators provided by the Equipment Manufacturer. Coordinate with all equipment. Regulators shall be appropriate for the pressures and capacity of the equipment and installation location.

3.4 TESTING AND PURGING

A. All new gas piping shall be pressure tested at 3 psi or 1.5 times the design pressure, whichever is greater, for a time period of 0.5 hours per 500 cubic feet of pipe volume, not to exceed 24 hours.

B. All gas piping 2.5” and larger shall be purged with an inert gas prior to operation, with the piping purge lengths as required by Code.

END OF SECTION

SECTION 233100

HVAC DUCTS, ACCESSORIES, AND CASINGS

PART 1 - GENERAL

1.1 DESCRIPTION

A. All work specified in this Section is governed by the Common Work Results for HVAC Section 230500.

B. This Section 233100 and the accompanying drawings cover the provisions of all labor, equipment, appliances, and materials and performing all operations in connection with the construction of the ductwork systems as specified herein and as shown. These systems include, but are not limited to, the following:

1. Supply air ductwork
2. Return, transfer and relief air ductwork
3. Exhaust ductwork
4. Grease exhaust ductwork (from kitchen hoods)
5. Dishwasher exhaust ductwork
6. Generator flue exhaust
7. Outside air ductwork
8. Combustion air ducts and flues
9. Ductwork accessories
10. Ductwork sound attenuators

1.2 INTENT

A. It is the intent of this Section of the specifications to provide a complete operable duct system as shown and specified which is reasonably airtight, free of noise, vibration and sweating, and fabricated so as to fit into the space allotted and to exhibit a minimum resistance to airflow.

1.3 DESIGN AND CONSTRUCTION - DUCTWORK

A. Ductwork shall be provided in strict accordance with the third edition - 2005 - of the SMACNA HVAC Duct Construction Standards - Metal and Flexible, NFPA No. 90A, 90B, 91 and 96, and UL 181. **Where SMACNA tables have an option between different gauges and supports, the heavier gauge shall be used.**

B. Ductwork dimensions shown are net, clear, inside dimensions with no allowance shown for duct liner. All ductwork specified to be lined shall be 2" larger than shown in each dimension to compensate for the liner. Ductwork shall be square, rectangular, round, spiral or flat oval as noted. Conversion of duct shapes and sizes shown shall be accomplished without increasing air velocities or friction losses and is subject to prior approval by the Architect and Engineer.

C. Elbows shall be either full radius type (inside radius equal to duct width), five-gore radiused flat-oval type or, in low pressure systems only, mitered with double-thickness turning vanes.

D. Abrupt changes in duct sizes and shapes shall not be permitted. The total angle of diverging transitions shall be not more than 15 degrees; converging transitions shall be not more than 30 degrees unless otherwise noted or required due to structural constraints.

E. Offsets, transitions, rises and drops are not individually called out on the Design Drawings.

They shall be provided as required to fit the ductwork into the allocated spaces.

F. Transition rectangular ductwork on bottom and sides. Maintain top of ductwork level and as high as possible.

G. “Medium pressure ductwork” shall be constructed for 3" WC static pressure class at 4000 FPM velocity with Class A seals. Applications shall include:
1. All supply air ductwork between the VAV packaged rooftop unit and the terminal units
2. All ductwork between central ventilation fans (such as outside air, toilet exhaust, pressure relief, energy recovery units, 100% outdoor air units) and their terminal units.
3. All ductwork in systems subject to more than 1” WC.

H. All other ductwork shall be constructed for standard 1" WC static pressure class at 2500 FPM with Class C seals and is herein defined as "low pressure ductwork".

I. Grease exhaust ductwork joints shall be continuously welded and be liquid tight.

J. Provide the following types of ductwork material for the services indicated:

1. Galvanized sheetmetal: supply, return, exhaust, and relief of conditioned and outside air
2. Black steel: grease exhaust, generator pipe
3. Stainless steel: dishwasher/warewasher exhaust

PART 2 - PRODUCTS

2.1 GALVANIZED SHEETMETAL

A. Galvanized sheetmetal shall be lock-forming grade G90-ASTM A 525 hot dip galvanized steel sheets. Sheetmetal shall be galvanized on each side with not less than 1.25 ounces of zinc per square foot.

B. Galvanized sheetmetal installed outside the building and subject to weather shall be soldered or welded. See Section 230713 for additional information about covering and insulation.

C. Galvanized sheetmetal installed outside the building and not exposed to weather, such as in covered loading docks and parking decks, may match the construction of ductwork inside the building.

D. Galvanized sheetmetal ductwork outside the building within 20 miles of the seacoast shall have corrosion coating appropriate to the installation location.

2.2 SPIRAL DUCT

A. Spiral duct shall be utilized for all flat-oval and round ductwork in medium and high-pressure systems.

B. Spiral duct shall be the product of United McGill Corporation, R.V. Money, Eastern Sheet Metal, or an approved equal.

C. Spiral duct with internal ribs is not acceptable.

D. Spiral duct shall conform to SMACNA 2005 Standards. Lighter gauges, etc. due to standing ribs are not acceptable.

2.3 DOUBLE-WALL DUCTWORK

A. See Section 230713 for insulation. Insulation shall be sandwiched between two (2) layers of sheetmetal in accordance with SMACNA standards. All joints shall be permanently sealed airtight.

2.4 BLACK STEEL

A. Black steel utilized for grease exhaust ductwork shall be minimum 0.054" thick (16 gauge MSG) black carbon steel.

B. Access panels shall be secured to the duct in a similar manner to the prescribed in NFPA 96-2011 for the hood-to-duct connection.

C. Ductwork shall have access panels, traps, slope, etc. as required by NFPA 96-2011 and the prevailing Code.

D. Grease exhaust ductwork shall be constructed with smooth elbows and transitions. There shall be no obstructions that could collect grease, including but not limited to: flanges, ductwork overlaps, transitions, turning vanes, access hatch lips, etc.

E. Black steel ductwork for generator flue exhaust shall be similar except that it shall be sloped away from the generator and to a ductwork drain location.

2.5 STAINLESS STEEL

A. Stainless steel utilized for dishwasher exhaust ductwork shall be a minimum 18 gauge stainless steel with #4 finish.

B. All seams shall be welded and polished. Ductwork shall slope toward equipment at a minimum of 1/8" per foot.

C. Stainless steel per the above may also be used for generator flue exhaust except that it shall be sloped away from the generator and to a ductwork drain location.

D. Stainless steel utilized for fume hood or lab equipment exhaust ductwork shall be a minimum 18 gauge stainless steel type 316L with #4 finish. All seams shall be welded and polished. **(Not to be used for acid hoods.)

2.6 COMBUSTION AIR DUCTS

A. All combustion air shall galvanized sheetmetal, constructed for the negative pressure per the Gas-Fired Equipment Manufacturer’s recommendation, as applicable. Alternatively, combustion air ductwork may be constructed per the plumbing vent requirements except PVC and CPVC are disallowed in return air plenums. Ductwork shall be sealed airtight to prevent mechanical room or conditioned space air infiltration. Combustion air ducts shall be complete with storm collars, weatherproof caps, and all accessories.

2.7 FLUES

A. All Category I and III flues shall be Type "B", double-wall, as manufactured by Metalbestos or an approved equal. Flues shall be complete with storm collars, weatherproof caps and all accessories.

B. All Category II and IV flues shall be double-walled AL29-4C stainless steel leak-proof vent material, as manufactured by Metalbestos or an approved equal. Flue must be sealed “gas-tight” at all joints. Flues shall be complete with storm collars, drip T with hose end connection, weatherproof caps, and all accessories.

C. Flues must be listed by the Combustion Equipment Manufacturer for the specific equipment applicable.

2.8 DAMPERS

A. Manual Volume Dampers

1. Single blade butterfly dampers are acceptable up to 12" round or 12" x 12" square. Dampers larger than these dimensions shall be multi-blade type. Single blade dampers shall be constructed of 16 gauge or heavier galvanized sheetmetal.
2. No multi-blade damper blade shall exceed 8" in width. All multiple blade dampers shall be constructed of 16 gauge galvanized steel or heavier. The damper frame shall be 16 gauge or heavier. The damper action shall be opposed-blade type.
3. Each blade shall pivot on a 1/2" cadmium plated, cold-rolled steel axle which pivots within self-lubricating, Oilite bronze bearings.
4. The top and bottom edges of each rectangular damper blade shall be crimped for stiffness.
5. The operating rod for all dampers shall be extended outside the damper frame for attachment of an operator. Each operator shall have a position indicator and locking quadrant.
6. All dampers utilized for introduction of outside air shall have flexible, gasketed edge and end seals. The leakage rate shall be less than 4 CFM per SF of face area against a 1" WC differential pressure, based on a nominal 48" x 48" damper size.
7. All dampers utilized for exhaust or relief air shall have flexible, gasketed edge and end seals. The leakage rate shall be less than 4 CFM per SF of face area against a 1" WC differential pressure, based on a nominal 48" x 48" damper size.
8. Dampers to be installed in insulated ductwork shall have standoffs sufficient to allow for insulation and vapor barrier integrity.
9. Manual volume dampers shall be as manufactured by Louvers & Dampers, Inc., Pottorff, Greenheck, Nailor, Ruskin, or an approved equal.

B. Control Dampers

1. Control dampers shall be of the same construction as manual volume dampers, except that no manual operator and quadrant is required. The operating rod shall be suitable for operation by an automatic pneumatic or electric operator.

C. Fire Dampers

1. Fire dampers shall be UL-listed and labeled for 1 1/2 or 3 hours, in accordance with the installation location, and shall be provided with 160°F links or linkages appropriate for the service. Dampers installed within ducts shall be Type B or Type C with the blades out of the air stream. Areas indicated shall be net, clear, open areas.
2. Fire dampers shall be installation location and application. All fire dampers in supply, return, exhaust, etc. shall be dynamic-type.
3. Fire dampers shall be as manufactured by Louvers & Dampers, Inc., Pottorff, Greenheck, Nailor, Ruskin, or an approved equal.

D. Smoke Dampers

1. Smoke dampers shall be UL-listed as Class 1 low-leakage smoke dampers. Smoke dampers shall be 24V and wired under this Division.
2. Smoke dampers shall be installation location and application. All fire dampers in supply, return, exhaust, etc. shall be dynamic-type.
3. Smoke dampers shall be as manufactured by Prefco, Louvers & Dampers, Inc., Pottorff, Greenheck, Nailor, Ruskin, or an approved equal.

E. Fire/Smoke Dampers

1. Fire/smoke dampers may be combined into a combination fire/smoke dampers. All provisions of the above shall apply. Fire/smoke dampers shall be UL-listed.

F. Backdraft Dampers

1. Backdraft dampers shall be sized according to their installation location and noted pressure setting. Damper pressure setting shall be adjustable and shall be accessible from outside ductwork or via access hatch, as applicable.

2.9 LOW-PRESSURE DUCT BRANCHES

A. Splitter dampers shall be provided at all low-pressure ductwork branches. All low-pressure ductwork branches shall be radiused or 45 degree take-offs; straight taps are unacceptable. The length of the damper blade shall be the same as the width of the widest duct section at the split, but in no case shall blade length be less than 12". Each operator rod shall have a locking swivel joint.

2.10 FLEXIBLE DUCT

A. Flexible ductwork shall be Class 1, UL 181 air duct and meet NFPA 90A and 90B Standards.

B. The internal duct surface shall be acoustically rated, black CPE bonded to a coated steel wire helix. The external jacket shall be a fiberglass, bi-directionally reinforced, metallized vapor barrier with a standing, triple ply seam. Fiberglass insulation shall be provided between the duct surface and the jacket to achieve a maximum thermal conductance of 0.24 BTU/Hr./sq. ft./°F at 75°F mean.

C. Flexible ductwork shall be suitable for 10" W.G. positive pressure and 1" W.G. negative pressure in sizes 4” through 12” ID, and 6” W.G. positive pressure and 0.5” W.G. negative pressure in sizes 14-16” ID.

D. Flexible ductwork, insulation and insulation cover shall be suitable for ceiling return air plenum installation and shall comply with all applicable codes and standards regarding such ceiling plenum installations.

E. Flexible duct shall be Thermaflex M-KE or an approved equal.

F. The maximum allowable installed length of flexible ductwork shall be as follows:

1. 8'-0" on low-pressure supply air systems limited to short runouts and end of runs connected to round neck supply diffusers and registers.
2. 4'-0" on medium and high-pressure supply air systems limited to the runouts from the sheetmetal ductwork to each terminal unit.
3. 2'-0" on connections from round neck grilles to sheetmetal ductwork on return, exhaust

and transfer ductwork.

G. Provide a spin-in fitting with integral scoop and volume damper at all flexible run-out connections in low-pressure supply air ductwork only, except locations where spin-in fittings would project more than 50% into the projecting ductwork dimension. Adhesive fittings are acceptable provided they are also screwed to the ductwork and sealed with mastic.

H. Flexible ductwork shall not pass through wall, floors, or ceilings.

2.11 TERMINAL UNIT RUNOUTS

A. Medium and high-pressure runouts to terminal units shall be connected to the trunk duct with factory-welded laterals, conical tees or bellmouth fittings; abrupt round to rectangular taps are strictly prohibited and shall be rejected.

B. Terminal unit runouts shall be the larger of the associated terminal unit inlet size or the size noted on the drawings.

2.12 FLEXIBLE CONNECTIONS

A. Provide flexible duct connections at the inlet and outlet of each belt-driven fan, indoor unit, fan coil unit, air handling unit, etc., and at all other locations indicated. Flexible connections shall be fabricated from a glass fabric coated on both sides with neoprene. Minimum weight shall be 30 oz. per sq. yard. Flexible connections shall be used for vibration isolation only and shall not be used to correct connection misalignment.

2.13 DUCT HARDWARE

A. Duct hardware shall be as manufactured by Young Regulator or an approved equal.

2.14 ACCESS DOORS

A. A duct access door shall be provided at each fire and smoke damper. Access doors shall be designed for 1.5 times the pressure of the duct in which they are mounted. Access doors shall be of sufficient size to provide access to the dampers for resetting the blades and replacing the links. Access doors in medium and high-pressure ductwork shall be installed downstream of fire dampers and shall be implosion type. Where access is provided through gypsum board walls or ceilings, furnish access door for installation under Division 09. Coordinate with Division 09 and Architect. Each door shall match the fire-rating of the wall or ceiling indicated.

B. Access shall be provided to duct-mounted smoke detector locations. Access shall allow inspection and maintenance of all aspects of the detector. Access doors shall meet the requirements of A, above, as needed.

2.15 DUCTWORK SOUND ATTENUTORS

A. The basis of design is as noted. Acceptable substitute manufacturers are Kinetics Noise Control, Vibro-Acoustics, Ruskin, or IAC Acoustics.

B. Silencer shall be dissipative straight type, sized for no more than 1,750 ft/min, and a 0.25” WC pressure drop.

C. Silencer shall have a minimum dynamic insertion loss of 4, 5, 10, 19, 29, 16, 14 dB and maximum generated noise of 69, 60, 54, 50, 50, 51, 47, 41 dB for octave bands 63-8000 Hz.

D. Silencer shall be constructed of minimum 22-gauge galvanized sheet metal casing and have a minimum 26-gauge perforated galvanized sheet metal liner with acoustic grade fiberglass fill.

E. Product shall be rated in accordance with ASTM E84 with a flame spread classification less than 25 and smoke development rating of less than 50.

F. Silencer shall be independently rated by a NVLAP accredited laboratory in accordance with ASTM E477-06a and AMCA 1011-03.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Ductwork shall be installed in strict accordance with SMACNA, UL, and NFPA standards.

B. All ductwork installed outside the building shall be secured to the structure. Coordinate with the Structural Engineer as needed. It is the Contractor’s responsibility to design and coordinate all supports. All supports shall be designed to withstand all code-required wind and seismic loads.

C. Flexible ducts utilized in the low-pressure ductwork systems shall be installed without kinks or bends which are less than a centerline radius equal to or greater than twice the diameter of the flexible duct being installed. Also, in the runouts from the medium or high-pressure ductwork to the terminal units, the flexible ducts shall be installed with a variance of no more than 1" per foot of installed length off a straight and level line from the centerline of the sheetmetal ductwork runout or tap to the centerline of the terminal unit inlet. The size of the flexible ductwork connected to each terminal unit shall be the equivalent size of the larger of the following:

1. The inlet size of the terminal unit valve
2. The runout size indicated on the drawings

Should the runout size indicated on the drawings differ from the inlet size of the terminal unit valve, or where the inlet to the terminal unit is rectangular, the transition shall be made with sheetmetal and shall occur at the inlet to the terminal unit.

D. All low pressure ductwork downstream of VAV units shall be left uncapped for balancing until tenant fit-up affects the units.

E. All intersections (crossing) of low-pressure and medium-pressure ductwork shall be made with offsets in the low-pressure ductwork only. The medium pressure ductwork shall be ran straight and level.

F. Electric duct heaters shall be installed as indicated and in conformance with the manufacturer's recommendations. Coordinate the actual units to be provided with all trades. The heater shall be tested and adjusted after installation to provide the capacities indicated.

G. Ductwork labels, including factory labels, tags, etc. except equipment nameplates shall be removed to the satisfaction of the Architect in all exposed areas.

H. Ductwork exposed to sight from common areas shall be flat oval or spiral, and shall be double-walled with insulation between walls.

END OF SECTION

SECTION 233400

HVAC FANS

PART 1 - GENERAL

1.1 DESCRIPTION

A. All work specified in this Section is governed by the Common Work Results for HVAC Section 230500.

B. This Section 233400 and the accompanying drawings cover the provision of all labor, equipment, appliances and materials, and performing all operations in connection with the construction and installation of the fans as specified herein and as shown. These fans include, but are not limited to the following:

1. Roof-mounted centrifugal exhaust fans
2. Roof-mounted upblast exhaust fans
3. Inline fans
4. Ceiling/cabinet fans
5. Air curtain fans
6. Roof-mounted kitchen upblast exhaust fans

1.2 INTENT

A. It is the intent of this Section of the specifications to provide complete, operable, adjusted fans as shown and specified which are free of excessive noise, vibration and airflow fluctuations.

1.3 BASIS OF DESIGN

A. The basis of design is as scheduled. Any proposed substitutions shall be proven equal in all aspects to the equipment specified as the basis of design. Particular attention is called to the requirements of Section 230500.

1.4 ACCEPTABLE SUBSTITUTE MANUFACTURERS

A. Acceptable substitute manufacturers are Carnes, Cook, Acme, PennBarry, Twin City, Price, and Greenheck. Acceptable manufacturers for kitchen grease exhaust fans are Captive-Aire, Viking, and Greenheck.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. All non-filtered fans shall be factory tested, rated and certified in accordance with the requirements of AMCA Standard No. 210 and shall be labeled accordingly. Filtered fans may be non-labeled but must be rated in an AMCA approved laboratory in accordance with 210.

B. All roof-mounted fans shall be constructed such that water cannot enter the building through the fan regardless of whether or not the fan is operating. Fans shall be provided with drain connection and piped to the nearest roof drain as applicable.

C. Fans installed outside or otherwise subject to weather shall have a weatherproof enclosure over the motor compartment. All components, including VFDs, shall have enclosures and be

appropriate for the installation locations.

D. All roof-mounted fans shall be provided complete with roof curbs. Roof curbs shall be of galvanized (hurricane rated) construction, insulated, canted and complete with wood nailer strips. Insulation shall meet NFPA 25/50 flame spread/smoke developed ratings.

E. Fan and curb shall be provided and installed in accordance with manufacturer's requirements and recommendations for hurricane wind speed at installation location, as required.

F. For buildings over three stories, fans that serve three stories or more, shall be provided and installed with motor-operated dampers interlocked to fan operation. Coordinate with Division 26 and Controls SubContractor.

G. All exhaust fans (except those utilized for grease exhaust service) shall be provided complete with gravity-type backdraft dampers.

H. All belt-drive assemblies shall be mounted on vibration isolators.

I. All motors on belt-drive assemblies shall be mounted on slide bases to provide adjustment of belt tension.

J. All belts in belt drives shall be rated for not less than 150% of the connected motor horsepower.

K. All belt-drives driven by a 5 HP or larger motor shall be multiple belt arrangements.

L. All belt-drives shall be adjustable to a minimum speed variation of plus or minus 20% of the design RPM.

M. All centrifugal fan wheels shall be statically and dynamically balanced.

N. All electric motors and equipment shall be UL labeled.

O. Refer to Division 26 of these specifications and to the electrical Contract Drawings for electrical characteristics and connections to all equipment. Coordinate all electric motors and other equipment with these electrical documents.

P. All kitchen grease exhaust fans shall be listed by UL 762 and cUL, and meet all requirements of NFPA 96 and all applicable local codes.

Q. Roof curbs for kitchen exhaust fans shall meet NFPA 96 requirements. Specific attention is called to clearance requirements.

R. All motors associated with kitchen exhaust fans shall be located outside of the airstream.

S. Fans with variable-frequency drives (VFDs) shall have shaft grounding ring and appropriate insulation class.

T. All exposed motors and belts shall be protected with enclosures or guards in accordance with OSHA requirements.

U. Life safety fans (i.e. stair pressurization, elevator hoistway pressurization, smoke control, etc. shall have 1.5 times the number of belts necessary for the scheduled performance with no less than two (2) belts.

2.2 ROOF-MOUNTED CENTRIFUGAL EXHAUST FANS

A. Roof-mounted centrifugal exhaust fans shall be Greenheck Model G for direct drive fans and Greenheck Model GB for belt-drive fans, or an approved equal, as scheduled.

2.3 CEILING/CABINET EXHAUST FANS

A. Ceiling/cabinet exhaust fans shall be Greenheck Model CSP (inline/cabinet) or Greenheck Model SP (ceiling) with integral grille, or an approved equal.

2.4 SIDEWALL PROPELLER EXHAUST FANS

A. Fans shall be wall propeller type with wall mounting panel, wire fan guard, and motor guard screen. Fans used for exhaust shall have a gravity backdraft damper.

B. Wall panel shall be steel, reinforced with steel channel for motor and fan mounting frame. Exposed surfaces shall have backed enamel or epoxy finish. Panel shall have a spun venturi formed into the panel. For exhaust service, venturi shall point out; for supply service, venturi shall point in.

C. Fan wheel shall be axial blade type constructed of aluminum. Blades shall be welded to fan hub. Fan shall have 6 blades (minimum). Fan shall have same finish as wall panel. On belt driven units, shaft bearings shall be self-aligning, pillow block type. Bearings not permanently sealed and lubricated shall have grease fittings.

D. Fan shall be Greenheck Model SBCE or approved equal.

2.5 AIR CURTAIN FANS

A. Fans shall be the air curtain type designed for recessed or exposed mounting with integral inlet and discharge grills. Fans shall bear National Sanitary Foundation seal.

B. Fan shall be provided with door switch or other controls to automatically energize fan when associated door is opened.

C. Fan and motor housing shall be steel with factory baked enamel finish.

D. Fan wheel shall be double width, double inlet centrifugal type. Fan shall be direct driven.

E. Fan shall be Mars Model CH, Powered Aire Inc., or equal by Greenheck or Cook as scheduled.

F. Fan shall be provided with a high/low airflow switch.

G. Fan shall be provided with cleanable filter, provided by Manufacturer, integral to the fan housing.

H. Carefully coordinate air curtain installation with associated door. Provide required mounting accessory to accommodate door hardware (especially at roll up doors and horizontal sliding doors).

2.6 ROOF-MOUNTED KITCHEN UPBLAST EXHAUST FANS

A. Roof-mounted kitchen exhaust fans shall be Greenheck Model CUE for direct drive fans and Greenheck Model CUBE for belt-drive fans, USGF for heavy grease exhaust and/or high wind

applications or an approved equal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Fans shall be installed as indicated and in conformance with the manufacturer's recommendations. Coordinate the actual units to be provided with all trades.

3.2 ADJUSTMENT

A. The fans shall be tested and adjusted after installation to provide the capacities indicated.

END OF SECTION

SECTION 233600

AIR TERMINAL UNITS

PART 1 - GENERAL

1.1 DESCRIPTION

A. All work specified in this Section is governed by the Common Work Results for HVAC Section 230500.

B. This Section 233600 and the accompanying drawings cover the provisions of all labor, equipment, appliances and materials, and performing all operations in connection with the construction and installation of the terminal units as specified herein and as shown. These units include, but are not limited to the following:

1. Variable air volume (VAV) units
2. Powered induction units (PIU)
3. Associated control systems

1.2 INTENT

A. It is the intent of this Section of the specifications to provide complete, operable, adjusted terminal units as shown and specified, which are free of excessive noise, vibration and airflow fluctuations.

1.3 BASIS OF DESIGN

A. The basis of design is Trane. Any proposed substitutions shall be proven equal in all aspects to the equipment specified as the basis of design.

1.4 ACCEPTABLE SUBSTITUTE MANUFACTURERS

A. Acceptable substitute manufacturers are Trane, Price, Carrier, Titus, and, Krueger.

PART 2 - PRODUCTS

2.1 DESCRIPTION

A. Variable air volume units (VAV) shall consist of primary air damper, attenuator section and noise shroud (if required to meet listed sound pressure levels), low-voltage electric primary air damper actuator, primary air controller and any other items required to perform as indicated and specified.

B. The maximum acceptable NC at the VAV unit discharge is 40 at 1.0" inlet static pressure; the maximum acceptable radiated NC is 35 at 1.0" inlet static pressure. The maximum static pressure drop through the unit shall be 0.45" WC. The maximum inlet velocity shall be 2200 FPM. All NC ratings are based on AHRI 880.

C. The unit housing shall be constructed of galvanized steel sheets, reinforced to eliminate excessive flexing. Housing shall be internally lined with acoustical fibrous glass liner with exposed face coated with a black fire retardant compound, conforming to NFPA requirements. Liner shall meet the requirements of Section 230713. Service to internal parts shall be through an access door in the bottom or side of the housing.

D. Controls shall be low-voltage electronic type with electrical actuators. All actuators shall be 24-volt.

E. A pressure independent primary air volume controller shall control the supply air quantity within 5% of the air volume required to satisfy the thermostat, regardless of changes in system static pressure. Each unit shall be factory set for maximum and minimum CFM. The VAV valves shall be normally closed on a loss of control power.

F. Powered induction units (PIUs) shall be factory fabricated complete with variable air volume section, fan powered induction section, disposable filter, backdraft damper for fan section, acoustically lined plenum section, factory-mounted heating coil (installed downstream of the fan section) and all electrical contactors, P.E. switches and controls. PIU shall have variable air volume unit (VAV) for primary air with fan discharge perpendicular to the VAV unit. See Paragraphs 2.01 A through E for VAV units.

G. Intermittent operation fan powered induction section shall consist of:

1. An acoustically lined sheetmetal housing and centrifugal direct drive fan wheel.
2. Resiliently mounted, vibration-isolated, permanently lubricated, ECM fan motor of the voltage shown on the electrical drawings.
3. Backdraft damper to prevent reverse flow through blower.

H. The plenum section shall be acoustically lined and shall receive air from either the primary VAV unit or the induction fan, and distribute the air through the low pressure duct system. Parallel (side by side) discharge is unacceptable.

I. Each PIU, when operating in the fan powered, 100% induced air mode, shall be selected to operate against a minimum external static pressure of 0.35" with a maximum NC level of 35 at the discharge. At the same operating condition, the radiated noise shall be a maximum NC level of 35. All NC ratings are based on AHRI 880.

J. The PIUs shall have intermittent fan operation except those serving toilets, lobbies and other core areas, which shall be constant volume units.

K. There shall be only one electrical power connection required to each PIU assembly to provide electrical power to both the fan and the electric heater. Unit shall operate on 460-volt, 3-phase unless otherwise scheduled. Provide a separate fused wiring for the fan motor only. The fan motor shall draw not more than 4 amperes at high speed when connected to 277 volts, single phase. Coordinate which phase the motor is to be connected to (A, B, or C) with the electrical drawings.

L. There shall be only one electrical power connection required to each VAV assembly to provide electrical power to both the actuator and controls, as applicable. Unit connection shall be 24-volt. **Submittal shall indicate specific compliance with this item.**

2.2 ELECTRIC HEATING COILS

A. All electric heating equipment shall be UL labeled.

B. Refer to Division 26 of these specifications and to the electrical Contract Drawings for electrical characteristics and connections to all equipment. Coordinate all electrical heating equipment with these electrical documents.

C. Electric Heaters

1. Electric heaters shall be an integral part of the PIUs.
2. Heaters shall consist of individually mounted heating elements mounted in a sheetmetal housing. Individual heating elements shall be of open coil construction.
3. Individual heating elements shall be interconnected and wired into a junction box mounted on the unit's sheetmetal housing. Terminal blocks shall be used for all terminations within the junction box. Three phase electric heaters shall consist of equally rated heater elements internally connected to provide a balanced three phase load.
4. Each electric heater shall be provided with a factory installed UL listed automatic reset high temperature limit switch plus a factory installed UL listed manual reset high temperature limit switch.
5. Each electric heater shall contain a factory installed pressure type air flow switch or fan interlock relay which shall prevent heater control circuits from becoming energized until air flow across the heater coils has been established. Paddle type air switch is not acceptable.
6. Each electric heater or separately controlled section of electric heat shall be controlled by a heating contactor factory mounted within the electric heater terminal box. Contactor shall be UL listed for 100,000 cycles use with resistance heating loads. Control coil contactor shall be operated by the automatic temperature control device in series with the automatic reset high temperature limit switches.
7. Each electric heater or separately controlled section of the electric heater shall be provided with fused circuit protection as an integral part of the duct heater. Fused protection must be at each terminal unit and are acceptable at the single-point power connection. Fuses shall be dual element type and shall be rated by the Electric Heater Manufacturer based on the enclosure temperature. A fuse shall be provided in each under grounded conductor.
8. Electric heater shall be full flange type or slip-in type if the space for removal is available.
9. Electric heater dimensions shall be such that the minimum air velocity recommended by the Duct Heater Manufacturer will be maintained based on the air quantities indicated.
10. All electric heaters over 8.0 KW shall be staged in increments not exceeding 8.0 KW.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Units shall be installed as indicated and in conformance with the manufacturer's recommendations. Coordinate the actual units to be provided with all trades.

B. The wiring of all VAVs shall be performed by the Installer of the VAVs under this Division.

3.2 ADJUSTMENT

A. The units shall be tested and adjusted after installation to provide the capacities indicated.

END OF SECTION

SECTION 233713

DIFFUSERS, REGISTERS, AND GRILLES

PART 1 - GENERAL

1.1 DESCRIPTION

A. All work specified in this Section is governed by the Common Work Results for HVAC Section 230500.

B. This Section 233713 and the accompanying drawings cover the provisions of all labor, equipment, appliances and materials, and performing all operations in connection with the construction and installation of air distribution devices as specified herein and as shown. These units include, but are not limited to the following:

1. Ceiling Diffusers (CD)
2. Return Air Grilles (RAG)
3. Exhaust Registers (ER)
4. Exhaust Grilles (EG)
5. Slot Diffusers (SD)
6. Return Air Slots (RS)
7. Supply Registers (SR)
8. Linear Slot Diffusers (LSD)
9. Linear Return Slots (LRS)
10. Linear Exhaust Slots (LES)
11. Transfer Grilles (TG)
12. Architectural Linear Slot (ALSD)

1.2 INTENT

A. It is the intent of this Section of the specifications to provide complete, operable, adjusted air distribution devices as shown and specified which are free of excessive noise, vibration and airflow fluctuations.

1.3 SELECTION CRITERIA

A. All air distribution devices shall be selected in accordance with the following minimum criteria unless otherwise noted below or on the drawings:

1. Method of mounting shall be compatible with the ceiling, wall or duct surface which it mounts on or in; i.e. lay-in, surface mounting, plaster frame, duct collar, etc. The architectural drawings shall be referenced to determine the mounting method for each device. All flanges on surface mounted devices shall be provided with a gasket.
2. Finish of all ceiling mounted devices shall be selected to match the color of the adjacent ceiling. Finish of all wall mounted devices shall be primer which is compatible with the finish coating specified for the adjacent wall; finish coat will be applied under Division 9.

1.4 BASIS OF DESIGN

A. The basis of design is Titus. Any proposed substitutions shall be proven equal in all respects to the equipment specified as the basis of design. Any modifications to ductwork, controls, ceilings, building structure, etc., that result from any substitution shall be coordinated with all trades. This coordination shall occur before delivery of equipment and any modifications shall

be performed without incurring additions to the Contract.

1.5 ACCEPTABLE MANUFACTURERS

A. Acceptable manufacturers are Price, Carnes, Metal Aire, Krueger, and Nailor, provided that their units, performance, appearance and physical characteristics are equal in all respects for this specific project.

PART 2 - PRODUCTS

2.1 DESCRIPTION

A. Ceiling Diffusers (CD)

1. CD Ceiling diffusers shall be square, plaque face diffusers capable of providing one-way, two-way, two-way corner, three-way, and four-way air patterns; Titus Model OMNI with directional blow clips. The diffuser shall have a 22 gauge steel face panel that captures a secondary 22-gauge panel. The face panel shall be removable by means of four hanger brackets. The exposed surface of the face panel shall be smooth, flat, and free of visible fasteners. The back pan shall be one piece precision die-stamped and shall be constructed of 22-guage steel. Diffuser performance data shall be in accordance with ANSI/ASHRAE Standard 70-1991. The maximum NC level at design airflow shall not exceed 35 when measured in a direct field 5'-0" from the face of the device. Diffusers to be 24"x24" unless noted on drawings. The finish shall be baked enamel white, unless directed otherwise by the Architect. Provide plaster frames and round neck damper (operable from face of diffuser) for diffusers installed in hard ceilings.

B. Return Air Grilles (RAG)

1. Return air grilles shall match the ceiling diffusers in the area or shall be hollow core, perforated face, lay-in type, selected to match the CDs; with the largest neck size available UON Titus PAR. Performance data shall be in accordance with ADC 162R4. All other characteristics shall be equal to the ceiling diffusers.

C. Exhaust Registers (ER)

1. Exhaust registers shall be surface mounted, fixed curved blade aluminum registers with blades at 0.666 to 0.750 inches on center. Provide opposed blade dampers with each ER for balancing purposes. ERs shall be Titus Titus 350 ZFL (aluminum) sized as indicated.

D. Exhaust Grilles (EG)

1. Exhaust grilles shall be the same as the return air grilles except the EGs shall have an opposed blade damper for balancing.

E. Slot Diffusers

1. Supply (SD)

a. Each slot diffuser shall be equipped with an individually adjustable pattern controller for each slot to insure full 180 degree air pattern; Titus TBD-80, with two (2) 1” slots unless otherwise noted. The diffuser shall be constructed of 24 gauge galvanized steel with inlet size and length as indicated. Each SD shall be provided with a lined steel plenum with tappings for round duct connections as

indicated. Maximum NC level shall not exceed 35 at design airflow. Liner shall conform to NFPA 90A 25/50 requirements.

2. Return (RS)

a. Return slots shall meet all above requirements for slot diffuser with the exception that the pattern controllers shall be removed to allow maximum free area for return air flow and a light shield or plenum shall be installed; Titus TBD-80.

F. Supply Registers (SR)

1. Supply registers shall be surface mounted, steel with aluminum blades, adjustable double-deflection type complete with opposed blade dampers for balancing purposes. The outermost set of deflection blades shall be parallel to the long dimension of the SR and the innermost set of deflection blades shall be parallel to the short dimension of the SR. The registers shall be tested in accordance with ADC standards and shall be selected to provide design airflow at a maximum NC of 35. SRs shall be Titus 272R.

G. Linear Slot Diffusers (LSD)

1. Supply (LSD)

a. Linear slot diffusers shall be Titus ML-39. Diffusers shall be of aluminum construction with one or more parallel slot(s). Diffusers shall have two (2) slots unless otherwise indicated. Each slot shall contain pattern controls, adjustable from the face of the diffuser. Each LSD shall be continuous length as indicated on the drawings, complete with finished ends, mitered corners and splined joints. All inactive sections of the LSD considered as LRS devices. Plenums shall have round collars for connection of flexible duct. Performance data shall be per ADC with a maximum NC of 35. Border option to be selected by Architect and shall be appropriate for the installation location. **Borders in drywall ceiling shall have mud-in flange unless otherwise directed.**

2. Return (LRS)

a. Linear return slots shall equal specified LSD with the following exceptions:

1) Plenums shall be lined in accordance with UL 181 and NFPA 90A for two and four foot sections, and insulated light shields where plenums do not fit.
2) Pattern controls are not required.

3. Exhaust (LES)

a. Linear exhaust slots shall equal specified LSDs with the following exceptions:

1) Plenums shall be lined in accordance with UL 181 and NFPA 90A.
2) Pattern controls shall be used for dampering only.

H. Transfer Grilles (TG)

1. Transfer grilles shall be similar to return air grilles (RAG).

I. Architectural Linear Slots (ALS)

1. Supply (ALSD)

    a. Architectural linear slot diffusers shall be Titus FL-20 wide body linear diffuser. Diffuser shall be aluminum construction with one (1) 2” wide slot. Diffuser shall be equipped with an individually adjustable pattern controller. Each ALSD shall be provided with a lined stem plenum with tappings for round duct connections as indicated. Maximum NC shall not exceed 35 at design airflow. Linear shall conform to NFPA 90A 25/50 requirements. All inactive sections of the LSD considered as ALSR devices. Border option to be selected by Architect and shall be appropriate for the installation location. **Borders in drywall ceiling shall have mud-in flanges unless otherwise directed.** Device shall be custom curved as required to match the nearest wall.

2. Return (ALSR)

    a. Architectural return slot to be same as supply with the exception that the pattern controllers shall be removed to allow maximum free area. All returns shall be fitted with lined plenums for two and four foot sections, and insulated light shields where plenums do not fit.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Air distribution devices shall be installed as indicated and in conformance with the manufacturer's recommendations. The color, frame, and border types shall be coordinated with Architectural requirements and shall be selected to install in the finished surface indicated.

B. All air distributions devices to be reused shall be installed the same way as indicated for new devices. All existing color, frame, and border types shall modified as required to match new device requirements.

C. All air distribution devices with blade orientations shall be coordinated with Architect. Specific attention is called to devices in exposed ceiling areas, including wall-mounted.

3.2 ADJUSTMENT

A. Grilles, registers, diffusers, etc. shall be tested and adjusted to provide the scheduled air flow capacities.

B. All devices shall have adjustable and accessible volume dampers. Where dampers are not or will not be accessible without access panels, provide and install remote balancing cable control system, Young Regulator or equal. Adjustment shall be from the face of the air distribution device, coordinated with the Air Distribution Manufacturer. Coordinate the location and size of the damper with the installation.

C. All adjustable air distribution devices located within three feet of any wall or kitchen hood shall be set to blow directly away from, or parallel to, the wall or hood. All air distribution patterns near kitchen hoods shall be coordinated with the Kitchen Hood Manufacturer.

D. In all slot diffuser applications, the inactive sections of the slot shall be finished with perforated steel, painted flat black, selected to match the SDs. These sections shall be open to the plenum as a return air path. Inactive sections shall have an insulated light shield.

END OF SECTION

SECTION 233723

HVAC GRAVITY VENTILATORS AND LOUVERS

PART 1 - GENERAL

1.1 DESCRIPTION

A. All work specified in this Section is governed by the Common Work Results for HVAC Section 230500.

B. This Section 233723 and the accompanying drawings cover the provisions of all labor, equipment, appliances and materials, and performing all operations in connection with the fabrication, construction and installation of the louvers, air inlet and air outlet devices as specified herein and as shown.

C. Coordinate with Architectural plans and specifications for all louvers subject to public view. Architectural documents shall supersede this specification section, except Architectural louvers must meet the free area noted in the Division 23 plans, and louvers exposed to rain must be stormproof.

1.2 INTENT

A. It is the intent of this Section of the specifications to provide complete, operable, finished louvers, air inlet and air outlet devices as shown and specified which are free of leaks.

1.3 BASIS OF DESIGN

A. The basis of design is as outlined for each louver and device in the 2.0 PRODUCTS subsection. Any proposed substitutions shall be proven equal in all respects to the equipment specified as the basis of design.

PART 2 - PRODUCTS

2.1 STORMPROOF LOUVERS

A. Louvers shall be stormproof, depth to match the width of the wall but no less than 4” deep, and of all-welded construction fabricated from 12 gauge extruded aluminum alloy 6063-T5. Blades shall be slanted at 45 degrees and feature an integral water baffle.

B. Louvers shall be fitted with a 1/2" mesh 16 gauge aluminum birdscreen in an aluminum frame.

C. Finish shall be Duranar Kynar 500 in a color selected by the Architect at the time of submittal review.

D. The performance standards shall be certified by the Manufacturer in accordance with the AMCA Certified Ratings Program and the louver shall carry the AMCA Seal.

E. Performance Standards

1. Maximum static pressure drop at 600 FPM velocity through the free area - 0.065" W.C.
2. No water penetration at up to 760 FPM velocity through the free area.
3. Minimum free area in relation to gross overall area - 53%.

F. The basis of design is Greenheck. Acceptable equal manufacturers are Louvers & Dampers, Inc., Airolite, Ruskin, Greenheck, Pottorff, Nailor, and Construction Specialties.

2.2 GRAVITY INTAKE AND RELIEF HOODS

A. Hoods shall be constructed from 0.063" thick aluminum sheets with rolled interlocking seams or all welded construction.

B. Relief hoods shall be fitted with a 1/2" x 1/2" galvanized birdscreen and backdraft damper.

C. Intake hoods shall be fitted with 1” thick cleanable filters.

D. All hoods shall be provided complete with 12" high roof curbs. Roof curbs shall be of aluminum construction, insulated, canted and complete with wood nailer strips. Insulation shall meet NFPA 25/50 flame spread/smoke developed ratings.

E. All hoods with a throat area of 12 square feet or less shall have hinged hoods.

F. Performance Standards

1. Maximum total pressure drop at 600 FPM throat velocity through the free area.

a. Intake Hoods - 0.125" WC
b. Relief Hoods - 0.08" WC

G. The basis of design is Greenheck Fabra Hood. Acceptable equal manufacturers are Louvers & Dampers, Inc., and Carnes.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Units shall be installed as indicated and in conformance with the manufacturer's recommendations. Coordinate the actual devices to be provided with all trades.

B. All devices shall be free of leaks, provided completely finished, trimmed, adjusted, cleaned and ready for use. They shall be properly secured to the structure.

C. Louvers with ductwork connections or future duct connections (louvers for future tenant connection) shall have a minimum of 12” deep insulated sheetmetal plenum back-box.

D. Insulated sheetmetal blank-offs shall be provided over all inactive sections or sections for future tenant use of louvers where the Architectural size exceeds the mechanical requirements.

END OF SECTION

SECTION 237200

AIR-TO-AIR ENERGY RECOVERY EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION

A. All work specified in this Section is governed by the Common Work Results for HVAC Section 230500.

B. This Section 237200 and the accompanying drawings cover the provision of all labor, equipment, appliances and materials, and performing all operations in connection with the construction and installation of the air handling units as specified herein and as shown. This work includes, but is not limited to, the following:
   1. Factory-assembled outdoor air handling unit including curbs and accessories
   2. Matched motor

C. Air handling units shall be completely factory-assembled and rooftop curb mounted. Only one electrical power connection shall be required for each unit.

D. Units shall be UL listed and certified in accordance with AHRI 430.

1.2 INTENT

A. It is the intent of this Section of the specifications to provide complete, operable, adjusted outdoor air handling units, as shown and specified, which operate efficiently and automatically, and are free of leaks, excessive noise and vibration.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data for each scheduled piece of equipment. Product data shall be clearly marked to indicate which model is being submitted. Product data shall include the following:

   1. Dimensions
   2. Operational and service clearances required
   3. Operational and shipping weights
   4. Furnished options and accessories
   5. Control diagrams clearly differentiating between portions of controls that are factory furnished and/or installed and controls that are field furnished and/or installed
   6. Electrical wiring diagram clearly differentiating between portions of factory and field wiring.
   7. Installation instructions
   8. Start-up instructions

1.4 QUALITY ASSURANCE

A. Codes and Standards:

   1. Energy recovery ventilators must be AHRI Certified, bear the AHRI Certification symbol, and be listed in the AHRI 1060 directory of Certified Air-to-Air Energy Recovery Ventilation Equipment. Ratings “in accordance with AHRI 1060” or “ratings independently certified” without AHRI Certification are not acceptable.

2. Energy recovery ventilators shall bear the AMCA Certified Ratings Seal for air performance.
3. Energy recovery ventilators shall be designed, manufactured, and tested in accordance with UL requirements and listed by UL or ETL and have UL o ETL label as a unit.
4. Insulation shall meet NFPA 90A and 90B and ASTME 84 requirements for flame spread of 25 or less and smoke development of 50 or less.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Handle equipment and components to prevent damage. Replace damaged equipment or components with new.

B. Store equipment and components in clean dry location, off the ground and protect from weather, water, and physical damage.

C. Rig and place equipment in accordance with manufacturer's instructions.

1.6 COORDINATION

A. Coordinate roof opening locations and installation of roof mounting curb with structural.

B. Coordinate electrical connections with Electrical Contractor.

1.7 WARRANTY

A. Energy recovery ventilators shall be warranted to be free from defects in material and workmanship for a period of one (1) year from the purchase date. The energy recovery wheel is warranted to be free from defects in material and workmanship for a period of five (5) years from the purchase date. Any units or parts which prove defective during the warranty period will be replaced at Manufacturer’s option by their factory, transportation prepaid. The Motor Manufacturer warrants motors for a period of one (1) year. Should motors furnished by the Manufacturer prove defective during this period, they should be returned to the nearest Authorized Motor Service Station. The Manufacturer will not be responsible for any removal or installation costs.

1.8 SPARE PARTS

A. Furnish to Owner, with receipt, the following spare parts for each energy recovery unit (place in a location determined by the Owner):

1. One set of matched fan belts for each belt-driven fan
2. One set of wheel belts for each energy recovery wheel
3. One set of replacement filters

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with requirements, provide energy recovery units of one of the following:

1. The basis of design is as scheduled. Acceptable substitute manufacturers include Greenheck, Cook, Valent, Semco, Ruskin, Trane, Daikin, AnnexAire, Addison, and RenewAire, or equal, provided all substitution requirements are met.

2.2 ENERGY RECOVERY UNITS

A. General Description: Units shall be UL listed and bear the UL label. Energy transfer ratings shall be AHRI Certified. Ventilators shall bear the AMCA Certified Rating Seals for air performance. Performance shall be as scheduled on plans. Outdoor air shall not mix with exhaust air in a common plenum. Exhaust discharge and outside air intake shall not be located on the same side of the roof top units.

B. Casing and Frames: Unit shall be of internal frame type construction of galvanized steel. Frame and panels shall be G90 galvanized steel. All panels exposed to the weather shall be a minimum of 18 gauge galvanized steel. Where top panels are joined there shall be an overlapping, standing seam to insure positive weather protection. All metal-to-metal seams shall be factory-sealed, requiring no caulking at job Site. Permatector exterior finish is available for outdoor installation. Unit base to be designed for curb mounting. Unit base shall over hang the curb for a positive seal against water run-off.

C. Weatherhoods: Weatherhoods shall be of the same finish as the unit. Outdoor air weatherhood shall incorporate a louvered design and moisture eliminator. Weatherhoods shall be tested in accordance with AMCA Standard 500-L to prevent water penetration up to 3 in/hr at 29 mph.

D. Energy Recovery Wheel: Wheel shall be of the enthalpy type for both sensible and latent heat recovery and be designed to ensure laminar flow. Energy transfer ratings must be AHRI Certified to Standard 1060 and bear the AHRI Certification symbol for AHRI Air-to-Air Energy Recovery Ventilation Equipment Certification Program based on AHRI 1060. Ratings ‘in accordance with 1060” without certification are not acceptable. Desiccant shall be silica gel for maximum latent energy transfer. Wheel shall be constructed of lightweight polymer media to minimize shaft and bearing loads. Polymer media shall be mounted in a stainless steel rotor for corrosion resistance. Wheel design shall consist of removable segments (for wheels greater the 26 in. diameter) for ease of service and/or cleaning. Silica gel desiccant shall be permanently bonded to wheel media to retain latent heat recovery after cleaning. Wheels with sprayed on desiccant coatings are not acceptable. Wheels with desiccant applied after the wheel formation is not acceptable. Energy recovery device shall transfer moisture entirely in the vapor phase. Energy recovery drive belt material shall be high strength urethane and shall be factory-installed in a pre-stretched state, eliminating the need for field belt tension adjustment. Link style belts are not acceptable.

E. Access Doors: All components shall be easily accessible through removable doors for exhaust, supply, filter and damper compartments. Energy recovery wheels (smaller than 54 inches) shall be mounted in a slide-out track for ease of inspection, removal and cleaning.

F. Insulation: Unit casing to be insulated with 2-inch high density foam. Insulation shall meet requirements of NFPA 90A and tested to meet UL 181 erosion requirements. Insulation to be enclosed in double wall construction.

G. Roof Curbs: Roof curb to be supplied by Unit Manufacturer for field assembly. Curb shall consist of die formed galvanized steel sections. Curb shall be full perimeter type with gasketing provided for field installation between curb and unit base.

H. Fans Sections: Centrifugal fans to be double width, double inlet, single fan forward curved type. All blower wheels shall be statically and dynamically balanced. Ground and polished steel fan shafts shall be mounted in permanently lubricated, sealed ball bearing pillow blocks. Bearing shall be selected for a minimum (L10) life in excess of 100,000 hours at maximum cataloged operating speeds. Separate motors for exhaust and supply blowers shall be provided. Adjustable sheaves on belt-driven fans with motors less than 10 HP shall allow independent

balancing of exhaust and supply airflow's. Fan and motor assemblies are mounted to unit base with neoprene isolators as standard. Fans shall be located in draw-through position in reference to the energy recovery wheel.

I. Motors and Drives: Motors shall be energy efficient, complying with EPACT standards, for single speed ODP and TE enclosures. Motors shall be permanently lubricated, heavy-duty type, matched to the fan load and furnished at the specified voltage, phase and enclosure. All variable speed motors shall have shaft-grounding rings. Drives shall be sized for a minimum of 150% of driven horsepower. Pulleys shall be of the fully machined cast type, keyed and securely attached to the fan wheel and motor shafts; 10 horsepower and less shall be supplied with an adjustable drive pulley. Energy wheel motors and direct drive motors shall have integral overload protection.

J. Motor Removal Rails: Provide rails, davit arm, etc. as recommended by the Manufacturer for removal of all motors.

K. Filters: Supply and exhaust filters shall 2 inch thick pleated fiberglass, MERV-13 and tested to meet UL Class 2. Filter racks shall be die formed galvanized steel.

L. Cooling Coil: Direct expansion (DX) and chilled water coils shall be factory-tested and rated in accordance with AHRI 410. Coils shall have copper tubes with permanently expanded aluminum fins, 12 fpi or less. DX coils shall be equipped with distributors to receive expansion valves at the liquid connections. DX coils shall include stainless steel drain pan.

M. Electrical: All internal electrical components shall be factory-wired for dual point power connection. All electrical components shall be UL Listed, Approved or Classified where applicable and wired in compliance with the National Electrical Code.

N. Accessories: Provide powered 115 volt service receptacle and accessories as scheduled.

PART 3 - EXECUTION

3.1 INSTALLATION, EXAMINATION AND COORDINATION

A. The energy recovery units and associated controls shall be installed in strict accordance with the manufacturer's recommendations. Install units plumb and level, firmly anchored in locations indicated, and maintain manufacturer's recommended clearances.

B. Automatic shutdown controls shall be provided to meet local codes (or NFPA 90A as a minimum) and shall consist of firestats and/or duct-mounted smoke detectors interlocked to the unit for shutdown on the detection of fire or smoke. Units having airflows of over 15,000 CFM shall be provided with smoke dampers on the entering side of the filter section to close on unit shutdown.

C. The associated control system shall be completely wired under this Division 23. Wiring shall be in accordance with the NEC and shall meet all requirements for this installation.

D. The condensate drain piping shall be complete with a drain trap constructed with sufficient head (vertical distance between inlet and outlet of trap) to drain throughout the units' operating range.

3.2 CONNECTIONS

A. Install piping and ductwork to allow service and maintenance.

3.3 CLEANING

A. After completing system installation and testing, inspect exposed finishes. Clean and remove burrs and construction debris; repair damaged finishes. Comb any flattened coils.

B. Vacuum equipment interior to remove foreign material and construction dirt and dust. Vacuum clean fan wheel, fan cabinet, and coils.

3.4 FIELD QUALITY CONTROL AND TESTING

A. Operational Test: Upon completion of inspection, testing, and startup, test system for proper operation and system capacity. Repair malfunctions and/or replace components. Re-test equipment until proper operation is achieved. All testing scheduling shall be coordinated with the Owner and Commissioning Agent. Provide testing documentation to Owner and Commissioning Agent.

3.5 START-UP

A. Provide services of a factory-trained Representative to start-up equipment. Contractor shall assist and cooperate with factory Representative as required. Coordinate start-up with TAB & ATC Contractors. Start-up equipment in accordance with manufacturer's instructions. Refer to Division 23, "HVAC Test and Balance" for additional start-up procedures.

1. Insure filters are installed prior to initial start-up; do not start-up or operate equipment without filters in-place. Filters shall remain in place through the duration of construction.
2. Provide and install new filters upon turn-over to Owner.

B. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.

3.6 TRAINING

A. Provide services of Manufacturer's Service Representative to instruct Owner's personnel in operation and maintenance of rooftop air handling units. Training to include start-up and shut-down, servicing and preventative maintenance schedules and procedures, and troubleshooting procedures, and procedures for obtaining replacement parts and technical assistance. Review operating and maintenance data contained in the Operating and Maintenance Manuals specified in Division One. Schedule four (4) hours of training with Owner; schedule at least 7-days prior notice. See other training requirements in 230500.

3.7 DEMONSTRATION

A. After completion of inspections, installation, and testing, contractor shall perform the following demonstration inspections and tests in the presence of the Owner and Commissioning Agent. Refer to Division 23, "Common Work Results", for scheduling and coordination of demonstrations.
1. Verification of proper installation
2. System functional and safety tests
3. System operational tests

END OF SECTION

SECTION 238126

SPLIT-SYSTEM AIR-CONDITIONERS

PART 1 - GENERAL

1.1 DESCRIPTION

A. All work specified in this Section is governed by the Common Work Results for HVAC Section 230500.

B. This Section 238126 and the accompanying drawings cover the provision of all labor, equipment, appliances and materials, and performing all operations in connection with the construction and installation of the split systems as specified herein and as shown. This work includes, but is not limited to, the following:

1. Split system fan coil, heating section and condensing units
2. Control system (interlocked to all split system components)

C. Split system units shall be self-contained, automatic, packaged units. These units shall be completely factory-assembled as unitary packages complete with operating controls, internal wiring and piping and fully charged with R-410A refrigerant. Only one electrical power connection shall be required for each unit.

D. Units shall be UL listed and cooling capacities shall be certified in accordance with ANSI/AHRI 210/240.

1.2 INTENT

A. It is the intent of this Section of the specifications to provide complete, operable, adjusted split systems, as shown and specified, which operate efficiently and automatically, and are free of excessive noise and vibration.

1.3 BASIS OF DESIGN

A. The basis of design is as scheduled. Acceptable alternate manufactures include Trane, Carrier, Mitsubishi, Lennox, and Daikin for ducted systems except that Liebert systems are also acceptable for Server/IT spaces, and Carrier, Mitsubishi, LG, Hitachi, and Daikin for ductless mini-splits. Any proposed substitutions shall be submitted in accordance with the prior approval requirements.

PART 2 - PRODUCTS

2.1 UNIT CASINGS

A. Unit casings shall be formed, galvanized steel construction with welded assembly. Galvanized steel surfaces shall be bonderized and painted with baked acrylic enamel for complete weather protection. Accessories and components shall match and interlock with all other split system components. Fan coil unit casings shall be fully internally insulated with liner which meets NFPA 25/50 flame spread/smoke developed ratings.

2.2 CONDENSING UNITS

A. Condensing unit refrigeration systems shall be factory-charged and ready for operation. All

units with capacities greater than five (5) tons shall be provided with minimum 2-stage (50% and 100%) cooling. Compressor(s) shall be direct drive, 3600 RPM, hermetic reciprocating type with centrifugal oil pump, crankcase heater and internal pressure relief valve. Compressor(s) shall have internal spring isolation and sound muffling and exhibit minimum vibration transmission and noise. Anti-recycle timers shall be provided to prevent excessive cycling of compressors thru utilization of a minimum five (5) minute time shutdown of unit on interruption of power or controlled shutdown.

B. Condensing unit condenser fans shall be direct-driven, propeller blade type. Condensing unit heat rejection shall be vertically upward.

2.3 COILS

A. Evaporator and condenser coils shall be copper tubing mechanically bonded to heavy duty aluminum fins. Aluminum tubes shall not be acceptable.

2.4 ELECTRIC HEATING SECTIONS

A. Electric heating sections shall be UL listed with nickel-chromium open coil resistance heating elements. Each heater shall be protected by an automatic reset high-limit thermostat and manual reset high-limit thermostat for the primary and secondary overcurrent/thermal protection. A proof of airflow/fan interlock shall also be provided. Controls shall provide for multiple stage start-up and operation.

2.5 CONTROLS AND ACCESSORIES

A. All operating and safety controls which are internal to each unit shall be factory-installed and shall include, as a minimum, solid state compressor overload protection, magnetic contactors, thermostatic expansion valve(s), refrigerant line drier(s), outdoor fan and compressor cycling thermostats, high and low limit protection against excessive temperatures or pressures.

B. A 24 volt transformer shall be provided to accommodate an accessory 24 volt indoor thermostat complete with an electronic programmable night setback, separate automatic heat/cool settings, auto/manual fan control and seasonal selector. Thermostat shall provide staging of the cooling and heating to match the stages of each component.

C. Controls on electric heat section shall meet NEMA specifications and requirements.

D. Automatic shutdown controls shall be provided on units ≤2,000 CFM to meet local Codes (or NFPA 90A as a minimum) and shall consist of firestats and duct-mounted smoke detectors interlocked to the fan coil unit for shutdown on the detection of fire or smoke.

2.6 FILTERS

A. Units shall have minimum 2 inch thick, low velocity, glass fiber throwaway filters in commercially available sizes. MERV 13 minimum.

PART 3 - EXECUTION

3.1 INSTALLATION

A. The split systems and associated controls shall be installed in strict accordance with the manufacturer's recommendations.

B. The control system shall be completely wired under this Division 23. Wiring shall be in accordance with the NEC and shall meet all requirements for this installation.

3.2 STARTUP

A. Provide the services of a factory-trained and qualified Service Technician employed by the Unit Manufacturer who shall inspect the installation including external interlock and power connections; supervise leak testing, initial operation, calibration of operating and safety controls and supervise electrical testing including insulation resistance of motors and voltage balance between phases during starting and running.

B. This Service Technician shall forward a report in four (4) copies to the Owner when the unit is in safe and proper operating condition. This report shall include all pressure and control settings, meg readings, voltage readings per phase during start and run, and shall list minor discrepancies to be corrected that affect safe and reliable operation. One additional copy of the report shall be left in the unit control panel. One copy of bound installation, operation, maintenance service and parts brochures, including applicable serial numbers, full unit description and parts ordering sources, shall be placed in the unit control panel at the time of startup; four (4) additional copies shall be forwarded to the Owner.

END OF SECTION

SECTION 238129

VARIABLE REFRIGERANT FLOW HVAC SYSTEMS

PART 1 - GENERAL

1.1 SYSTEM DESCRIPTION

A. The VRF (Variable Refrigerant Flow) system shall be simultaneous cooling and heating heat pump with energy recovery. The VRF system shall consist of an outdoor unit, high efficiency heat recovery units designed for minimum piping and maximum design flexibility, indoor units, and controls by the Equipment Manufacturer. Every indoor unit shall be independently capable of operating in either heating or cooling mode regardless of the mode of other indoor units. The system shall be capable of changing mode of individual indoor units (cooling to heating or heating to cooling) within a maximum time of 5 minutes to ensure indoor temperature can be properly maintained.

1.2 QUALITY INSURANCE

A. The units shall be manufactured in a facility registered to ISO 9001 and ISO 14001 which is a set of standards applying to environmental protection set by the International Standard Organization (ISO).

B. All wiring shall be in accordance with the National Electrical Code (NEC).

C. The units shall be listed by Electrical Testing Laboratories (ETL) and bear the ETL label.

D. All units must meet or exceed the efficiency requirements per ASHRAE 90.1-2010 efficiency requirements for VRF systems. Efficiency shall be published in accordance with the DOE alternative test procedure, which is based on the AHRI Standards 340/360-2007, 1230 and ISO Standard 13256-1.

E. A full charge of R-410A for the condensing unit only shall be provided in the condensing unit. The total system charge shall be provided under this scope for the installed system conditions.

1.3 STORAGE AND HANDLING

A. All VRF equipment shall be stored protected from weather, extreme temperature, etc. as suggested by the Manufacturer. All VRF equipment shall be moved, lifted, etc. as suggested by the Manufacturer.

1.4 BASIS OF DESIGN

A. The basis of design shall be as scheduled. Similar products by LG, Mitsubishi, and Daikin are acceptable.

B. Substitute manufacturer consideration must be submitted and approved to the Owner and Engineer prior to equipment procurement. Substitutions shall match the BOD in all respects. Substitution documentation shall include:

1. Full submittal data
2. A list of authorized area installers, complete with references and similar jobs
3. Complete warranty information

PART 2 - PRODUCTS

2.1 SIMULTANIOUS HEATING AND COOLING OUTDOOR UNIT

A. General:

1. The outdoor unit shall be used with VRF components of the same Manufacturer consisting of the outdoor unit, high efficiency heat recovery units, indoor units, factory designed and supplied Y-branches, and controls.
2. System components shall be of the same Manufacturer or as recommended by the Manufacturer of the VRF equipment.
3. Unit control boards shall perform all functions required to effectively and efficiently operate the VRF system and communicate in a daisy chain configuration from outdoor unit to heat recovery and indoor units via RS485.
4. The outdoor unit shall be completely factory-assembled, piped and wired. Dual and triple frame outdoor units will be field piped with factory designed and supplied Y-branch kits to manifold them together into a single refrigerant circuit.
5. Each outdoor unit shall be run tested at the factory.
6. The sum of connected nominal capacity of all indoor air handlers shall range from 50% to 130% of outdoor unit nominal capacity to ensure the VRF system will have sufficient capacity to handle the building space loads at peak design.
7. Outdoor unit shall have a tested sound rating no higher than 58 dB(A) per outdoor unit frame tested per KSA0701. The outdoor unit frame shall include three quiet/nighttime operation settings of 47, 44, and 41 dBA.
8. All refrigerant lines from the outdoor unit to the heat recovery unit and from the heat recovery unit to the indoor units shall be field-insulated.
9. The outdoor unit shall have an accumulator.
10. The outdoor unit shall have a high pressure safety switch.
11. The outdoor unit shall have over-current protection.
12. The outdoor unit shall use a brazed plate subcooling heat exchanger.
13. The outdoor unit shall have the ability to operate with an elevation difference of up to 328 feet above or below the indoor units.
14. The outdoor unit shall allow up to a total equivalent refrigerant piping length of 3,280 feet.
15. The maximum length from outdoor unit to indoor unit shall be up to 656 feet without traps.
16. The outdoor unit shall be capable of operating in heating only mode down to -4°F and up to 61°F ambient wet bulb without additional low ambient controls.
17. The outdoor unit shall be capable of operating in cooling only mode down to 21°F and up to 110°F ambient dry bulb.
18. The outdoor unit shall be capable of operating in simultaneous heating and cooling mode down to 14°F and up to 86°F ambient dry bulb.
19. The outdoor unit shall have an oil separator for each compressor and controls to ensure sufficient oil supply is maintained for the compressor.
20. The system shall use R-410A refrigerant.
21. Each outdoor unit frame shall have a removable inspection panel no greater than 6 inches tall or 12 inches wide to allow access to service tool connection, DIP switches, auto addressing and error codes.
22. All units requiring factory-supplied twinning kits shall be piped together in the field, without the need for equalizing line(s). If an alternate manufacturer is selected, any additional material, cost, and labor to install additional lines shall be incurred by the Contractor.
23. The outdoor unit shall not cease operation in any mode based solely on outdoor ambient temperature.

B. Frame:

1. Shall be constructed with galvanized steel, bonderized and be finished with powder coat baked enamel paint.

C. Compressor:

1. All 208/230V 3-phase outdoor unit frames shall be equipped with one hermetic digitally controlled inverter driven scroll compressor and one hermetic constant speed scroll compressor.
2. All 460V 3-phase outdoor unit frames greater than 80 MBH nominal capacity shall be equipped with one hermetic digitally controlled inverter driven scroll compressor and one hermetic constant speed scroll compressor.
3. A crankcase heater shall be factory-mounted on all compressors.
4. The outdoor unit compressor shall have an inverter to modulate capacity. The frequency of the inverter compressor shall be completely variable from 25 to 105 Hz.
5. The compressor shall be equipped with an internal thermal overload.
6. The compressor shall be mounted to avoid the transmission of vibration.
7. Field-installed oil equalization lines between modules are not allowed. Prior to bidding, Manufacturers requiring equalization must submit oil line sizing calculations specific to each system and module placement for this project.

D. Fan:

1. All outdoor unit frames shall be furnished with two direct drive, variable speed propeller type fans.
2. All fan motors shall have inherent protection, have permanently lubricated bearings, and be variable speed with a maximum speed up to 950 RPM.
3. All fans shall be provided with a raised guard to limit contact with moving parts.

E. Coil:

1. The outdoor coil shall be of nonferrous construction with louvered fins on copper tubing.
2. The coil fins shall have a factory-applied corrosion resistant material with hydrophilic coating.
3. The coil shall be protected with an integral metal guard.
4. Refrigerant flow from the outdoor unit shall be controlled by means of a digitally controlled inverter driven scroll compressor.

F. Electrical:

1. The outdoor unit electrical power shall be as scheduled.
2. The outdoor unit shall be capable of operation within voltage limits of +/-10% rated voltage.
3. The outdoor unit shall be controlled by integral microprocessors.
4. The control circuit between the indoor units, heat recovery box and the outdoor unit shall be 24 VDC completed using a 2-conductor, stranded, shielded cable for the RS485 daisy chain communication.

2.2 BRANCH CIRCUIT (BC) CONTROLLERS

A. General:

1. The BC (Branch Circuit) Controllers shall be specifically used with the system selected. These units shall be equipped with a circuit board that interfaces to the Manufacturer’s

controls system and shall perform all functions necessary for operation. The unit shall have a galvanized steel finish. The BC Controller shall be completely factory-assembled, piped and wired. Each unit shall be run tested at the factory. This unit shall be mounted indoors, with access and service clearance provided for each controller.

B. BC Unit Cabinet:

1. The casing shall be fabricated of galvanized steel.
2. Each cabinet shall house a liquid-gas separator and multiple refrigeration control valves.
3. The unit shall house two tube-in-tube heat exchangers.

C. Refrigerant

1. R-410A refrigerant shall be required.

D. Refrigerant valves:

1. The unit shall be furnished with multiple branch circuits which can individually accommodate up to 54,000 BTU/h and up to three indoor units, as required by the design. Branches may be twinned to allow more than 54,000 BTU/h.
2. Each branch shall have multiple two-position valves to control refrigerant flow.
3. Service shut-off valves shall be field-provided/installed for each branch to allow service to any indoor unit without field interruption to overall system operation.
4. Linear electronic expansion valves shall be used to control the variable refrigerant flow.

E. Integral Drain Pan:

1. An integral condensate pan and drain shall be provided as recommended by the Manufacturer. The integral condensate pan shall be provided with a water sensor, interlocked to shut down the unit upon detection of water. Alternatively, an external drain pan and sensor may be provided.

F. Electrical:

1. The electrical power shall be 208/230 volts, 1-phase, 60 Hz.
2. The unit shall be capable of satisfactory operation within voltage limits of 198-218 volts (208V/60Hz) or 207-253V (230V/60Hz).
3. The BC Controller shall be controlled by integral microprocessors.
4. The control circuit between the indoor units and the outdoor unit shall be 24VDC completed using a 2-conductor, twisted pair shielded cable to provide total integration of the system.

2.3 HEAT RECOVERY UNITS FOR SIMULTANEOUS HEATING AND COOLING AIR HANDLERS

A. General:

1. Heat recovery units shall be designed for use with VRF equipment of the same Manufacturer.
2. Heat recovery units shall have factory-installed control boards that interface to the VRF equipment controls system and shall perform all functions to effectively and efficiently control the simultaneous heating and cooling VRF system.
   Heat recovery units shall be completely factory-assembled, internally piped and wired.
3. Heat recovery units shall be run tested at the factory.
4. Heat recovery units shall be designed for indoor installation.

5. Systems shall use R-410A refrigerant.
6. All refrigerant lines from the outdoor unit to the indoor units shall be field insulated.
7. Piping between heat recovery unit and outdoor unit and between heat recovery unit and indoor unit shall be sized per manufacturer's recommendations.

B. Heat Recovery Unit Construction:

1. The heat recovery unit housing shall be galvanized steel.
2. Each heat recovery unit shall contain piping, valves and controls to divert refrigerant for optimum efficiency.
3. The unit shall house the heat exchanger.

C. Refrigerant System

1. R-410A refrigerant shall be required for all VRF equipment and components including indoor units, outdoor units, refrigerant piping, valves, branches, heat recovery units, etc. as applicable.

D. Refrigerant valves:

1. Each port shall be circuited with two 2-position solenoid valves to control refrigerant flow path.
2. Isolation valves shall be field-supplied and installed for ease of service to the heat recovery unit without evacuating the entire system refrigerant charge.

    a. System shall be designed for use with R-410A.

E. Electrical:

1. The electrical connection shall be as scheduled.
2. All units shall be capable of satisfactory operation within +/-10% of nominal voltage.
3. The heat recovery unit shall be controlled by integral microprocessors from the main control in the outdoor unit.
4. The control circuit between the indoor units, heat recovery box and the outdoor unit shall be 24 VDC completed using a 2-conductor, stranded and shielded cable.

2.4 4-WAY CEILING CASSETTE INDOOR UNIT

A. General:

1. Four-way ceiling cassette indoor units shall recess into the ceiling and mount flush.
2. Shall be designed for use with R-410A refrigerant.
3. Shall be installed with heat pump or simultaneous heating and cooling heat pump VRF systems of the same Manufacturer.
4. Shall be rigidly constructed using a decaweb base plate.

B. Indoor Unit:

1. The indoor unit shall be factory-assembled, wired and run tested.
2. The indoor unit shall be factory-wired and piped with its own electronic expansion device, control circuit board, fan and motor.
3. The indoor unit shall have:

    a. Self-diagnostic function

b. Auto restart function

4. Indoor unit refrigerant circuit shall be filled with a dry nitrogen gas charge from the factory.

C. Unit Cabinet:

1. The four-way ceiling cassette cabinet shall be designed to recess into the ceiling.
2. The cabinet panel shall have provisions for a field-installed, pressurized and filtered outside air intake.
3. Branch ducting shall be allowed from cabinet following manufacturer recommendations.

D. Grille:

1. Four-way grille shall be fixed to bottom of the cabinet and allow two, three or four-way air flow.
2. Grille vane angles shall be individually adjustable from the wired remote controller to customize the airflow pattern for the conditioned space.
3. The indoor unit vanes shall have 6 fixed positions.
4. The indoor unit vanes shall be capable of automatically swinging the vanes up and down for uniform air distribution. Vanes shall also be capable of being stopped at any position during swing operation.
5. The indoor unit shall have a setting in the heating or cooling mode that shall cycle the vanes up and down to evenly heat or cool the space.
6. Four-way ceiling cassette grille shall have integral sensor to read wireless handheld remote controller as standard from the factory.

E. Filter:

1. Return air shall be filtered with a removable, washable filter.

F. Fan:

1. The indoor fan shall be an assembly with one turbo fan direct driven by a single motor.
2. The indoor fan shall be statically and dynamically balanced.
3. Motor shall have permanently lubricated bearings.
4. In cooling mode, the indoor fan shall have the following settings; Super Low, Low, Med, High, Power Cool, and Auto.
5. In heating mode, the indoor fan shall have the following settings; Super Low, Low, Med, High, and Auto.
6. The fan shall have a selectable Auto fan setting that will adjust the fan speed based on the difference between controller set-point and space temperature.
7. The indoor unit shall have DIP switches that can be set to provide optimum airflow based on ceiling height.

G. Coil:

1. The indoor unit coil shall be nonferrous with louvered fins on copper tubing for maximum efficiency.
2. The tubing shall have inner grooves for high efficiency heat exchange.
3. The coils shall be pressure tested at the factory.
4. A condensate drain pan shall be factory-installed below the coil.
5. All refrigerant lines to the indoor units shall be field-insulated.

H. Condensate Pump:

1. The unit shall include a factory-installed condensate pump that will be able to raise drain water 27 inches above the ceiling cassette face. The condensate pump shall be internally powered from the unit.

I. Electrical:

1. The unit electrical connection shall be as scheduled.
2. The indoor unit shall be capable of operation within voltage limits of +/-10% rated voltage.

J. Controls:

1. Unit shall use controls provided by the Manufacturer to perform all functions necessary to operate the system effectively and efficiently.

2.5 CEILING-CONCEALED BOTTOM RETURN BUILT-IN DUCT INDOOR UNIT

A. General:

1. Ceiling-concealed bottom return built-in duct indoor unit shall mount fully concealed within the ceiling.
2. Built-in duct models shall have a compact profile which requires as little as 8 inches vertical space.
3. Shall be designed for use with R-410A refrigerant.
4. Shall be installed with heat pump or simultaneous heating and cooling heat pump VRF systems of the same Manufacturer.

B. Indoor Unit:

1. The indoor unit shall be factory-assembled, wired and run tested.
2. The indoor unit shall be factory-wired and piped with its own modulating linear electronic expansion device, control circuit board, fan and motor.
3. The indoor unit shall have:

    a. Self-diagnostic function
    b. Auto restart function

4. Indoor unit refrigerant circuit shall be filled with a dry nitrogen gas charge from the factory.

C. Unit Cabinet:

1. The unit shall be low profile no greater than 7.5 inches.
2. The unit shall have provisions to attach a suction canvas and/or grille.
3. The cabinet panel shall have provisions for a field-installed filtered outside air intake.

D. Filter:

1. Return air shall be filtered with a removable, washable filter.

E. Fan:

1. The indoor unit fan shall have a minimum of two assemblies each with up to two Sirocco direct driven fans per single motor.
2. The indoor fan shall be statically and dynamically balanced.
3. Motor shall have permanently lubricated bearings.
4. In cooling mode, the indoor fan shall have the following settings; Low, Med, and High.
5. In heating mode, the indoor fan shall have the following settings; Low, Med, and High.
6. The indoor unit shall be designed for low static pressure up to 0.08 inches external static pressure.

F. Coil:

1. The indoor unit coil shall be nonferrous with louvered fins on copper tubing for maximum efficiency.
2. The tubing shall have inner grooves for high efficiency heat exchange.
3. The coils shall be pressure tested at the factory.
4. A condensate drain pan shall be factory-installed below the coil.
5. All refrigerant lines to the indoor units shall be field-insulated.

G. Condensate Pump:

1. The unit shall include a factory-installed condensate pump that will be able to raise drain water 27 inches above the bottom of the indoor unit. The condensate pump shall be internally powered from the unit.

H. Electrical:

1. The unit electrical connection shall be as scheduled.
2. The indoor unit shall be capable of operation within voltage limits of +/-10% rated voltage.

I. Controls:

1. Unit shall use controls provided by the Manufacturer to perform all functions necessary to operate the system effectively and efficiently.

2.6 LOW PROFILE CEILING-CONCEALED DUCTED INDOOR UNIT

A. General:

1. Low profile ceiling-concealed ducted indoor unit shall mount fully concealed within the ceiling.
2. Low profile models shall have a compact profile which requires as little as 8 inches vertical space.
3. Shall be designed for use with R-410A refrigerant.
4. Shall be installed with heat pump or simultaneous heating and cooling heat pump VRF systems of the same Manufacturer.

B. Indoor Unit:

1. The indoor unit shall be factory-assembled, wired and run tested.
2. The indoor unit shall be factory-wired and piped with its own electronic expansion device, control circuit board, fan and motor.
3. The indoor unit shall have:

    a. Self-diagnostic function

b. Auto restart function

4. Indoor unit refrigerant circuit shall be filled with a dry nitrogen gas charge from the factory.

C. Unit Cabinet:

1. The unit shall be low profile no greater than 7.5 inches.
2. The cabinet panel shall have provisions for a field-installed filtered outside air intake.

D. Filter:

1. Return air shall be filtered with a removable, washable filter.

E. Fan:

1. The indoor unit fan shall have a minimum of two assemblies each with up to two Sirocco direct driven fans per single motor.
2. The indoor fan shall be statically and dynamically balanced.
3. Motor shall have permanently lubricated bearings.
4. In cooling mode, the indoor fan shall have the following settings; Low, Med, and High.
5. In heating mode, the indoor fan shall have the following settings; Low, Med, and High.
6. The indoor unit shall be designed for low static pressure up to 0.08 inches external static pressure.

F. Coil:

1. The indoor unit coil shall be nonferrous with louvered fins on copper tubing for maximum efficiency.
2. The tubing shall have inner grooves for high efficiency heat exchange.
3. The coils shall be pressure tested at the factory.
4. A condensate drain pan shall be factory-installed below the coil.
5. All refrigerant lines to the indoor units shall be field-insulated.

G. Condensate Pump:

1. The unit shall include a factory-installed condensate pump that will be able to raise drain water 27 inches above the bottom of the indoor unit. The condensate pump shall be internally powered from the unit.

H. Electrical:

1. The unit electrical connection shall be as scheduled.
2. The indoor unit shall be capable of operation within voltage limits of +/-10% rated voltage.

I. Controls:

1. Unit shall use controls provided by the Manufacturer to perform all functions necessary to operate the system effectively and efficiently.

2.7 HIGH STATIC CEILING-CONCEALED DUCTED INDOOR UNIT

A. General:

1. High static ceiling-concealed duct indoor unit shall mount fully concealed within the ceiling.
2. Shall be designed for use with R-410A refrigerant.
3. Shall be installed with heat pump or simultaneous heating and cooling heat pump VRF systems of the same Manufacturer.
4. The indoor unit shall communicate with the outdoor unit via RS485 daisy chain communication.
5. Field installed ductwork shall not exceed the external static pressure limitation of the high static ducted indoor unit.

B. Indoor Unit:

1. The indoor unit shall be factory-assembled, wired and run tested.
2. The indoor unit shall be factory-wired and piped with its own electronic expansion device, control circuit board, fan and motor.
3. The indoor unit shall have:

    a. Self-diagnostic function
    b. Auto restart function

4. Indoor unit refrigerant circuit shall be filled with a dry nitrogen gas charge from the factory.

C. Unit Cabinet:

1. The cabinet shall be ceiling-concealed and ducted.
2. The cabinet panel shall have provisions for a field-installed filtered outside air intake

D. Filter:

1. Return air shall be filtered with a factory-supplied removable, washable filter.

E. Fan:

1. The indoor unit fan shall be no more than one assembly with two Sirocco fans direct driven by a single motor.
2. The indoor fan shall be statically and dynamically balanced.
3. Motor shall have permanently lubricated bearings.
4. In cooling mode, the indoor fan shall have the following settings; Low, Med, and High.
5. In heating mode, the indoor fan shall have the following settings; Low, Med, and High.

F. Coil:

1. The indoor unit coil shall be nonferrous with louvered fins on copper tubing for maximum efficiency.
2. The tubing shall have inner grooves for high efficiency heat exchange.
3. The coils shall be pressure tested at the factory.
4. A condensate drain pan shall be factory-installed below the coil.
5. All refrigerant lines to the indoor units shall be field-insulated.

G. Condensate Pump:

1. The unit shall include a factory-installed condensate pump that will be able to raise drain water 27 inches above the bottom of the indoor unit. The condensate pump shall be internally powered from the unit.

H. Electrical:

1. The unit electrical connection shall be as scheduled.
2. The indoor unit shall be capable of operation within voltage limits of +/-10% rated voltage.

I. Controls:

1. Unit shall use controls provided by the Manufacturer to perform all functions necessary to operate the system effectively and efficiently.

2.8 CEILING-SUSPENDED INDOOR UNIT

A. General:

1. Ceiling-suspended indoor unit shall mount suspended from the ceiling.
2. Shall be designed for use with R-410A refrigerant.
3. Shall be installed with heat pump or simultaneous heating and cooling heat pump VRF systems of the same Manufacturer.

B. Indoor Unit:

1. The indoor unit shall be factory-assembled, wired and run tested.
2. The indoor unit shall be factory-wired and piped with its own electronic expansion device, control circuit board, fan and motor.
3. The indoor unit shall have:

    a. Self-diagnostic function
    b. Auto restart function

4. Indoor unit refrigerant circuit shall be filled with a dry nitrogen gas charge from the factory.

C. Unit Cabinet:

1. The casing shall be white and/or off white molded plastic.
2. Indoor unit casing shall have integral sensor to read wireless handheld remote controller as standard from the factory.
3. The cabinet panel shall have provisions for a field-installed filtered outside air intake.

D. Filter:

1. Return air shall be filtered with a removable, washable filter.

E. Fan:

1. The indoor unit fan shall be no more than one assembly with two Sirocco fans direct driven by a single motor.
2. The indoor fan shall be statically and dynamically balanced.
3. Motor shall have permanently lubricated bearings.

4. In cooling mode, the indoor fan shall have the following settings; Low, Med, High, Power Cool, and Auto.
5. In heating mode, the indoor fan shall have the following settings; Low, Med, High, and Auto.
6. The fan shall have a selectable Auto fan setting that will adjust the fan speed based on the difference between controller set-point and space temperature.

F. Coil:

1. The indoor unit coil shall be nonferrous with corrugated fin on copper tubing for maximum efficiency.
2. The tubing shall have inner grooves for high efficiency heat exchange.
3. The coils shall be pressure tested at the factory.
4. A condensate drain pan shall be factory-installed below the coil.
5. All refrigerant lines to the indoor units shall be field-insulated.

G. Electrical:

1. The unit electrical power shall be 208/230 volts, 1-phase, 60 Hz.
2. The indoor unit shall be capable of operation within voltage limits of +/-10% rated voltage.

H. Controls:

1. Unit shall use controls provided by the Manufacturer to perform all functions necessary to operate the system effectively and efficiently.

2.9 CONTROLS

A. Overview:

1. The Controls Network shall be integrated with the building EMS.

B. Electrical Characteristics

1. General:

a. The controls system shall operate at 24 VDC. Controller power and communications shall be via a common non-polar communications bus.

2. Wiring:

a. Control wiring shall be installed in a daisy chain configuration from indoor unit remote controller, to the BC controller (main and subs, if applicable) and to the outdoor unit. Control wiring to remote controllers shall be run from the indoor unit terminal block to the controller associated with that unit.
b. Control wiring for schedule timers, system controllers, and centralized controllers shall be installed in a daisy chain configuration from outdoor unit to outdoor unit, to system controllers, to the power supply.
c. Control wiring for the remote controllers shall be from the remote controller to the first associated indoor unit then to the remaining associated indoor units in a daisy chain configuration.
d. The centralized controller shall be capable of being networked with other centralized controllers for centralized control.

3. Wiring Type:

    a. Wiring shall be 2-conductor (16 AWG), twisted, stranded, shielded wire as defined by the Design Tool AutoCAD output.
    b. Network wiring shall be CAT-5e with RJ-45 connection.

C. Remote Controllers

1. A remote controller shall be provided for each indoor air handling unit, as shown on the mechanical plans. The remote controller shall be compact in size, approximately 3” x 5” and have limited user functionality. The controller shall support temperature display selection of Fahrenheit or Celsius. The remote controller shall allow the user to change on/off, mode (cool, heat, auto, dry, and fan), temperature setting, and fan speed setting. The remote controller shall be able to limit the set temperature range. The room temperature shall be sensed at the remote controller or the indoor unit dependent on the indoor unit dipswitch setting.

D. System Controllers

1. ON/OFF Controller

    a. The controller shall be capable of turning ON/OFF up to sixteen groups of indoor units, for a maximum of 50 indoor units. One ON/OFF Controller shall be provided for each system (each floor). All of the units, up to 50, shall be turned ON/OFF using the main switch. A LED for each group of indoor units, up to 16 groups, shall indicate if there is a failure within each group by flashing. A main LED shall flash if there is an error on any one of the 16 groups for a maximum of 50 indoor units. A LED shall indicate the ON/OFF status for each group of indoor units.

2. Schedule Timer

    a. The schedule timer shall schedule operation for a maximum of 50 indoor units. The maximum number of indoor units supported per one group shall be 16. The maximum number of groups supported shall be 50.
    b. The Schedule Timer shall support up 9 scheduling patterns with up to 16 operations per pattern. Operations shall include on/off, mode selection (cool, heat), set temperature, and prohibition of remote controller functions (on/off, operation mode change, and set temperature adjustment). Patterns shall be applied to each group of indoor units on a per-day basis. The minimum time interval shall be 5-minutes. The Schedule Timer shall display a four-digit error code in the event of system abnormality/error.

E. System Group Controller

1. The System Centralized Controller shall be capable of controlling a maximum of 50 groups or a maximum of 50 indoor units across multiple outdoor units. The System Group Controller shall have operation controls which can be applied to an individual indoor unit, a group of indoor units (up to 50 indoor units), or all indoor units (collective batch operation). This control set of operation controls for the System Group Controller shall include on/off, operation mode selection (cool, heat, auto, dry, and fan), and temperature setting. The System Group Controller shall be able to enable or disable operation of local remote controllers.

F. Input/Output (IO) Boards

1. Digital Input Digital Output (DIDO) Board

a. The DIDO IO board shall be capable of providing On/Off control for other equipment via the touch screen of the centralized controller. Each DIDO board shall a total of six (6) digital inputs and six (6) digital outputs. Each digital output shall be capable of supporting an independent schedule via the centralized controller's licensed web browser functions. Status indication of the On/Off state of the other equipment shall be either via the On/Off status of the digital output or by receipt of a digital input to the DIDO board.

b. The DIDO IO board shall be capable of receiving a digital input for interlock settings with the indoor units or digital outputs on the DIDO board. Based on the digital input status the DIDO board shall be capable of setting the following parameter on the indoor unit On/Off, Mode, and Set Temperature to predefined settings. The DIDO board shall also be capable of interlocking the On/Off state of a digital output on the DIDO board based on a digital input status.

2. Analog Input (AI) Board

a. The AI IO board shall be capable of monitoring temperature or humidity via the centralized controller's licensed web browser functions. Each AI board shall have two analog inputs. Each input shall be capable of receiving a 4/20mA, 0/10 VDC, or 1/5 VDC signal for monitoring temperature or humidity. The AI board shall be capable of monitoring the temperature or humidity input and shall be capable of displaying graphical trending of the temperature or humidity values via the centralized controller's licensed web browser functions. Notification of user adjustable high and low level alarms shall be capable of being emailed to distribution list or outputted via a digital output.

b. The AI IO board shall be capable of setting the following parameters on the indoor unit On/Off, Mode, and Set Temperature to predefined settings based on the input value of the temperature or humidity. The AI board shall also be capable of interlocking the On/Off state of a digital output on the input value of the temperature or humidity.

G. Centralized Controller

1. The centralized controller shall be capable of controlling a maximum of 50 indoor units across multiple outdoor units. The centralized controller shall support operation superseding that of the remote controllers, system configuration, daily/weekly scheduling, monitoring of operation status, and malfunction monitoring. The centralized controller shall have five basic operation controls which can be applied to an individual indoor unit, a group of indoor units (up to 50 indoor units), or all indoor units (collective batch operation). This basic control set of operation controls for the centralized controller shall include on/off, operation mode selection (cool, heat, auto as applicable, dry, and fan), temperature setting, fan speed setting, and airflow direction setting. The centralized controller shall be able to enable or disable operation of local remote controllers. In terms of scheduling, the centralized controller shall allow the user to define both daily and weekly schedules with operations consisting of ON/OFF, mode selection, temperature setting, vane direction, fan speed, and permit/prohibit of remote controllers.
2. All centralized controllers shall be equipped with one RJ-45 Ethernet port to support interconnection with a network PC via a closed/direct Local Area Network (LAN). The

centralized controller shall be capable of performing initial settings via a PC using the centralized controller's initial setting browser.

3. Standard software functions shall allow the Building Manager to securely log into each centralized controller via the PC's web browser to support operation monitoring, scheduling, error email, and online maintenance diagnostics. Standard software functions shall not expire.

H. Web-Based User Interface

1. PC-Monitoring (SW-Mon)

a. Shall be capable of monitoring and operating all indoor units from a networked PC's web browser for up to 50 units.

2. PC Scheduling (SW-Sch)
3. Shall be capable of creating customized daily, weekly, and annual schedules from a network PC's web browser for up to 50 units. Schedules shall be applied to a single indoor unit, a group of indoor units, or collectively (batch) to all indoor units controlled by the central controller.

I. Online Error Email (SW-Email)

1. Shall be capable of sending detailed alerts to customizable distribution lists based on user defined error types.

J. Personal Web Browser (SW-Pweb)

1. Shall be capable of allowing up to 50 individual users to monitor and control user defined zones via a network PC or MAC's web browser.

K. Online Maintenance Diagnostics (SW-Maint)

1. Shall be capable of performing maintenance diagnostics via a network PC and the centralized controller using Maintenance Tool Software.

PART 3 - EXECUTION

3.1 WARRANTY

A. General:

1. The units shall be covered by the Manufacturer's limited warranty for a period of one (1) year from date of installation. The additional Manufacturer's limited warranty for a period of seven (7) years from the date of install shall apply to the compressor shall apply as the system is to be:

a. Designed by a certified CITY MULTI Diamond Designer.
b. Installed by a Contractor that has successfully completed the Mitsubishi Electric three-day service course.
c. Verified with a completed commissioning report submitted to and approved by the Mitsubishi Electric Service Department, then the units shall be covered by an extended manufacturer's limited warranty for a period of five (5) years from date of installation.

2. If, during this period, any part should fail to function properly due to defects in workmanship or material, it shall be replaced or repaired at the discretion of the Manufacturer.
3. This warranty shall not include labor.
4. If a substitute manufacturer is used, the warranty provided shall abide by these requirements.

B. Manufacturer shall have a minimum of five years of HVAC experience in the U.S. market.

C. All manufacturer technical and service manuals must be readily available for download by any local Contractor should emergency service be required. Registering and sign-in requirements which may delay emergency service reference are not allowed.

D. The VRF system shall be installed by a Licensed Mechanical Contractor trained by the VRF Equipment Manufacturer or Certified Manufacturer's Agent.

E. Commissioning shall be performed by the Manufacturer or Certified Manufacturer's Agent.

3.2 CONTROLS

A. Controls shall be as recommended by Manufacturer and connect to the Building Management System.

END OF SECTION

SECTION 260100

ELECTRICAL GENERAL

PART 1 - GENERAL

1.1 SCOPE

A. Division 26 includes all Specifications in the 260000 Series and the accompanying Electrical Drawings. Provide all labor, materials and equipment, and all necessary operations to provide the complete scope of the electrical systems intended under this Division. Division 26 is not a standalone document, but a part of the complete Project Documents.

B. Attention is called to the fact that there are many interfaces between the work required in this Division and the work required in other Divisions. Provide the necessary interface and coordination with other Divisions to provide a complete project.

1.2 CODES AND REGULATIONS

A. All work under this Division shall comply with all local building codes, laws, regulations, ordinances and the requirements of the 2017 National Electrical Code.

B. Where conflicts of installation requirements occur between the aforementioned codes, regulations or the Contract Documents, the most restrictive shall govern.

C. Obtain all permits and licenses and pay all fees required by local authorities. Arrange for all necessary inspections required by the authorities having jurisdiction and provide written certificates of approval to the project Owner or his designated representative.

D. This project shall adhere to the Marriot life safety standards in Module 14 of the Marriott Brand Standards. Refer to owner literature for complete details.

1.3 DEFINITIONS

A. Contract Documents: The complete set of project Drawings and Specifications.

B. Provide: Furnish, install and connect.

C. Work: All materials installed, including all labor to provide complete system.

D. Wiring or Wired: All wire or cable installed in conduit from panelboard to equipment and connected at both ends with all required boxes, connectors, couplings, etc.

E. Conduit: Rigid steel conduit intermediate metal conduit (I.M.C.), electrical metallic tubing (EMT) plastic conduit (PVC), or flexible steel conduit.

1.4 DRAWINGS AND SPECIFICATIONS

A. The Drawings and Specifications together are to be considered as the Contract Documents. Any work shown in one and not shown in the other, or implied by either, shall be provided to give a complete project.

B. Should any conflicts exist between the Drawings and Specifications or there is an item shown/called for which is not clearly defined, immediately submit a request for clarification. No additional monies will be granted later when a conflict is resolved or an item is more clearly

defined.

C. The Drawings are schematic and are not intended to show the exact location outlets, etc. or the routing of conduit.

D. The exact location of equipment requiring electrical connections (mechanical equipment, elevators, lights, etc.) shall be as located by other Divisions of the Contract Documents. Refer to the Architectural, Structural and Mechanical Documents for dimensions and details of building construction and provide work described in this Division so that it conforms to the details of the project. The right is reserved to relocate any receptacle, switch or other outlet a maximum of 10'-0" before it is permanently installed without incurring additions to the Contract amount.

1.5 SITE VISIT

A. Visit the site and become familiar with all aspects of the site and existing conditions before submitting Contract price.

B. No allowance will be made for lack of knowledge of existing conditions.

1.6 DEVIATIONS

A. No deviations from the Contract Documents shall be made without the full knowledge and written consent of the Architect.

B. If the existing conditions make it desirable to modify the Contract Documents in regard to any item, provide a written request to the Architect.

PART 2 - PRODUCTS

2.1 STANDARDS FOR MATERIALS AND WORKMANSHIP

A. All materials used shall be new and shall be stamped with the label of Underwriters Laboratories, Inc. (UL).

B. All materials shall meet the standards of the following associations and institutes where applicable:

1. National Fire Protection Association (NFPA)
2. American Society of Testing Materials (ASTM)
3. American National Standards Institute (ANSI)
4. National Electrical Manufacturer's Association (NEMA)
5. Institute of Electrical and Electronic Engineers (IEEE)

C. Manufacturer’s names and catalog numbers specified herein are intended to describe the material and set the standard of quality. All bids shall be based on material specified. Requests for approval of material not specified shall be considered if the request is in written form and submitted to the Architect no later than fourteen (14) days before bid date. All requests shall conform with the provisions of the general and supplementary conditions.

D. Samples of materials requested to be substituted shall be furnished upon the request of the Architect.

2.2 SHOP DRAWINGS AND SUBMITTAL

A. The Engineer's review of shop drawings or submittals is a cursory review to check for general

compliances of submittals with the design intent of the Contract Documents. The Engineer's review does not relieve the Contractor of his responsibility of complying with the Contract Documents. All coordination of the work in strict compliance with the Contract Documents is the sole responsibility of the Contractor.

B. The following items shall be submitted for review:

1. Conduit and wire
2. Grounding system
3. Devices
4. Coverplates
5. Metering equipment
6. Panelboards
7. Switchboards
8. Transformers
9. Fuses
10. Overcurrent devices
11. Busway
12. Ground fault system
13. Disconnect switches
14. Lighting fixtures
15. Lighting control system
16. Dimming system
17. Life safety system
18. Emergency system
19. Motor starters
20. Motor control center
21. Transient Voltage Surge Suppression

C. All shop drawings and submittals shall be submitted in compliance with the requirements of the general and supplementary conditions. No more than four (4) copies of submittal data will be reviewed. Any additional copies will be returned unmarked. The responsibility of copying review comments on any additional copies will rest solely with the contractor.

D. All submittals shall bear the name of the manufacturer to be used.

E. All shop drawings and submittals shall include a stamped indication signifying that the submittal has been reviewed for compliance with the Contract Documents by the Contractor. This stamped indication also represents the fact that the Contractor has checked this submittal for its interaction with all other Divisions and certifies by his signature or initials that all coordination has taken place. The stamp shall include the date, name of the Contracting Firm, the signature of the Contractor, certification of compliance and approval. This stamp shall be on the submittal before the Engineer will review it.

F. The engineer will review an individual submittal not more than twice. If the submittal is rejected again on the second review, the contractor will bare all responsibility for paying for the engineer's time for additional reviews. Such payments to the engineer shall be withheld from the next monthly pay application.

G. For equipment that requires an electrical connection, Division 21/22/23 shall provide a summary coordination schedule with the following information. The schedule shall be signed off by Div 21, 22, 23 and 26 as applicable indicating coordination:

1. Electrical voltage/phase
2. Starter by Div 21/22/23 or Div 26

3. Disconnect by Div 21/22/23 or Div 26
4. Low voltage transformer by Div 21/22/23 or Div 26
5. Indicate discrepancy between supplied equipment and design plans. Note that substitutions shall be required to be coordinated by the Contractor as outlined in this specification. Re-design can be provided by the Engineer as requested at an agreed upon fee.

2.3 RECORD (AS-BUILT) DRAWINGS AND MAINTENANCE MANUALS

A. At job completion, submit to the Architect, a set of mylar sepias showing all deviations from the Contract Documents. The Drawings shall also have dimensions locating all underground conduits.

B. At job completion, submit to the Architect, three (3) sets of maintenance and instruction manuals for all equipment furnished on the project.

PART 3 - EXECUTION

3.1 COORDINATION

A. Coordinate all space requirements with all other Divisions before installing any work. Install work such that adequate space will be allotted for all other work from other Divisions to be installed and also will allow room for future access for repair and maintenance.

B. Any work installed without proper coordination shall be relocated at the Architect's direction without increasing the Contract price.

C. During the bidding process or the pricing for a guaranteed maximum price, coordinate with all other Divisions for the total amount of work required in Division 26. Any work shown or implied in another Division requiring work in Division 26 shall be included in the Contract price regardless of whether or not it is addressed in Division 26.

3.2 PROTECTION OF MATERIALS

A. All equipment shall have the original finish when the building is turned over to the Owner.

B. Protect equipment during construction from dirt, water, chemical, mechanical damage, etc. Protect all conduit openings so that no foreign material will enter the conduit.

3.3 TESTS, DEMONSTRATION AND INSTRUCTIONS

A. Test all systems described in this Division in the presence of the Owner or a designated representative upon completion of the work. Demonstrate that the installation is in accordance with Contract Documents.

B. Any work found not to be in compliance with the Contract Documents shall be repaired or replaced without incurring any additions to the Contract price.

C. Provide to the Owner, all instruction on maintenance and operation of all systems and equipment provided under this Division. Provide all necessary tools and personnel to thoroughly present these instructions.

3.4 GUARANTEE

A. All systems, equipment, components, work, etc. provided under this Division shall be covered

by a one year guarantee starting at the time of final acceptance of the work by the Owner. Any defects in the work, systems, equipment or components found during this year shall be corrected at no charge. The guarantee shall include providing all necessary cutting, patchwork, repainting, etc. to make the work complete and new.

B. Present this guarantee and any additional warranties or guarantees on furnished equipment or systems to the Architect. All equipment or system guarantees are in addition to the general guarantee.

END OF SECTION

SECTION 261000

ELECTRICAL BASIC MATERIALS & METHODS

PART 1 - GENERAL

1.1 DESCRIPTION

A. All work specified in this Section shall comply with the provisions of Section 260100.

B. This Section describes the basic electrical materials and installation methods that are acceptable and applicable to Division 26.

PART 2 - PRODUCTS

2.1 CONDUIT

A. Galvanized rigid steel conduit shall be low carbon, hot-dipped galvanized both inside and out with threaded joints.

B. Intermediate metal conduit (IMC) shall be steel, galvanized both inside and out with threaded joints.

C. Electrical metallic tubing (EMT) shall be steel, galvanized both inside and out.

D. Plastic conduit (PVC) shall be schedule 40 PVC heavy wall type. A grounding conductor shall be provided.

E. Flexible metal conduit shall be flexible steel conduit tubing and shall meet Underwriters Laboratories Standard for Flexible Steel Conduit.

F. Liquid-tight flexible metal conduit and liquid-tight non-metallic conduits shall be liquid-tight and sunlight resistant.

G. Steel conduit approved manufacturers are Allied, Triangle and Republic.

H. PVC conduit approved manufacturers are Carlon and Triangle.

2.2 CONDUIT FITTINGS

A. Rigid conduit and IMC conduit fittings shall be zinc-coated, ferrous metal and taper threaded type.

B. EMT fittings shall be zinc-coated steel and hexnut compression or set-screw type. EMT connectors shall have insulated throats.

C. PVC fittings, elbows and cement shall be produced by the same manufacturer. All joints shall be solvent welded in accordance with the manufacturer's recommendations.

D. Conduit connections to switchboards, motor control centers, transformers, panel cabinets, and pull boxes shall have grounding wedge lugs between the bushing and the box or locknuts designed to bite into the metal.

E. Each conduit end shall be provided with either an insulated throat connector or separate locknut and insulated bushing. Bushing shall be installed before any wire is pulled.

F. Conduit fittings approved manufacturers are Raco, Steel City, O.Z. Gedney, Thomas & Betts and Appleton.

G. Expansion fittings shall be provided in all conduit which crosses and expansion joint.

2.3 CONDUCTORS

A. Conductors shall be copper of 98% conductivity, 600 volt insulation. Sizes specified are AWG gauge for No. 4/0 and smaller and circular mils (MCM) for all sizes larger than no. 4/0. Conductors No. 10 and smaller shall be solid and type "THHN" or "THWN" insulation. No. 8 and larger shall be stranded and type "THW" or "XHHW" insulation. Aluminum conductors shall be Alcan 8000 series, Stabiloy or approved equal. All conductors to mechanical equipment shall be copper.

2.4 OUTLETS

A. Outlet boxes and covers shall be of such form and dimensions as to be adapted to their specified usage, locations, size and quantity of conduit, and size and quantity of conductors entering the boxes. In special "Fire Rated" partitions, outlets shall comply with ASTM No. E119.

B. Flush ceiling outlets for surface or pendant mounted lighting fixtures shall be one-piece 4" square or octagonal pressed steel boxes. Boxes for devices in unfinished masonry walls or stud walls shall be pressed steel, square corner, sectional switch boxes, or shall be 4" square box with a square cornered tile wall cover, set flush with masonry construction. Boxes in concrete ceiling slab shall be octagonal, shallow concrete boxes. Welded boxes are not acceptable.

C. All outlet boxes in plaster or masonry walls or ceiling shall be provided with plaster rings.

D. Junction boxes and all outlets not indicated as containing wiring devices or lighting fixtures shall have covers. Covers for outlets in walls shall be as specified for wall switches and receptacles.

E. Outlet boxes exposed to the weather and outlet boxes for vaportight lighting fixtures and devices shall be of cast iron corrosion resistant type.

F. Outlet box approved manufacturers are Appleton, Raco, Steel City or Crouse-Hinds.

2.5 DISCONNECT SWITCHES

A. Disconnect switches shall be "heavy-duty" type, enclosed switches of quick-make, quick-break construction. Switches shall be horsepower rated for 600 volts AC as required. Lugs shall be UL listed for copper and aluminum.

B. Padlocking provisions shall be provided for padlocking in the OFF position.

C. Switches shall be furnished in NEMA I General purpose enclosure unless noted otherwise. Switches located on the exterior of the building or in "wet" locations shall have NEMA 3R enclosures.

D. Fused disconnect switches shall have rejection type fuse clips with dual element, current limiting fuses of rating shown.

E. Disconnect switches shall be mounted to structure. Disconnect switches shall not be mounted

to mechanical equipment or ductwork.

2.6 NAMEPLATES

A. Nameplates shall have 3/8" high engraved letters.

B. 120 or 208 volts: white core laminated bakelite with black finish.

C. 277 or 480 or higher volts: black core laminated bakelite with white finish.

D. Emergency power: white core laminated with red finish.

2.7 WALL SWITCHES

A. Wall switches shall be Decora style plastic, totally enclosed, quiet type, self-grounding, 277 volts and 20A rating and shall match existing if possible and equal the following:

Single Pole: Hubbell No. DS115, or equal by Leviton, P&S or Cooper.

Double Pole: Hubbell No. CS1222, or equal by Leviton, P&S or Cooper.

Three-Way: Hubbell No. CS1223, or equal by Leviton, P&S or Cooper.

Four-Way: Hubbell No. CS1224, or equal by Leviton, P&S or Cooper.

B. Guestroom and wall switches shall be Leviton Decora series. Provide with dimming capability where noted on plans. Note: Provide dimmer switches with separate neutrals where all devices are not connected to the same phase. Guestroom switches shall be installed with locator light enabled where noted on floor plans.

C. Color shall be as selected by architect.

D. Flush motor switches with red pilot light and with overload protection for fractional horsepower motors shall be Hubbell No. HBL1221PL.

E. Key switches shall be Hubbell No. HBL1221L 20A Series or approved equal by P&S or Leviton.

F. Coordinate with lighting designer for control panel and switch specificaitons for public space lighting.

2.8 RECEPTACLES

A. Duplex receptacles shall be Decora style plastic, two-pole, three wire, self-grounding, side wired, 125 volts and 20A rating and shall match existing if possible and be equal to the following: Duplex receptacles shall be Hubbell No. DR20 Series, Leviton No. 16532-T Series or Bryant DR520 Series. Isolated ground type shall be Hubbell No. IG-20DR Series or Bryant 9300-IG Series.

B. Single receptacles shall be two-pole, three wire, self-grounding, side wired, 125 volts and 20A rating and shall be equal to the following: Single receptacles shall be Hubbell No. HBL5361 Series, or equal by Leviton, P&S or Cooper. Isolated ground type to be Hubbell No. IG-5361 Series, or equal by Leviton, P&S or Cooper.

C. Ground fault circuit interrupt (GFI) receptacles shall be Hubbell GFR5352, or equal by P&S, Leviton or Cooper.

D. All receptacles in guestrooms shall be tamper resistant.

E. Color shall be as selected by the Architect.

2.9 COVERPLATES

A. Coverplates for flush mounted devices shall be brushed finished stainless steel standard size, Hubbell “P” Series or equal by Leviton, P&S or Cooper.

B. Telephone outlet coverplates shall have same finish as above and have a bushed hole in the center.

C. Coverplates for exterior devices shall be self-closing, die cast aluminum Hubbell WP8M or equal by Leviton, P&S or Cooper.

2.10 PLYWOOD BACKBOARDS

A. Provide plywood backboards where shown. Backboards shall be minimum 3/4" thick and sized as shown or to accommodate equipment indicated to be mounted thereon.

B. Secure plywood to the building structure and paint with two coats of gray paint.

2.11 SMOKE AND FIRE STOP FITTINGS

A. Smoke and Fire Stop Fittings shall be UL listed for that purpose. The fittings used to seal conduit either on the outside of the conduit, busway or cable or internally shall have heat activated intumescent material, which expands to fill all voids. Smoke and fire stop fittings shall be O.Z./Gedney "FIRE-SEAL" or Dow Corning silicone RTV foam with an hourly fire-rating equal to or higher than the rating of the floor, ceiling or wall through which the cable or conduit passes. The seals for conduit shall be of the flanged type.

2.12 FLOOR OUTLETS

A. Floor outlets shall be single gang floor boxes (unless noted on drawings), Hubbell B2436 Series, complete with cast iron body, vertical angular adjustment, brushed brass frame, brushed brass floor plate and gasket. Larger than standard tappings shall be furnished where required. Adjacent boxes shall be installed on minimum 7" centers.

B. Duplex floor receptacle outlets shall have Hubbell No. S3825 floor plate, a No. SB3083 carpet plate where installed in carpeted floor and a Hubbell CR5262 Series duplex receptacle. Single floor receptacle outlets shall have a S2625 plate and Hubbell single receptacle. Equal manufacturers shall be Legrand.

2.13 FUSES

A. Provide all fuses. All fuses shall be of the same manufacturer. All fuses shall be of the high interrupting rating (200,000 Amps), current limiting type and manufactured by Bussmann. Fuses shall be provided for each fuse cutout and the specified quantity of fuses shall be furnished for spares.

B. Circuits 0 to 600 ampere shall be protected by rejection type, current limiting BUSSMANN LOWPEAK Dual Element Fuses LPN-RK (250 volts) or LPS-RK (600 volts). All dual-element fuses shall have separate overload and short-circuit clearing chamber. The fuse must hold 500% of rated current for a minimum of 10 seconds and be listed by Underwriter's

Laboratories, Inc., with an interrupting rating of 200,000 amperes RMS symmetrical. The fuses shall be UL Class RK-1.

C. Circuits 601 to 6000 ampere shall be protected by current limiting BUSSMANN HI-CAP Time-Delay Fuses KRP-C. Fuses shall employ "O" rings as positive seals between the end bells and the glass melamine fuse barrel. The terminals shall be opened. Fuses shall be time-delay and must hold 500% of rated current for a minimum of 4 seconds, clear 20 times rated current in 0.1 seconds or less and be listed by Underwriter's Laboratories, Inc., with an interrupting rating of 200,000 amperes RMS symmetrical. The fuses shall be UL Class L.

D. Furnish and turn over to the Owner a minimum of one (1) set of spare fuses (set consisting of three fuses) for each type and rating of fuse used. When the number of fuse sets of the same type and rating actually installed exceeds five (5) sets, furnish an additional spare set of fuses for each five (5) or fraction thereof.

E. Provide a cabinet in which to store all spare fuses, Bussman Catalog No. SFC

F. Acceptable manufacturers are Bussman or equal by Littlefuse.

PART 3 - EXECUTION

3.1 CONDUIT

A. Rigid steel (or IMC) shall be used for service entrance and all feeders and branch circuits where exposed to damage.

B. EMT or MC cable shall be used for branch circuits, fire alarm and telephone when not underground or in concrete in contact with the earth.

C. Schedule 40 PVC may be used for all underground feeders, service entrance conductors when encased in 4" of concrete on all sides, or under the lowest floor slab.

D. Conduit shall be continuous from outlet to outlet, from outlet to cabinet, junction box and pull box. Conduit shall enter and be secured to all boxes, etc., in such a manner that each system will be electrically continuous from service to all outlets such that a good ground is provided. All conduit from cabinets and junction boxes shall terminate in approved outlet boxes or conduit fittings. Conduit connections to any box which has no threaded hub shall be double locknutted.

E. Provide junction boxes or pull boxes where shown and where necessary to avoid excessive runs or too many bends between outlets. The conduit sizes shown may increase if desired to facilitate the pulling of cables.

F. All conduit shall be concealed unless indicated otherwise. Install exposed conduit parallel with or at right angles to the building walls and support from walls or ceilings at intervals required by Code with approved galvanized iron clamps or hangers. Concealed conduit above the ceiling shall be supported independent of ceiling construction. Where ceilings of lay-in type are used, conduit must be installed high enough to permit removal of ceiling panels and lighting fixtures. Use threaded rods and hangers for supporting single conduit. Use trapeze hangers consisting of double-nutted threaded rods and "Unistrut" channels or angles of 12 gauge minimum steel for supporting multiple conduit.

G. Minimum size conduit for branch circuits shall not be smaller than 1/2". Home runs shall extend from outlets shown to panel designated. Home runs shown shall not be combined. Home run conduit shall not be smaller than 3/4".

H. At couplings, conduit ends shall be threaded so that they meet in the coupling. Right and left hand couplings shall not be used; conduit couplings of the Erikson Type shall be used at locations requiring such joints.

I. All conduit for future use, for telephone wire, or for data communication cable, shall be left with No. 16 gauge wire pulled in them or a pull line as manufactured by Ideal, and the ends securely corked or capped.

J. Expansion fittings shall be installed in all conduit which pass through the cross-sectional area of expansion joints.

K. Provide non-hardening elastic type duct seal compound, Neer No. DC., 3M Co. "Scotchfil", or Gardner Bender duct seal, for each conduit entering the building from outside and for each conduit passing from one space into another which is normally at a lower temperature.

L. Provide watertight conduit hubs on conduit terminating in a box or cabinet exposed to the weather.

M. Space in sleeves or around conduit that pass through fire resistive or fire rated walls, partitions, floors or ceilings shall be closed by packing with an unlabelled fire resistive material that will maintain the rating of the barrier penetrated.

3.2 FLEXIBLE CONDUIT

A. PVC extruded cover flexible conduit shall be used in making short flexible connections to rotating or vibrating machinery or equipment. The flexible conduit at these locations shall be as short as possible, but shall have a minimum length of 12".

B. A green stranded bonding jumper shall be installed outside of all flexible conduit that extends directly from a non-flex conduit to a rotating or vibrating machine. Where a junction box is used, the green stranded bonding jumper shall be installed inside the flexible conduit and attached to the junction box and to the machine. When the bonding jumper is installed outside of the flexible conduit, plastic wire straps shall be used 6" o.c. to secure the jumper to the flexible conduit.

C. Flexible metal (MC) conduit system may be utilized where concealed in walls and/or millwork only. MC Cable shall run from point of exit from wall or millwork to nearest structurally support junction box. MC cable will not be permitted to be installed in the above ceiling space and shall not pass through a fire rated partition. Conductor colors of the MC cable shall comply with 16100 3.04 C

3.3 CONDUIT PROTECTION

A. All conduit installed in the ground outside the building exterior line (with the exception of exterior lighting circuits) shall be encased in 4" of concrete on all sides. Concrete shall be a minimum of 3000 P.S.I. mix. All threaded joints in rigid conduit that is encased in concrete shall have a U.L. listed joint compound applied. All conduit installed outside the building underground shall be buried a minimum of 30" below finished grade but in no case shall be buried deeper than 48". Where conduit is installed below the ground floor slab inside the building exterior line, the conduit shall be run between the floor slab and the vapor barrier. These conduits shall be installed in the slab itself where feasible. When a conduit duct bank must be installed then the entire duct bank shall be encased in concrete and installed per Appendix B of the NEC. Derating of conductors in the underslab duct bank shall be the responsibility of the contractor. Conduit installed in any slab, where permitted above, shall be above the bottom steel and below the top steel.

B. Conduit shall be secured in place and protected where necessary to prevent damage to work during construction. The ends of all conduit shall be plugged to avoid filling with any foreign matter. All conduit shall be blown out and swabbed clear of water and trash prior to pulling wire.

C. Provide identifying marker tape the entire length of each conduit installed in the ground outside the building. The tape shall be constructed of inert polyethylene, resistant to acids, alkalis, etc., in the soil, and shall be a minimum 4 mil thickness. The tape shall be yellow, 6" wide, and shall have the words, "CAUTION - ELECTRIC LINE BURIED BELOW," imprinted with contrasting permanent ink. The imprint shall repeat itself for the entire length of the tape. The tape shall be buried at a maximum of 18" below finished grade, above a portion of the earth fill shall be "Terra Tape" as manufactured by Reef Industries, Inc., P.O. Box 33248, Houston, Texas 77033 (1-800-231-6074).

D. All conduit installed from the power company vault to the main switchboard and fire pump shall be encased in a minimum of 4” on concrete.

3.4 WIRING

A. All conductors shall be installed in conduit. No conductors shall be pulled into the conduit until the conduit system is complete and plaster had dried. Wire pulling lubricants shall be Gardner-Bender "Wireaide" or Ideal "Yellow 77".

B. Conductors shall be continuous from outlet to outlet and from outlet to junction box or pull box. All splices and joints shall be carefully and securely made to be mechanically and electrically solid with pressure type connectors, Gardner Bender "Winggard" or Ideal "Wingnut". Tape shall be "Scotch" No. 33 for indoor and No. 88 for outdoor or Gardner Bender No. 95-661. Where connection is made to any terminals of more than 30 amperes capacity and where conductors larger than No. 10 are connected to any terminal, copper terminal lugs shall be bolted to the conductors. Where multiple connections are made to the same terminal, individual lugs for each conductor shall be used. Aluminum conductors, if used for service conductors, shall be made with high compression lugs as manufactured by Square D, Ideal or MAC.

C. Each conduit shall have a minimum of two (2) conductors pulled in unless that particular conduit is noted as being for systems other than electrical circuitry and/or future use or unless noted otherwise.

D. Conductors for lighting and receptacle circuits shall have color coded jackets. The wiring shall be color coded with the same color used with its respective phase through the entire job as follows:

208/120 Volt System	480/277 Volt System
Phase A - Black	Phase A - Brown
Phase B - Red	Phase B - Orange
Phase C - Blue	Phase C - Yellow
Neutral - White	Neutral - Gray
Ground - Green	Ground - Green

E. The feeder and service entrance conductors shall be color coded by the use of colored plastic tape applied within 6" of each conductor end.

F. Branch circuit conductors shall not be smaller than No. 12 and where the home run from center of load exceeds 100'-0", the conductors from home run outlet to panel shall be No. 10 minimum.

G. For branch circuits terminating in outlet without device, leave minimum of 12" of slack wire coiled for connection of equipment. All conductors shall be identified with proper circuit numbers at terminals, junction boxes at panelboards within 6" of conductor ends.

3.5 OUTLETS

A. Provide galvanized steel or cast type boxes for all outlets.

B. Where outlet boxes are used to support lighting fixtures, the outlet box shall be anchored to the structural members of the building per NEC 370-13.

C. Outlet boxes shall be flush mounted unless they are specifically shown as being used with exposed conduit or are located above a ceiling.

D. Where outlets are supplied from conduit run in or below floor slabs, the conduit shall be stubbed up at the location shown and the wall built up around the conduit.

E. Cuts for outlet boxes in masonry walls shall be made so that the coverplate will completely cover the cut. The mounting height of switch, receptacle and other outlets may be varied slightly, with the Architects approvals, so that the outlet box, top or bottom, will occur at a masonry joint.

F. The edge of all outlet boxes shall be flush with the surface in which they are recessed. The devices that fit into the outlet boxes shall be screwed tight before the coverplate is installed and the coverplate shall not be used as a means of tightening the devices in place.

G. Where outlets are shown as being adjacent and different mounting heights are specified for each, they shall be mounted one directly over the other, on the centerline of the group.

3.6 NAMEPLATES

A. Provide specified nameplates on the main switchboard, distribution panels, feeder switches, feeder breakers, panelboards motor control centers, disconnect switches, contactors, starters, transformers, start-stop push buttons and motor switches.

B. Provide nameplates on every device in the main switchboard, distribution panels and motor control centers.

C. Nameplates for surface mounted equipment shall be installed on the exterior of equipment with sheetmetal screws. Nameplates for flush or recessed mounted equipment shall be installed on the inside of the panel door or cover with epoxy cement.

3.7 WALL SWITCHES AND RECEPTACLES

A. Where more than one device is indicated at a location, the devices shall be gang-mounted in combined multi-gang boxes and covered jointly by a common coverplate. Provide barriers as required by the devices and voltages being used.

3.8 COVERPLATES

A. All junction boxes, outlet boxes, multi-gang switch boxes, utility boxes, etc., shall be covered with a coverplate. The coverplate shall be a finished plate as specified unless designated otherwise.

B. Coverplates shall be mounted vertically unless designated otherwise.

3.9 GROUNDING

A. Ground connections shall be in accordance with the 2017 National Electrical Code.

1. Provide a grounding electrode system consisting of a minimum of three (3) copperweld rods, 3/4" x 10'-0", driven 24" below grade a minimum of 72" apart in the form of an equilateral triangle, bonded together with No. 4/0 conductors. Install rods a minimum of 36" clear of foundation walls to effect the building ground. If the resistance to ground exceeds 25 ohms, additional rods shall be driven and bonded together until a reading of 25 ohms or less to ground is obtained. After completion of the grounding system, measure the system ground resistance with a "Megger Earth Tester". Submit directly to the Architect two (2) copies of each test report certified by the testing technician and the Owner's representative.
2. Extend from the electrodes to the main service disconnect with a No. 4/0 copper insulated ground conductor in a 1" conduit and connect to the neutral bar, housing and frame.
3. Provide a No. 4/0 copper insulated conductor across the water meter with the conductor attached with clamps to the water line on each side of the meter.
4. Provide a No. 4/0 copper insulated ground conductor in a 1" conduit from cold water entrance pipe ahead of first valve to the main service disconnect and connect to the neutral bar, housing and frame.
5. Where nonmetallic insulating couplings or dielectric flanges are used in metallic water piping systems, provide a No. 4/0 copper, insulated ground conductor across the couplings with the conductor attached with clamps to the water line on each side of the coupling.
6. All ground connections in the building system ground shall be done with Cadwell.
7. All ground clamps shall be equipped with compression type cable lugs independent of the compression device clamping the pipe or rod.
8. All steel conduit entering the main service disconnect shall have threaded conduit insulated grounding bushings. All bushings shall be bonded together and bonded to the main grounding bus with a No. 4 bare conductor.

B. Provide an insulated green bonding jumper from the grounding lug of all receptacles to a Steel City "GEE" clip or a sheet metal screw in the outlet box. The ground wire installed behind the device mounting screws will not be acceptable.

C. Provide 1 #6-3/4" conduit from the system ground to the telephone company main distribution frame or service cabinet and to each telephone backboard.

D. Provide a # 4/0 ground riser for the telecommunications service. The #4/0 ground riser shall extend from the MDF room up through the IDF room on each floor. A 20” x 4” copper ground bar shall be provided in each room for connections. The riser connections to the ground bar in each room shall be CADweld connecitons.

3.10 TELEPHONE CONDUIT SYSTEM

A. Telephone service shall include wood backboards and equipment cabinets with service entrance conduit as shown.

B. Telephone service entrance cable, all branch cabling and telephone instruments shall be provided by the telephone equipment vendor.

C. Provide an outlet and conduit system for the telephones as shown and leave the same in

readiness for wiring by others. Provide pull line in all telephone conduit. Terminate all conduit at a uniform height with smooth insulated bushings at the telephone wood backboards.

D. Telephone wall outlets shall be pressed steel sectional switch boxes, wall mounted at the locations indicated. Coverplate shall have a bushed hole.

E. Telephone floor outlets shall be floor boxes as specified at the locations indicated.

3.11 CONNECTION TO EQUIPMENT

A. Equipment furnished by the Owner or under other Sections, such as mechanical equipment, elevators, escalators, signs, kitchen equipment, etc., will be installed by others. Provide electrical service and make the electrical circuit connection to this equipment.

B. Provide PVC insulated flexible cord sets for all cord and plug connected building appliances and equipment. Cords shall be sized in accordance with electrical circuits indicated. Multiple conductor cords shall be "SO" cable with PVC jacket and green insulated ground conductor.

3.12 CORING, CUTTING AND PATCHING

A. Set sleeves for conduit accurately before the concrete floors are poured, or set boxes on the forms so as to leave openings in the floors in which the required sleeves can be subsequently located. Fill in the voids around the sleeves with concrete.

B. Should the performance of this preliminary work be neglected and should cutting be required in order to install conduit, then the expense of the cutting and restoring of surfaces to their original conditions shall be accomplished without incurring additions to the Contract.

3.13 EQUIPMENT ANCHORING

A. All items of electrical equipment, such as switchboards, motor control centers, transformers, standby generator, etc., shall be securely anchored to the building structure. The anchoring shall be accomplished by utilizing a minimum size of 3/8" steel anchor bolts in the structure and to the item of equipment. A minimum of two (2) anchor bolts shall be provided on each side of each item of equipment with the following exceptions:

Exception No. 1: If the equipment manufacturer includes more than two (2) anchor holes per side in the base or base frame of the equipment item, then there shall be one anchor for each anchor hole.

Exception No. 2: If the equipment manufacturer recommends a particular quantity greater than two (2) per side, then that quantity of anchors shall be provided.

END OF SECTION

SECTION 261000

ELECTRICAL BASIC MATERIALS & METHODS

PART 1 - GENERAL

1.1 DESCRIPTION

A. All work specified in this Section shall comply with the provisions of Section 260100.

B. This Section describes the basic electrical materials and installation methods that are acceptable and applicable to Division 26.

PART 2 - PRODUCTS

2.1 CONDUIT

A. Galvanized rigid steel conduit shall be low carbon, hot-dipped galvanized both inside and out with threaded joints.

B. Intermediate metal conduit (IMC) shall be steel, galvanized both inside and out with threaded joints.

C. Electrical metallic tubing (EMT) shall be steel, galvanized both inside and out.

D. Plastic conduit (PVC) shall be schedule 40 PVC heavy wall type. A grounding conductor shall be provided.

E. Flexible metal conduit shall be flexible steel conduit tubing and shall meet Underwriters Laboratories Standard for Flexible Steel Conduit.

F. Liquid-tight flexible metal conduit and liquid-tight non-metallic conduits shall be liquid-tight and sunlight resistant.

G. Steel conduit approved manufacturers are Allied, Triangle and Republic.

H. PVC conduit approved manufacturers are Carlon and Triangle.

2.2 CONDUIT FITTINGS

A. Rigid conduit and IMC conduit fittings shall be zinc-coated, ferrous metal and taper threaded type.

B. EMT fittings shall be zinc-coated steel and hexnut compression or set-screw type. EMT connectors shall have insulated throats.

C. PVC fittings, elbows and cement shall be produced by the same manufacturer. All joints shall be solvent welded in accordance with the manufacturer's recommendations.

D. Conduit connections to switchboards, motor control centers, transformers, panel cabinets, and pull boxes shall have grounding wedge lugs between the bushing and the box or locknuts designed to bite into the metal.

E. Each conduit end shall be provided with either an insulated throat connector or separate locknut and insulated bushing. Bushing shall be installed before any wire is pulled.

F. Conduit fittings approved manufacturers are Raco, Steel City, O.Z. Gedney, Thomas & Betts and Appleton.

G. Expansion fittings shall be provided in all conduit which crosses and expansion joint.

2.3 CONDUCTORS

A. Conductors shall be copper of 98% conductivity, 600 volt insulation. Sizes specified are AWG gauge for No. 4/0 and smaller and circular mils (MCM) for all sizes larger than no. 4/0. Conductors No. 10 and smaller shall be solid and type "THHN" or "THWN" insulation. No. 8 and larger shall be stranded and type "THW" or "XHHW" insulation. Aluminum conductors shall be Alcan 8000 series, Stabiloy or approved equal. All conductors to mechanical equipment shall be copper.

2.4 OUTLETS

A. Outlet boxes and covers shall be of such form and dimensions as to be adapted to their specified usage, locations, size and quantity of conduit, and size and quantity of conductors entering the boxes. In special "Fire Rated" partitions, outlets shall comply with ASTM No. E119.

B. Flush ceiling outlets for surface or pendant mounted lighting fixtures shall be one-piece 4" square or octagonal pressed steel boxes. Boxes for devices in unfinished masonry walls or stud walls shall be pressed steel, square corner, sectional switch boxes, or shall be 4" square box with a square cornered tile wall cover, set flush with masonry construction. Boxes in concrete ceiling slab shall be octagonal, shallow concrete boxes. Welded boxes are not acceptable.

C. All outlet boxes in plaster or masonry walls or ceiling shall be provided with plaster rings.

D. Junction boxes and all outlets not indicated as containing wiring devices or lighting fixtures shall have covers. Covers for outlets in walls shall be as specified for wall switches and receptacles.

E. Outlet boxes exposed to the weather and outlet boxes for vaportight lighting fixtures and devices shall be of cast iron corrosion resistant type.

F. Outlet box approved manufacturers are Appleton, Raco, Steel City or Crouse-Hinds.

2.5 DISCONNECT SWITCHES

A. Disconnect switches shall be "heavy-duty" type, enclosed switches of quick-make, quick-break construction. Switches shall be horsepower rated for 600 volts AC as required. Lugs shall be UL listed for copper and aluminum.

B. Padlocking provisions shall be provided for padlocking in the OFF position.

C. Switches shall be furnished in NEMA I General purpose enclosure unless noted otherwise. Switches located on the exterior of the building or in "wet" locations shall have NEMA 3R enclosures.

D. Fused disconnect switches shall have rejection type fuse clips with dual element, current limiting fuses of rating shown.

E. Disconnect switches shall be mounted to structure. Disconnect switches shall not be mounted to mechanical equipment or ductwork.

2.6 NAMEPLATES

A. Nameplates shall have 3/8" high engraved letters.

B. 120 or 208 volts: white core laminated bakelite with black finish.

C. 277 or 480 or higher volts: black core laminated bakelite with white finish.

D. Emergency power: white core laminated with red finish.

2.7 WALL SWITCHES

A. Wall switches shall be Decora style plastic, totally enclosed, quiet type, self-grounding, 277 volts and 20A rating and shall match existing if possible and equal the following:

Single Pole: Hubbell No. DS115, or equal by Leviton, P&S or Cooper.

Double Pole: Hubbell No. CS1222, or equal by Leviton, P&S or Cooper.

Three-Way: Hubbell No. CS1223, or equal by Leviton, P&S or Cooper.

Four-Way: Hubbell No. CS1224, or equal by Leviton, P&S or Cooper.

B. Guestroom and wall switches shall be Leviton Decora series. Provide with dimming capability where noted on plans. Note: Provide dimmer switches with separate neutrals where all devices are not connected to the same phase. Guestroom switches shall be installed with locator light enabled where noted on floor plans.

C. Color shall be as selected by architect.

D. Flush motor switches with red pilot light and with overload protection for fractional horsepower motors shall be Hubbell No. HBL1221PL.

E. Key switches shall be Hubbell No. HBL1221L 20A Series or approved equal by P&S or Leviton.

F. Coordinate with lighting designer for control panel and switch specificaitons for public space lighting.

2.8 RECEPTACLES

A. Duplex receptacles shall be Decora style plastic, two-pole, three wire, self-grounding, side wired, 125 volts and 20A rating and shall match existing if possible and be equal to the following: Duplex receptacles shall be Hubbell No. DR20 Series, Leviton No. 16532-T Series or Bryant DR520 Series. Isolated ground type shall be Hubbell No. IG-20DR Series or Bryant 9300-IG Series.

B. Single receptacles shall be two-pole, three wire, self-grounding, side wired, 125 volts and 20A rating and shall be equal to the following: Single receptacles shall be Hubbell No. HBL5361 Series, or equal by Leviton, P&S or Cooper. Isolated ground type to be Hubbell No. IG-5361 Series, or equal by Leviton, P&S or Cooper.

C. Ground fault circuit interrupt (GFI) receptacles shall be Hubbell GFR5352, or equal by P&S, Leviton or Cooper.

D. All receptacles in guestrooms shall be tamper resistant.

E. Color shall be as selected by the Architect.

2.9 COVERPLATES

A. Coverplates for flush mounted devices shall be brushed finished stainless steel standard size, Hubbell “P” Series or equal by Leviton, P&S or Cooper.

B. Telephone outlet coverplates shall have same finish as above and have a bushed hole in the center.

C. Coverplates for exterior devices shall be self-closing, die cast aluminum Hubbell WP8M or equal by Leviton, P&S or Cooper.

2.10 PLYWOOD BACKBOARDS

A. Provide plywood backboards where shown. Backboards shall be minimum 3/4" thick and sized as shown or to accommodate equipment indicated to be mounted thereon.

B. Secure plywood to the building structure and paint with two coats of gray paint.

2.11 SMOKE AND FIRE STOP FITTINGS

A. Smoke and Fire Stop Fittings shall be UL listed for that purpose. The fittings used to seal conduit either on the outside of the conduit, busway or cable or internally shall have heat activated intumescent material, which expands to fill all voids. Smoke and fire stop fittings shall be O.Z./Gedney "FIRE-SEAL" or Dow Corning silicone RTV foam with an hourly fire-rating equal to or higher than the rating of the floor, ceiling or wall through which the cable or conduit passes. The seals for conduit shall be of the flanged type.

2.12 FLOOR OUTLETS

A. Floor outlets shall be single gang floor boxes (unless noted on drawings), Hubbell B2436 Series, complete with cast iron body, vertical angular adjustment, brushed brass frame, brushed brass floor plate and gasket. Larger than standard tappings shall be furnished where required. Adjacent boxes shall be installed on minimum 7" centers.

B. Duplex floor receptacle outlets shall have Hubbell No. S3825 floor plate, a No. SB3083 carpet plate where installed in carpeted floor and a Hubbell CR5262 Series duplex receptacle. Single floor receptacle outlets shall have a S2625 plate and Hubbell single receptacle. Equal manufacturers shall be Legrand.

2.13 FUSES

A. Provide all fuses. All fuses shall be of the same manufacturer. All fuses shall be of the high interrupting rating (200,000 Amps), current limiting type and manufactured by Bussmann. Fuses shall be provided for each fuse cutout and the specified quantity of fuses shall be furnished for spares.

B. Circuits 0 to 600 ampere shall be protected by rejection type, current limiting BUSSMANN LOWPEAK Dual Element Fuses LPN-RK (250 volts) or LPS-RK (600 volts). All dual-element fuses shall have separate overload and short-circuit clearing chamber. The fuse must hold 500% of rated current for a minimum of 10 seconds and be listed by Underwriter's Laboratories, Inc., with an interrupting rating of 200,000 amperes RMS symmetrical. The fuses shall be UL Class RK-1.

C. Circuits 601 to 6000 ampere shall be protected by current limiting BUSSMANN HI-CAP Time-

Delay Fuses KRP-C. Fuses shall employ "O" rings as positive seals between the end bells and the glass melamine fuse barrel. The terminals shall be opened. Fuses shall be time-delay and must hold 500% of rated current for a minimum of 4 seconds, clear 20 times rated current in 0.1 seconds or less and be listed by Underwriter's Laboratories, Inc., with an interrupting rating of 200,000 amperes RMS symmetrical. The fuses shall be UL Class L.

D. Furnish and turn over to the Owner a minimum of one (1) set of spare fuses (set consisting of three fuses) for each type and rating of fuse used. When the number of fuse sets of the same type and rating actually installed exceeds five (5) sets, furnish an additional spare set of fuses for each five (5) or fraction thereof.

E. Provide a cabinet in which to store all spare fuses, Bussman Catalog No. SFC

F. Acceptable manufacturers are Bussman or equal by Littlefuse.

PART 3 - EXECUTION

3.1 CONDUIT

A. Rigid steel (or IMC) shall be used for service entrance and all feeders and branch circuits where exposed to damage.

B. EMT or MC cable shall be used for branch circuits, fire alarm and telephone when not underground or in concrete in contact with the earth.

C. Schedule 40 PVC may be used for all underground feeders, service entrance conductors when encased in 4" of concrete on all sides, or under the lowest floor slab.

D. Conduit shall be continuous from outlet to outlet, from outlet to cabinet, junction box and pull box. Conduit shall enter and be secured to all boxes, etc., in such a manner that each system will be electrically continuous from service to all outlets such that a good ground is provided. All conduit from cabinets and junction boxes shall terminate in approved outlet boxes or conduit fittings. Conduit connections to any box which has no threaded hub shall be double locknutted.

E. Provide junction boxes or pull boxes where shown and where necessary to avoid excessive runs or too many bends between outlets. The conduit sizes shown may increase if desired to facilitate the pulling of cables.

F. All conduit shall be concealed unless indicated otherwise. Install exposed conduit parallel with or at right angles to the building walls and support from walls or ceilings at intervals required by Code with approved galvanized iron clamps or hangers. Concealed conduit above the ceiling shall be supported independent of ceiling construction. Where ceilings of lay-in type are used, conduit must be installed high enough to permit removal of ceiling panels and lighting fixtures. Use threaded rods and hangers for supporting single conduit. Use trapeze hangers consisting of double-nutted threaded rods and "Unistrut" channels or angles of 12 gauge minimum steel for supporting multiple conduit.

G. Minimum size conduit for branch circuits shall not be smaller than 1/2". Home runs shall extend from outlets shown to panel designated. Home runs shown shall not be combined. Home run conduit shall not be smaller than 3/4".

H. At couplings, conduit ends shall be threaded so that they meet in the coupling. Right and left hand couplings shall not be used; conduit couplings of the Erikson Type shall be used at locations requiring such joints.

I. All conduit for future use, for telephone wire, or for data communication cable, shall be left with

No. 16 gauge wire pulled in them or a pull line as manufactured by Ideal, and the ends securely corked or capped.

J. Expansion fittings shall be installed in all conduit which pass through the cross-sectional area of expansion joints.

K. Provide non-hardening elastic type duct seal compound, Neer No. DC., 3M Co. "Scotchfil", or Gardner Bender duct seal, for each conduit entering the building from outside and for each conduit passing from one space into another which is normally at a lower temperature.

L. Provide watertight conduit hubs on conduit terminating in a box or cabinet exposed to the weather.

M. Space in sleeves or around conduit that pass through fire resistive or fire rated walls, partitions, floors or ceilings shall be closed by packing with an unlabelled fire resistive material that will maintain the rating of the barrier penetrated.

3.2 FLEXIBLE CONDUIT

A. PVC extruded cover flexible conduit shall be used in making short flexible connections to rotating or vibrating machinery or equipment. The flexible conduit at these locations shall be as short as possible, but shall have a minimum length of 12".

B. A green stranded bonding jumper shall be installed outside of all flexible conduit that extends directly from a non-flex conduit to a rotating or vibrating machine. Where a junction box is used, the green stranded bonding jumper shall be installed inside the flexible conduit and attached to the junction box and to the machine. When the bonding jumper is installed outside of the flexible conduit, plastic wire straps shall be used 6" o.c. to secure the jumper to the flexible conduit.

C. Flexible metal (MC) conduit system may be utilized where concealed in walls and/or millwork only. MC Cable shall run from point of exit from wall or millwork to nearest structurally support junction box. MC cable will not be permitted to be installed in the above ceiling space and shall not pass through a fire rated partition. Conductor colors of the MC cable shall comply with 16100 3.04 C

3.3 CONDUIT PROTECTION

A. All conduit installed in the ground outside the building exterior line (with the exception of exterior lighting circuits) shall be encased in 4" of concrete on all sides. Concrete shall be a minimum of 3000 P.S.I. mix. All threaded joints in rigid conduit that is encased in concrete shall have a U.L. listed joint compound applied. All conduit installed outside the building underground shall be buried a minimum of 30" below finished grade but in no case shall be buried deeper than 48". Where conduit is installed below the ground floor slab inside the building exterior line, the conduit shall be run between the floor slab and the vapor barrier. These conduits shall be installed in the slab itself where feasible. When a conduit duct bank must be installed then the entire duct bank shall be encased in concrete and installed per Appendix B of the NEC. Derating of conductors in the underslab duct bank shall be the responsibility of the contractor. Conduit installed in any slab, where permitted above, shall be above the bottom steel and below the top steel.

B. Conduit shall be secured in place and protected where necessary to prevent damage to work during construction. The ends of all conduit shall be plugged to avoid filling with any foreign matter. All conduit shall be blown out and swabbed clear of water and trash prior to pulling wire.

C. Provide identifying marker tape the entire length of each conduit installed in the ground outside the building. The tape shall be constructed of inert polyethylene, resistant to acids, alkalis, etc., in the soil, and shall be a minimum 4 mil thickness. The tape shall be yellow, 6" wide, and shall have the words, "CAUTION - ELECTRIC LINE BURIED BELOW," imprinted with contrasting permanent ink. The imprint shall repeat itself for the entire length of the tape. The tape shall be buried at a maximum of 18" below finished grade, above a portion of the earth fill shall be "Terra Tape" as manufactured by Reef Industries, Inc., P.O. Box 33248, Houston, Texas 77033 (1-800-231-6074).

D. All conduit installed from the power company vault to the main switchboard and fire pump shall be encased in a minimum of 4” on concrete.

3.4 WIRING

A. All conductors shall be installed in conduit. No conductors shall be pulled into the conduit until the conduit system is complete and plaster had dried. Wire pulling lubricants shall be Gardner-Bender "Wireaide" or Ideal "Yellow 77".

B. Conductors shall be continuous from outlet to outlet and from outlet to junction box or pull box. All splices and joints shall be carefully and securely made to be mechanically and electrically solid with pressure type connectors, Gardner Bender "Winggard" or Ideal "Wingnut". Tape shall be "Scotch" No. 33 for indoor and No. 88 for outdoor or Gardner Bender No. 95-661. Where connection is made to any terminals of more than 30 amperes capacity and where conductors larger than No. 10 are connected to any terminal, copper terminal lugs shall be bolted to the conductors. Where multiple connections are made to the same terminal, individual lugs for each conductor shall be used. Aluminum conductors, if used for service conductors, shall be made with high compression lugs as manufactured by Square D, Ideal or MAC.

C. Each conduit shall have a minimum of two (2) conductors pulled in unless that particular conduit is noted as being for systems other than electrical circuitry and/or future use or unless noted otherwise.

D. Conductors for lighting and receptacle circuits shall have color coded jackets. The wiring shall be color coded with the same color used with its respective phase through the entire job as follows:

208/120 Volt System	480/277 Volt System
Phase A - Black	Phase A - Brown
Phase B - Red	Phase B - Orange
Phase C - Blue	Phase C - Yellow
Neutral - White	Neutral - Gray
Ground - Green	Ground - Green

E. The feeder and service entrance conductors shall be color coded by the use of colored plastic tape applied within 6" of each conductor end.

F. Branch circuit conductors shall not be smaller than No. 12 and where the home run from center of load exceeds 100'-0", the conductors from home run outlet to panel shall be No. 10 minimum.

G. For branch circuits terminating in outlet without device, leave minimum of 12" of slack wire coiled for connection of equipment. All conductors shall be identified with proper circuit numbers at terminals, junction boxes at panelboards within 6" of conductor ends.

3.5 OUTLETS

A. Provide galvanized steel or cast type boxes for all outlets.

B. Where outlet boxes are used to support lighting fixtures, the outlet box shall be anchored to the structural members of the building per NEC 370-13.

C. Outlet boxes shall be flush mounted unless they are specifically shown as being used with exposed conduit or are located above a ceiling.

D. Where outlets are supplied from conduit run in or below floor slabs, the conduit shall be stubbed up at the location shown and the wall built up around the conduit.

E. Cuts for outlet boxes in masonry walls shall be made so that the coverplate will completely cover the cut. The mounting height of switch, receptacle and other outlets may be varied slightly, with the Architects approvals, so that the outlet box, top or bottom, will occur at a masonry joint.

F. The edge of all outlet boxes shall be flush with the surface in which they are recessed. The devices that fit into the outlet boxes shall be screwed tight before the coverplate is installed and the coverplate shall not be used as a means of tightening the devices in place.

G. Where outlets are shown as being adjacent and different mounting heights are specified for each, they shall be mounted one directly over the other, on the centerline of the group.

3.6 NAMEPLATES

A. Provide specified nameplates on the main switchboard, distribution panels, feeder switches, feeder breakers, panelboards motor control centers, disconnect switches, contactors, starters, transformers, start-stop push buttons and motor switches.

B. Provide nameplates on every device in the main switchboard, distribution panels and motor control centers.

C. Nameplates for surface mounted equipment shall be installed on the exterior of equipment with sheetmetal screws. Nameplates for flush or recessed mounted equipment shall be installed on the inside of the panel door or cover with epoxy cement.

3.7 WALL SWITCHES AND RECEPTACLES

A. Where more than one device is indicated at a location, the devices shall be gang-mounted in combined multi-gang boxes and covered jointly by a common coverplate. Provide barriers as required by the devices and voltages being used.

3.8 COVERPLATES

A. All junction boxes, outlet boxes, multi-gang switch boxes, utility boxes, etc., shall be covered with a coverplate. The coverplate shall be a finished plate as specified unless designated otherwise.

B. Coverplates shall be mounted vertically unless designated otherwise.

3.9 GROUNDING

A. Ground connections shall be in accordance with the 2017 National Electrical Code.

1. Provide a grounding electrode system consisting of a minimum of three (3) copperweld rods, 3/4" x 10'-0", driven 24" below grade a minimum of 72" apart in the form of an

equilateral triangle, bonded together with No. 4/0 conductors. Install rods a minimum of 36" clear of foundation walls to effect the building ground. If the resistance to ground exceeds 25 ohms, additional rods shall be driven and bonded together until a reading of 25 ohms or less to ground is obtained. After completion of the grounding system, measure the system ground resistance with a "Megger Earth Tester". Submit directly to the Architect two (2) copies of each test report certified by the testing technician and the Owner's representative.

2. Extend from the electrodes to the main service disconnect with a No. 4/0 copper insulated ground conductor in a 1" conduit and connect to the neutral bar, housing and frame.
3. Provide a No. 4/0 copper insulated conductor across the water meter with the conductor attached with clamps to the water line on each side of the meter.
4. Provide a No. 4/0 copper insulated ground conductor in a 1" conduit from cold water entrance pipe ahead of first valve to the main service disconnect and connect to the neutral bar, housing and frame.
5. Where nonmetallic insulating couplings or dielectric flanges are used in metallic water piping systems, provide a No. 4/0 copper, insulated ground conductor across the couplings with the conductor attached with clamps to the water line on each side of the coupling.
6. All ground connections in the building system ground shall be done with Cadwell.
7. All ground clamps shall be equipped with compression type cable lugs independent of the compression device clamping the pipe or rod.
8. All steel conduit entering the main service disconnect shall have threaded conduit insulated grounding bushings. All bushings shall be bonded together and bonded to the main grounding bus with a No. 4 bare conductor.

B. Provide an insulated green bonding jumper from the grounding lug of all receptacles to a Steel City "GEE" clip or a sheet metal screw in the outlet box. The ground wire installed behind the device mounting screws will not be acceptable.

C. Provide 1 #6-3/4" conduit from the system ground to the telephone company main distribution frame or service cabinet and to each telephone backboard.

D. Provide a # 4/0 ground riser for the telecommunications service. The #4/0 ground riser shall extend from the MDF room up through the IDF room on each floor. A 20” x 4” copper ground bar shall be provided in each room for connections. The riser connections to the ground bar in each room shall be CADweld connecitons.

3.10 TELEPHONE CONDUIT SYSTEM

A. Telephone service shall include wood backboards and equipment cabinets with service entrance conduit as shown.

B. Telephone service entrance cable, all branch cabling and telephone instruments shall be provided by the telephone equipment vendor.

C. Provide an outlet and conduit system for the telephones as shown and leave the same in readiness for wiring by others. Provide pull line in all telephone conduit. Terminate all conduit at a uniform height with smooth insulated bushings at the telephone wood backboards.

D. Telephone wall outlets shall be pressed steel sectional switch boxes, wall mounted at the locations indicated. Coverplate shall have a bushed hole.

E. Telephone floor outlets shall be floor boxes as specified at the locations indicated.

3.11 CONNECTION TO EQUIPMENT

A. Equipment furnished by the Owner or under other Sections, such as mechanical equipment, elevators, escalators, signs, kitchen equipment, etc., will be installed by others. Provide electrical service and make the electrical circuit connection to this equipment.

B. Provide PVC insulated flexible cord sets for all cord and plug connected building appliances and equipment. Cords shall be sized in accordance with electrical circuits indicated. Multiple conductor cords shall be "SO" cable with PVC jacket and green insulated ground conductor.

3.12 CORING, CUTTING AND PATCHING

A. Set sleeves for conduit accurately before the concrete floors are poured, or set boxes on the forms so as to leave openings in the floors in which the required sleeves can be subsequently located. Fill in the voids around the sleeves with concrete.

B. Should the performance of this preliminary work be neglected and should cutting be required in order to install conduit, then the expense of the cutting and restoring of surfaces to their original conditions shall be accomplished without incurring additions to the Contract.

3.13 EQUIPMENT ANCHORING

A. All items of electrical equipment, such as switchboards, motor control centers, transformers, standby generator, etc., shall be securely anchored to the building structure. The anchoring shall be accomplished by utilizing a minimum size of 3/8" steel anchor bolts in the structure and to the item of equipment. A minimum of two (2) anchor bolts shall be provided on each side of each item of equipment with the following exceptions:

Exception No. 1: If the equipment manufacturer includes more than two (2) anchor holes per side in the base or base frame of the equipment item, then there shall be one anchor for each anchor hole.

Exception No. 2: If the equipment manufacturer recommends a particular quantity greater than two (2) per side, then that quantity of anchors shall be provided.

END OF SECTION

SECTION 262000

SERVICE AND DISTRIBUTION

PART 1 - GENERAL

1.1 DESCRIPTION

A. All work specified in this Section shall comply with the provisions of Section 260100.

B. Provide a complete electrical distribution system. The system shall include the service entrance, main switchboards, feeders, transformers, distribution panels, panelboards, busway, remote control switches, contactors, etc., to provide a complete system.

C. All distribution switchgear (branch circuit panelboards, switchboards, distribution panelboards, transformers, busway, etc.) shall be the unit responsibility of one manufacturer. All component parts of the above listed items shall be of the same manufacturer except where a written request for deviation from this requirement has been approved prior to bid date.

D. Shop drawings for equipment specified in this Section shall show that all specified requirements have been incorporated.

E. Coordination studies shall be done prior to shop drawing submittals. Shop drawings shall include all breakers that meet the coordination study. If study is performed after the shop drawings are submitted, any revisions to breakers or panels shall be at no additional cost to the project.

F. All floor mounted distribution equipment shall be mounted on a 4" high concrete pad.

1.2 ELECTRICAL SERVICE

A. Make all arrangements with the power company and pay all charges made by the power company for permanent electric service. In the event that the power company's charges are not available at the time the project is bid, the bids shall be qualified to notify the Owner that such charges are not included.

B. The secondary service to hotel and restaurant building shall be 277/480 volts, 3 phase, 4 wire, 60 Hertz AC. Provide all conduit and wire as specified from the secondary terminals of the transformer to the main switchboard.

C. The secondary service to spa building shall be 120/208 volts, 3 phase, 4 wire, 60 Hertz AC. Provide all conduit and wire as specified from the secondary terminals of the transformer to the main switchboard.

1.3 METERING

A. Metering equipment will be by the power company. The power company will furnish the meter base for installation at a location as directed by the power company. The power company will provide meter, control wires to the meter, and the current transformers.

B. Provide the current transformers cabinet and a 1.5" conduit with pull-string to the meter base. Install all equipment as directed by the power company.

PART 2 - PRODUCTS

2.1 BRANCH CIRCUIT PANELBOARDS

A. Panelboards (panels) shall be general purpose enclosures and shall be surface or flush mounted as indicated. Panels shall be of the automatic circuit breaker type, factory assembled by the manufacturer of the circuit breakers. Panels shall be for the voltage indicated with the quantity of poles and ampacity of circuit breakers shown.

B. Boxes and trim shall be made from code gauge steel. Boxes shall be sufficient size to provide a minimum gutter space of 4" on all sides. Boxes shall be minimum 20" width and 5 3/4" depth.

C. Hinged door covering all device handles shall be included in all panel trim. Doors shall have flush-type cylinder lock and catch, except that doors over 48" in height shall have auxiliary fasteners at top and bottom of door in addition to flush-type cylinder lock and catch. Door hinges shall be concealed. All locks shall be keyed alike. Directory frame and card having a transparent cover shall be furnished each panel door.

D. Trims for flush panels shall overlap the box by at least 3/4" all around. Surface trims shall have the same width and height as the box. Trims shall be mountable by a screwdriver without the need for special tools. After installation, trim mounting mechanism or hardware shall not be accessible when panel door is closed and locked.

E. All exterior and interior steel surfaces of the trim shall be cleaned and finished with gray paint over a rust-inhibiting phosphatized coating.

F. All interiors shall be completely factory assembled with protective devices, wire connectors, etc. All wire connectors, except screw terminals, shall be of the anti-turn solderless type and all shall be suitable for copper or aluminum wire.

G. Interiors shall be so designed that devices can be replaced without disturbing adjacent units and without removing the main bus connectors, and shall be so designed that devices may be changed without machining, drilling or tapping.

H. Bus bars for the mains shall be of copper sized in accordance with U.L. standards. Full size bars shall be included. Bus bar taps for panels with single pole branches shall be arranged for sequence phasing of the branch circuit devices.

I. Phase bussing shall be full height without reduction. Cross and center connectors shall be of the same material as the bus.

J. The neutral bus shall utilize setscrews to bond the neutral wire to the neutral bus through holes drilled in the neutral bar. A sheet copper neutral bus utilizing flathead screws to hold the neutral wires will not be acceptable.

K. Spaces for future devices shall be included as indicated and shall be bussed for the maximum rated device that can be fitted into them.

L. All circuit breakers (except as listed below) shall be manually operated, thermal-magnetic, automatic, of the ampacity and poles as indicated. They shall be quick-make, quick-break, both on manual and automatic operation. Breakers shall be over-the-center toggle operating type, with the handle going to a position between ON and OFF to indicate automatic tripping. All multi-pole breakers shall have internal common trip. Breakers shall have a minimum of 10,000 RMS symmetrical amperes interrupting capacity unless designated otherwise. The breakers furnished shall be determined by the specifications and by the minimum U.L. labeled RMS symmetrical

amperes interrupting capacity at circuit voltage. All circuit breakers shall be bolted on and rigidly braced.

M. All circuit breakers feeding an emergency panel or main breaker for an emergency panel shall have solid state trip units that are insensitive to changes in ambient temperature and a push-to-trip button to mechanically check the trip mechanism or for the use under emergency trip conditions. Interchangeable rating plugs shall establish the continuous current rating of each breaker. An interlock in the rating plug shall trip the breaker if an attempt is made to remove the plug with the breaker in the ON position. With the plug removed, it shall not be possible to close the breaker. In addition, the trip shall include a short time delay permitting coordination and selective tripping with downstream devices.

N. The solid state trip breakers shall provide long delay and magnetic tripping similar to thermal magnetic breakers. In addition, the magnetic trip shall include a short time delay permitting coordination and selective tripping with downstream devices. It shall be possible to check the breaker electrically and mechanically while in service without dismantling equipment and with minimum down time.

O. Panels having sub-feed lugs for feeding through shall have 8" minimum extra gutter space at the lug end and on one side.

P. Each panel as a complete unit shall have a short-circuit current rating equal to or greater than the equipment rating indicated.

Q. A listed surge protective device shall be installed in or on all emergency systems panelboards.

R. Panels shall be as manufactured by General Electric, Square D, Siemens, or Cutler-Hammer.

2.2 DISTRIBUTION PANELBOARDS

A. Distribution panelboards (panels) shall be of the circuit breaker type, factory assembled by the manufacturer of the circuit breakers, complete with front door cover. The main breaker and the branch circuit breakers shall be as indicated. The main bus shall be 98% conductivity silver plated copper, rated as and of capacity equal to or greater than the rating or setting of the over-current protective device next back in the line. Panel shall be suitable for the voltage and phase indicated. Provide 25% ground bus.

B. Panels shall be flush or surface mounted as indicated, with baked-on enamel trim, adjustable trim clamps and door with chromium plated combination cylinder lock and catch, all locks keyed alike. Provide a specified nameplate for each device and a blank (not engraved) nameplate for each spare breaker or space.

C. The neutral bus shall utilize setscrews to bond the neutral bus through holes drilled in the neutral bar. A sheet copper neutral bus utilizing flathead screws to hold the neutral wires will not be acceptable.

D. All circuit breakers (except those described to feed emergency panels listed below) shall be manually operated, thermal-magnetic, automatic, of the ampacity and poles as indicated. They shall be quick-make, quick-break both on manual and on automatic operation. Breakers shall be over-the-center toggle operating type, with the handle going to a position between "ON" and "OFF" to indicate automatic tripping. All multi-pole breakers shall have internal common trip.

E. The interrupting capacity of the breakers furnished shall be 10,000 RMS symmetrical unless indicated otherwise.

F. All main circuit breakers (except as listed below) shall be molded case and vertically mounted. All vertically mounted molded case circuit breakers shall be mounted so that the handle is up for "ON" and down for "OFF", when viewed from the normal standing position. All vertically mounted molded case main circuit breakers shall be UL approved for feeding in the bottom and out the top.

G. All circuit breakers feeding an emergency panel or main breaker for an emergency panel shall have solid state trip units that are insensitive to changes in ambient temperature and a push-to-trip button to mechanically check the trip mechanism or for the use under emergency trip conditions. Interchangeable rating plugs shall establish the continuous current rating of each breaker. An interlock in the rating plug shall trip the breaker if an attempt is made to remove the plug with the breaker in the ON position. With the plug removed, it shall not be possible to close the breaker. In addition, the trip shall include a short time delay permitting coordination and selective tripping with downstream devices.

H. The solid state trip breakers shall provide long delay and magnetic tripping similar to thermal magnetic breakers. In addition, the magnetic trip shall include a short time delay permitting coordination and selective tripping with downstream devices. It shall be possible to check the breaker electrically and mechanically while in service without dismantling equipment and with minimum down time.

I. All circuit breakers, including any connectors to the main bus, shall be bolted and rigidly braced.

J. Spaces for future installation of molded case circuit breakers are specifically by range of trip rather than a single trip size or frame size. The spaces so scheduled shall be complete with all bus and required bus connectors such that future breakers can be installed without adding or changing bus connectors on the main bus and without using a larger (frame size) or more expensive breaker than the trip size and interrupting capacity would require. If the bus connectors furnished on the main bus will not cover the trip range specified, then duplicate sets of connectors shall be furnished on the main bus for each frame size required.

K. Distribution panels shall be as manufactured by General Electric, Siemens, Square D, or Cutler-Hammer.

2.3 TRANSFORMERS

A. Branch circuit and distribution transformers shall be the dry type and shall have the ratings indicated.

B. Single phase transformers shall be 480 volt primary and 120/208 volt secondary. Three phase transformers shall be 480 volt delta primary and 120/208 volt grounded type secondary. Transformers 25 KVA and larger shall have a minimum of 4 1/2% full capacity primary taps.

C. Transformers shall have a U.L. recognized 150 degree insulation system for transformers 112.5 kVA and below and 220 degree insulation for transformers above 112.5kVA, and shall be designed so that under full load, the average conductor temperature rise does not exceed 115 degree C. rise above a 40 degree C. ambient and the enclosure does not exceed a 50 degree C. rise at any point.

D. Transformer coils shall be of the continuous wound construction and shall be impregnated with non-hygroscopic, thermosetting varnish. All cores to be constructed of high grade, non-aging silicon steel with high magnetic permeability, and low hystersesis and eddy current losses. Magnetic flux densities shall be kept well below the saturation point. The core laminations shall be clamped together with structural steel angles. The completed core and coil shall then be bolted to

the base of the enclosure but isolated therefrom by means of rubber, vibration-absorbing mounts. There shall be no metal-to-metal contact between the core and coil and the enclosure. On transformers 500 KVA and smaller, the vibration isolating system shall be designed to provide a permanent fastening of the core and coil to the enclosure. Sound isolating systems requiring the complete removal of all fastening devices will not be acceptable. Sound levels shall be guaranteed by the manufacturer not to exceed the following: 25 to 50 KVA - 45 DB; 51 to 150 KVA - 50 DB; 151 to 300 KVA - 55 DB; 301 to 500 KVA - 60 DB.

E. Transformers 24 KVA and larger shall be in a heavy gauge, sheet steel, ventilated enclosure. The ventilating openings shall be designed to prevent accidental access to live parts in accordance with UL, NEMA, and National Electrical Code standard for ventilated enclosures. Transformers 25 KVA through 112.5 KVA shall be designed so that they can be either floor or wall mounted. Above 112.5 KVA, they shall be floor-mounted design. The entire transformer enclosure shall be degreased, cleaned, phosphatized, primed and finished with a gray, baked enamel.

F. Transformers that are of the floor-mounted type shall be provided with neoprene mountings for on-grade installations and spring mountings for above grade installations.

G. Transformers shall be DOE 2016 compliant.

H. Transformers shall be as manufactured by General Electric, Siemens , Square D, or Cutler-Hammer.

2.4 MAIN SWITCHBOARD

A. General

1. Provide where indicated, a front and rear accessible dead front type, completely metal enclosed, self-supporting structure independent of wall supports. It shall consist of the required number of vertical sections bolted together to form one rigid switchboard approximately 90" high incorporating switching and protective devices of the number, ratings and type noted herein or shown with necessary interconnections, instrumentation and control wiring. The sides, top and rear shall be covered with removable screw-on plates. Front plates shall be sectionalized and removable. All covers shall be secured by self-tapping screws. Ventilation openings shall be provided where required. The switchboard shall be vermin proof.
2. All sections of the switchboard shall be 20 inches deep except service sections containing large ampacity main circuit breaker or pressure contact type main fusable switch which may be deeper. All section of the switchboard shall align so that the back of the complete structure may be placed flush against a wall. Construction shall allow maintenance of incoming line terminations, main device connections and all main bus bolted connections to be performed with front and rear access.
3. The feeder or branch devices shall be removable from the front and shall be panel mounted with the necessary device line and load connections front accessible.
4. All exterior and interior steel surfaces of the switchboard shall be cleaned and finished with gray hard dried enamel over a rust-inhibiting phosphatized coating.
5. Small wiring, necessary fuse blocks and terminal blocks within the switchboard shall be furnished when required. All groups of control wires leaving the switchboard shall be provided with terminal blocks with numbering strips.

B. Bussing

1. The bus shall be tin plated aluminum or silver plated copper adequately braced and supported to withstand mechanical forces exerted during short circuit conditions. The main

horizontal bus bars shall be mounted on glass polyester insulators with all three phases arranged in the same vertical plane. The main bus shall be braced for short circuits up to the RMS ampere value as shown.

2. A ground bus shall be provided firmly secured to each vertical structure and shall extend the entire length of the switchboard. A ground lug shall be furnished attached to the ground bus in an accessible location.
3. Provide a removable link (solid bar) in the neutral bus where the main disconnect device is provided.
4. Provide a bonding strap from the neutral bus to the switchboard frame. The bonding strap shall be located on the line side of the removable neutral link.

C. Circuit Breakers

1. Electrical circuits shall be protected by molded case circuit breakers. Each pole shall provide inverse time delay and instantaneous circuit protection.
2. Circuit breakers shall be operated by a toggle type handle and shall have a quick-make, quick-break overcenter switching mechanism that is mechanically trip free from the handle so that the contacts cannot be held closed against short circuits and abnormal circuits. Tripping due to overload or short circuit shall be indicated by the handle automatically assuming a position midway between ON and OFF positions.
3. Breakers must be completely enclosed in a molded case. Non-interchangeable trip breakers shall have the trip unit sealed to prevent tampering. Ampere ratings shall be clearly visible. Contacts shall be of the non-welding silver alloy. Arc extinction must be accomplished by means of arc chutes.
4. All circuit breakers with frame sized 600 amps and larger shall have solid state trip units that are insensitive to changes in ambient temperature and a push-to-trip button to mechanically check the trip mechanism or for the use under emergency trip conditions. Interchangeable rating plugs shall establish the continuous current rating of each breaker. An interlock in the rating plug shall trip the breaker if an attempt is made to remove the plug with the breaker in the ON position. With the plug removed, it shall not be possible to close the breaker.
5. The solid state trip breakers shall provide long delay and magnetic tripping similar to thermal magnetic breakers. In addition, the magnetic trip shall include a short time delay permitting coordination and selective tripping with downstream devices. It shall be possible to check the breaker electrically and mechanically while in service without dismantling equipment and with minimum down time.
6. Where the highest continuous current trip setting for which the actual overcurrent device installed in a circuit breaker is rated, or can be adjusted, is 1200 amps or higher, documentation shall be available to those authorized to design, install, operate or inspect the installation as to the location of the circuit breakers for the purposes of arc energy reduction. One of following methods to reduce clearing time shall be provided:

    a. Zone-selective interlocking
    b. Differential relaying
    c. Energy-reducing maintenance switching with local status indicator
    d. Energy-reducing active arc flash mitigation system
    e. An approved equivalent means

D. Ground Fault Protection

1. An adjustable ground fault protection system shall be provided as an integral part of the main circuit breaker or main fused switch, designated feeder breakers and fused switches.
2. The ground fault protection system shall consist of a current sensor enclosing all phase and neutral conductors of the circuits to be monitored, appropriate relaying equipment to provide the desired ground current sensitivity and time-current response characteristics, and

equipped to function in conjunction with the other elements of the system.

3. The current sensor shall be of sufficient size to encircle the phase and neutral conductors of the circuit to be monitored. Current sensor output shall be coordinated with the required input to the delay. The current sensor shall have a ground fault current pick-up range of 200 to 1200 amperes. A test winding shall be included to simulate the flow of ground fault current through the sensor to test the operation of the ground fault protection system. The frame of the current sensor shall be constructed so that one leg can be opened to allow removal or installation around cable without disturbing that cable.
4. The ground fault relay shall be solid state construction, except that a coil operated output relay may be provided to control 120 volt power to operate a fusible bolted pressure contact switch. The relay shall have an adjustable current sensitivity for ground fault pick-up currents from 200 amperes to 1200 amperes.
5. Provide a monitor panel on the switchboard, including a push-to-test button for the test circuit and a red ground fault indicator light to indicate the circuit interrupter has opened due to a ground fault condition. The unit shall operate on a 120 volt AC source.
6. Provide a pulsating audible horn that is activated when a ground fault condition occurs. Horn shall stop when ground fault protection system is reset. Horn shall operate during testing of ground fault protection system.

E. Short Circuit Current Rating

1. The switchboard as a complete unit shall be given a single short circuit current by the manufacturer of the rating as shown. Such a rating shall be established by actual test in accordance with U.L. specifications.

F. Provide with standard internal digital meter in the switchboard to display a minimum of the following measured values: Real time readings, energy readings, demand readings and harmonics.

G. Main switchboards shall be as manufactured by General Electric, Siemens, Square D, or Cutler-Hammer.

2.5 BUSWAY

A. Provide aluminum, totally enclosed, non-ventilated plug-in or feeder busway as shown, three-phase, of the ratings scheduled or shown. When a neutral bus is specified, the neutral shall be full size unless designated otherwise. Busway shall be of the low impedance type. The busway shop drawings shall show in detail the design of the totally enclosed busway including in detail, the design of the joint connection. Perforated ventilating housings will not be acceptable.

B. When a ground bus is specified, it shall be sized in accordance with the 2005 National Electrical Code based on the overcurrent protective device.

C. The aluminum bus bars shall be tin plated over their entire surface. All bolted connections shall be equipped with Belleville type spring washers. The temperature rise at full rated amperage at any point in the duct shall not exceed 55 degrees C. above ambient temperature.

D. Access shall be required to only one side of the busway for tightening joint bolts. It shall be possible to remove any one length without disturbing the two lengths to which it connects. On feeder busway, tap-offs shall be made with sections specifically designed for that purpose. In these cases, plug-in busway sections shall not be used.

E. The ampere ratings, approximate footage, fittings, etc., are shown. Final field measurements shall be made prior to release of the busway for fabrication. The responsibility for routing the duct as

shown shall be included in this Section.

F. The busway shall be securely supported at intervals not exceeding 10'-0". The busway shall be complete with all elbows connectors, expansion joints, floor and wall flanges and offsets shown or required to meet job conditions. Wall flanges shall be provided at each wall and floor flanges at each floor where busway passes through. The openings between the flanges and the floor or wall should be caulked with suitable insulation material. Expansion joints shall be provided at building expansion joints, at least one in each horizontal run of 100'-0" and a maximum of 150'-0" apart throughout the busway length.

G. The busway shall be Underwriter's Laboratories approved for mounting in any position with derating. The short circuit stress bracing shall be 100,000 amperes RMS symmetrical.

H. Busway shall be of the same manufacturer as the main switchboard where connected to switchboard. Busway not connected to switchboard shall be General Electric, Siemens, Square D, or Cutler-Hammer.

2.6 SINGLE PHASE PROTECTION

A. Provide Taylor Electronics Model #PND-3, 6, 9, 12 ADJ-REM LED’s, or equal, single phase relay behind hinged panel in switchboard. Provide green and amber LED’s on a plug in cable for mounting on face of switchboard. Provide snap on lenses and labels identifying the green LED as “SYSTEM NORMAL” and the amber LED as “SINGLE PHASE CONDITION”.

B. Provide shunt trip coils on all main devices, operated by the phase failure relay.

C. Provide capacitive trip unit to guarantee relay and shunt trip operation during a single phase occurrence.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Provide a typewritten directory under plastic for all panelboards with spares marked in pencil.

B. Provide all necessary hardware to level and secure the switchgear as required by the manufacturer's instructions. Make all electrical connections for supply and load circuits and leave in operating condition.

C. Clean enclosure of all switchgear of all foreign matter, including dust.

D. Remove all rust marks and repaint to leave switchgear in new condition.

3.2 STUDIES

A. As a requirement for the project documents to be delivered by the contractor, provide a complete short circuit and selective coordination study from the service entrance to all end devices. The study shall be provided by the switchgear manufacturer or their vendor and shall utilize time current curves that are developed by the gear manufacturer selected for use in the building. The study shall be made available for review by the engineer and local code enforcement authorities no later than at the times they deem necessary for certificates of occupancy to be issued. Obtain critical dates from the inspections department of the local code enforcement department during the inspection process to determine when presentation of the selective coordination study to the inspections department is necessary for timely issuance of the certificate of occupancy.

B. The selective coordination study shall be broken into parts where the systems described in NEC Articles 700.27, 701.18, 708.54 and 620.22 are isolated in the report to simplify the review of those isolated systems.

C. As a minimum requirement for the details that are necessary in the selective coordination study, refer to the requirements for selective coordination in the 2014 NEC Articles 700.27, 701.18, 708.54 and 620.62.

D. The minimum NEC requirement for the selective coordination study is applicable to the systems described in NEC Articles 700.27, 701.18, 708.54, 620.62, and as indirectly referenced for essential electrical systems in Article 517. The minimum project requirement described in A. above shall not be scaled back to the minimum NEC code requirement unless agreed to by all parties associated with the construction of the project including, but not limited to, the owner, architect, engineer, developer, etc.

E. All breakers provided in the electrical switchgear/panel submittal shall meet the requirements of the coordination study. Revisions to the breakers, if required by the coordination study, shall be included in the submittal.

END OF SECTION

SECTION 263000

LIGHTING

PART 1 - GENERAL

1.1 DESCRIPTION

A. All work in this Section shall comply with the provisions of Section 260100.

B. Provide all lighting fixtures and lamps as specified herein and as shown.

C. All lamps shall be operating at the time of the final inspection and for a period of six (6) months after the final acceptance of the project by the Owner.

D. Confirm exact locations of all lighting fixtures by coordination with the Architects Reflected Ceiling Plans and mechanical equipment above or on the ceiling.

E. Confirm all ceiling types before ordering lighting fixtures.

F. Each lighting fixture shall have been tested and certified for proper operation by the fixture manufacturer for the type mounting and ceiling on/in, which it is installed.

PART 2 - PRODUCTS

2.1 LIGHTING FIXTURES

A. Each lighting fixture shall be as specified in the Lighting Fixture Schedule corresponding with its fixture type indication (letter).

B. Most lighting outlets are lettered or groups of outlets are indicated by a letter.

C. Each lighting fixture shall have a manufacturer's label affixed and shall comply with the requirements of all authorities having jurisdiction.

D. The lighting fixtures that are indicated by the letters shall be as indicated on the Lighting Fixture Schedule.

2.2 LAMPS

A. The type lamps shall be as specified for each lighting fixture in the lighting fixture schedule.

B. The lamp catalog number is the catalog number is generally for Sylvania Lighting and is given as a standard of the quality and performance required. Equal lamps by General Electric or Philips will be acceptable. When a lamp manufacturer's name is used along with the catalog number in the lighting fixture schedule, it is considered unequaled by any other lamp and shall not be substituted for. The lamp performance with energy conserving ballasts furnished under this Section shall be certified by a nationally recognized independent testing laboratory.

C. Fluorescent lamps shall be as specified in the Lighting Fixture Schedule.

D. Incandescent lamps shall be as specified in Lighting Fixture Schedule.

E. All incandescent lamps, except quartz tubes, shall be rated for 130 volt operation.

F. High Intensity Discharge (HID) lamps shall be as specified in the Lighting Fixture Schedule.

2.3 BALLASTS (electronic)

A. Fluorescent ballast shall be electronic type manufactured by Motorola, Magnetek or Advance.

B. Ballast shall operate lamps at a frequency or 25 KHz or higher with less than 2% lamp flicker.

C. Ballast shall operate at an input voltage of 108 - 132 Vac (120V line) or 249 - 305 Vac (277V line) at an input frequency of 60 Hz. Light output shall remain constant for line voltage fluctuation of $\pm$ 5%.

D. Ballast shall comply with EMI and RFI limits set by the FCC (CFR 47 part 18) for non-residential applications and not interfere with normal electrical equipment.

E. Ballast shall withstand transients as specified by ANSI C.62.41 for location category A3 in the normal mode and location category A1 in the common mode.

F. Ballast shall meet applicable ANSI standards.

G. Ballast shall have a minimum power factor of .99.

H. Ballast shall not be potted or weigh more than 1.3 pounds.

I. Ballast shall have less than 10% Total Harmonic Distortion.

J. Ballast shall have less than 6% Third Harmonic Distortion.

K. Ballast height shall be less than or equal to 1.5 inches.

L. Ballast shall have a poke-in wiretrap connector.

M. Ballast shall meet sound rating "A".

N. Ballast must be Underwriters Laboratories (UL) listed Class P, Type 1 Outdoor.

O. Ballast shall provide normal rated lamp life as stated by lamp manufacturers.

P. Rapid start ballast are series wired and shall maintain full cathode heat during operation.

Q. Rapid start ballast shall have less than a 1.5 Lamp Current Crest Factor (LCCF) and instant start ballasts have less than a 1.7 LCCF.

R. Instant start ballast shall have parallel lamp operation.

S. Ballast factor standard is .875$\pm$0.025 on all normal light output products.

T. Ballasts for "PL" fluorescent lamps shall be coordinated with lamps and 2-pin or 4-pin configuration ballasts shall be provided to match lamps. Manufacturer for "PL" fluorescent fixtures shall be Advance, Roberson, Lightolier or Lutron.

U. Ballasts for High Intensity Discharge (HID) lamps shall be Constant Wattage Autotransformer (CWA) type or equal type with minimum power factor of .9.

2.4 DIFFUSERS

A. Unless specified otherwise, all prismatic diffusers for fluorescent lighting fixtures shall be prismatic acrylic KSH K12 with a thickness of 0.125", measured from the back side to the peak of the prism.

B. All wraparound lenses shall be virgin acrylic, one-piece and injection molded.

2.5 LIGHT FIXTURE TRIM

A. Each recessed lighting fixture shall have a trim to match the type of ceiling (plaster, exposed grid, concealed spline, exposed panel, etc.) in which it is being installed, regardless of catalog number given. Coordinate with the Architect's reflected ceiling plan to provide the right trim for the type of ceiling the fixture is to be installed in.

B. Each lighting fixture recessed in a plastered ceiling of any type shall have a plaster frame.

2.6 RECESSED INCANDESCENT FIXTURES

A. All recessed incandescent fixtures shall comply with Article 410-65, C of the N.E.C.

PART 3 - EXECUTION

3.1 SUPPORT OF LIGHTING FIXTURES

A. All lighting shall be supported from the building structure. The fixtures shall be supported in a manner that will insure the fixture weight being equally distributed from each support and the fixture remaining in a level position.

B. Fluorescent fixtures installed recessed in a suspended ceiling system shall be supported from the building structure with two (2) 12 gauge wires on diagonal corners of the fixture. In addition, the fixture shall be clipped to members of the ceiling suspension system.

C. Fluorescent fixtures installed in or on any ceiling other than a suspended ceiling system specifically mentioned above shall be supported with concealed steel rods. Rods shall be 1/4" diameter minimum and shall be located where recommended by the fixture manufacturer. Provide a minimum of two (2) supports for each 4' or 8' fixture chassis. Supports shall be maximum of 48" centers. For incandescent fixtures, steel hanging wire may be used by attaching the wire to the fixture mounting frame.

D. Pendant mounted incandescent fixtures shall be stem supported by a fixture stud mounted in the outlet box. Suspended fluorescent fixtures shall have mounting stems located as per the manufacturer's recommendations, but in no case shall have less than two (2) stems per chassis.

3.2 AIMING OF ADJUSTABLE LIGHT FIXTURES

A. All fixtures with lamp position, tilt, shutters, rotation, or other types of adjustments during the final inspection. Fixtures serving areas where day lighting is predominant will be adjusted after sunset.

3.3 LIGHTING FIXTURES IN MILLWORK

A. Special attention shall be given to lighting fixtures indicated to be mounted within, under, on or

otherwise incorporated into millwork or cabinetry.

B. Refer to the Architectural drawings and details for specific dimensions. This coordination shall occur prior to ordering fixtures to assure fixtures will fit the space limitations of the millwork.

C. This requirement is intended to preclude incurring additions to the Contract due to fixtures being too small or too large for the space.

END OF SECTION

SECTION 265613

SITE LANDSCAPE LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes materials, labor, apparatus, tools, equipment, temporary construction, transportation, and services necessary for and incidental to performing the proper completion of Work as required to make a complete Exterior Site Lighting installation, as shown on the Contract Drawings, and as specified herein this Section.

B. Work under this Section consists of, but is not necessarily limited to, furnishing and installing the following:

1. Exterior luminaries (bollards, pathway, pole mounted, ground mounted up-lights, step lights and tree mounted down-lights) with lamps and ballasts.
2. Exterior railing luminaries
3. Luminaire-mounted photoelectric relays.
4. Poles and accessories.
5. Luminaire lowering devices.

C. Related Documents: The following Documents contain requirements that relate to Work in this Section:

1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
2. Division 26 - Electrical.
3. Section 044216 “Site Stone Blocks, Boulders and Slabs”
4. Section 044300 “Site Stone Masonry Veneer Assemblies”.
5. Section 321323 "Cast-in-Place Concrete for Landscape Features".

1.2 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color-rendering index.

C. HID: High-intensity discharge.

D. LER: Luminaire efficacy rating.

E. Luminaire: Complete lighting fixture, including ballast housing if provided.

F. Pole: Luminaire support structure, including tower used for large area illumination.

G. Standard: Same definition as "Pole" above.

1.3 SUBMITTALS

A. Product Data: For each luminaire, pole, and support component, arranged in order of lighting unit designation. Include data on features, accessories, finishes, and the following:

1. Physical description of luminaire, including materials, dimensions, effective projected area, and verification of indicated parameters.
2. Details of attaching luminaires and accessories.
3. Details of installation and construction.
4. Luminaire materials.
5. Photometric data based on laboratory tests of each luminaire type, complete with indicated lamps, ballasts, and accessories.

    a. Testing Agency Certified Data: For indicated luminaires, photometric data shall be certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer.
    b. Manufacturer Certified Data: Photometric data shall be certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.

6. Photoelectric relays.
7. Ballasts, including energy-efficiency data.
8. Lamps, including life, output, CCT, CRI, lumens, and energy-efficiency data.
9. Materials, dimensions, and finishes of poles.
10. Means of attaching luminaires to supports, and indication that attachment is suitable for components involved.
11. Anchor bolts for poles.
12. Manufactured pole foundations.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Anchor-bolt templates keyed to specific poles and certified by manufacturer.
3. Design calculations, certified by a qualified professional engineer, indicating strength of screw foundations and soil conditions on which they are based.
4. Wiring Diagrams: For power, signal, and control wiring.

C. Samples: For products designated for sample submission in the Exterior Lighting Device Schedule. Each Sample shall include lamps and ballasts.

D. Pole and Support Component Certificates: Signed by manufacturers of poles, certifying that products are designed for indicated load requirements in AASHTO LTS-4-M and that load imposed by luminaire and attachments has been included in design. The certification shall be based on design calculations by a professional engineer.

E. Qualification Data: For qualified agencies providing photometric data for lighting fixtures.

F. Field quality-control reports.

G. Warranty: Sample of special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For luminaries and poles to include in emergency, operation, and maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Lamps: One for every 10 of each type and rating installed. Furnish at least one of each type.
2. Glass and Plastic Lenses, Covers, and Other Optical Parts: Furnish at least one of each type.
3. Ballasts: Furnish at least one of each type.

1.6 QUALITY ASSURANCE AND CONTROL

A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.

B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Comply with IEEE C2, "National Electrical Safety Code."

E. Comply with NFPA 70.

1.7 STRUCTURAL ANALYSIS CRITERIA FOR POLE SELECTION

A. Dead Load: Weight of luminaire and its horizontal and vertical supports, lowering devices, and supporting structure, applied as stated in AASHTO LTS-4-M.

B. Live Load: Single load of 500 lbf distributed as stated in AASHTO LTS-4-M.

C. Ice Load: Load of 3 lbs/sq. ft., applied as stated in AASHTO LTS-4-M Ice Load Map.

D. Wind Load: Pressure of wind on pole and luminaire, calculated and applied as stated in AASHTO LTS-4-M.

1. Basic wind speed for calculating wind load for poles exceeding 49.2 feet in height is 100 mph.

a. Wind Importance Factor: 1.0
b. Minimum Design Life: 50 years
c. Velocity Conversion Factors: 1.0

2. Basic wind speed for calculating wind load for poles 50 feet high or less is 100 mph.

a. Wind Importance Factor: 1.0

b. Minimum Design Life: 25 years
c. Velocity Conversion Factors: 1.0

1.8 DELIVERY, STORAGE, AND HANDLING

A. Package aluminum poles for shipping according to ASTM B 660.

B. Store poles on decay-resistant-treated skids at least 12 inches above grade and vegetation. Support poles to prevent distortion and arrange to provide free air circulation.

C. Handle wood poles so they will not be damaged. Do not use pointed tools that can indent pole surface more than 1/4 inch deep. Do not apply tools to section of pole to be installed below ground line.

D. Retain factory-applied pole wrappings on fiberglass and laminated wood poles until right before pole installation. Handle poles with web fabric straps.

E. Retain factory-applied pole wrappings on metal poles until right before pole installation. For poles with nonmetallic finishes, handle with web fabric straps.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace products that fail in materials or workmanship; that corrode; or that fade, stain, perforate, erode, or chalk due to effects of weather or solar radiation within specified warranty period. Manufacturer may exclude lightning damage, hail damage, vandalism, abuse, or unauthorized repairs or alterations from special warranty coverage.

1. Warranty Period for Luminaires: Five (5) years from date of Substantial Completion.
2. Warranty Period for Metal Corrosion: Five (5) years from date of Substantial Completion.
3. Warranty Period for Color Retention: Five (5) years from date of Substantial Completion.
4. Warranty Period for Poles: Repair or replace lighting poles and standards that fail in finish, materials, and workmanship within manufacturer's standard warranty period, but not less than three (3) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 LUMINARIES:

A. Refer to fixture schedule in contract documents.

B. Refer to Appendix A, this section, for product cut sheets.

2.2 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide product indicated on Drawings.

2.3 GENERAL REQUIREMENTS FOR LUMINAIRES

A. Luminaires shall comply with UL 1598 and be listed and labeled for installation in wet locations by an NRTL acceptable to authorities having jurisdiction.

1. LER Tests Incandescent Fixtures: Where LER is specified, test according to NEMA LE 5A.
2. LER Tests Fluorescent Fixtures: Where LER is specified, test according to NEMA LE 5 and NEMA LE 5A as applicable.
3. LER Tests HID Fixtures: Where LER is specified, test according to NEMA LE 5B.

B. Lateral Light Distribution Patterns: Comply with IESNA RP-8 for parameters of lateral light distribution patterns indicated for luminaires.

C. Metal Parts: Free of burrs and sharp corners and edges.

D. Sheet Metal Components: Corrosion-resistant aluminum unless otherwise indicated. Form and support to prevent warping and sagging.

E. Housings: Rigidly formed, weather- and light-tight enclosures that will not warp, sag, or deform in use. Provide filter/breather for enclosed luminaires.

F. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit re-lamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during re-lamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses. Designed to disconnect ballast when door opens.

G. Exposed Hardware Material: Stainless steel.

H. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

I. Light Shields: Metal baffles, factory installed and field adjustable, arranged to block light distribution to indicated portion of normally illuminated area or field.

J. Reflecting surfaces shall have minimum reflectance as follows unless otherwise indicated:

1. White Surfaces: 85 percent.
2. Specular Surfaces: 83 percent.
3. Diffusing Specular Surfaces: 75 percent.

K. Lenses and Refractors Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.

L. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.

M. Factory-Applied Finish for Steel Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or SSPC-SP 8, "Pickling."
2. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.

a. Color: As selected from manufacturer's standard catalog of colors.
b. Color: As selected by Landscape Architect from manufacturer's full range.

N. Factory-Applied Finish for Aluminum Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
2. Natural Satin Finish: Provide fine, directional, medium satin polish (AA-M32); buff complying with AA-M20; and seal aluminum surfaces with clear, hard-coat wax.
3. Class I, Clear Anodic Finish: AA-M32C22A41 (Mechanical Finish: medium satin; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.
4. Class I, Color Anodic Finish: AA-M32C22A42/A44 (Mechanical Finish: medium satin; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA 611.

O. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps and ballasts. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

1. Label shall include the following lamp and ballast characteristics:

a. "USES ONLY" and include specific lamp type.
b. Lamp diameter code (T-4, T-5, T-8, T-12), tube configuration (twin, quad, triple), base type, and nominal wattage for fluorescent and compact fluorescent luminaires.
c. Lamp type, wattage, bulb type (ED17, BD56, etc.) and coating (clear or coated) for HID luminaires.
d. Start type (preheat, rapid start, instant start) for fluorescent and compact fluorescent luminaires.
e. ANSI ballast type (M98, M57, etc.) for HID luminaires.
f. CCT and CRI for all luminaires.

2.4 LUMINAIRE-MOUNTED PHOTOELECTRIC RELAYS

A. Comply with UL 773 or UL 773A.

B. Contact Relays: Factory mounted, single throw, designed to fail in the on position, and factory set to turn light unit on at 1.5 to 3 fc and off at 4.5 to 10 fc with 15-second minimum time delay. Relay shall have directional lens in front of photocell to prevent artificial light sources from causing false turnoff.

1. Relay with locking-type receptacle shall comply with ANSI C136.10.
2. Adjustable window slide for adjusting on-off set points.

2.5 GENERAL REQUIREMENTS FOR POLES AND SUPPORT COMPONENTS

A. Structural Characteristics: Comply with AASHTO LTS-4-M.

1. Wind-Load Strength of Poles: Adequate at indicated heights above grade without failure, permanent deflection, or whipping in steady winds of speed indicated in "Structural Analysis Criteria for Pole Selection" Article.
2. Strength Analysis: For each pole, multiply the actual equivalent projected area of luminaires and brackets by a factor of 1.1 to obtain the equivalent projected area to be used in pole selection strength analysis.

B. Luminaire Attachment Provisions: Comply with luminaire manufacturers' mounting requirements. Use stainless-steel fasteners and mounting bolts unless otherwise indicated.

C. Mountings, Fasteners, and Appurtenances: Corrosion-resistant items compatible with support components.

1. Materials: Shall not cause galvanic action at contact points.
2. Anchor Bolts, Leveling Nuts, Bolt Caps, and Washers: Hot-dip galvanized after fabrication unless otherwise indicated.
3. Anchor-Bolt Template: Plywood or steel.

D. Handhole: Oval-shaped, with minimum clear opening of 2-1/2 by 5 inches with cover secured by stainless-steel captive screws.

E. Concrete Pole Foundations: Cast in place, with anchor bolts to match pole-base flange. Concrete, reinforcement, and formwork are specified in Section 32 13 23 "Cast-in-Place Concrete for Landscape Features".

F. Power-Installed Screw Foundations: Factory fabricated by pole manufacturer, with structural steel complying with ASTM A 36/A 36M and hot-dip galvanized according to ASTM A 123/A 123M; and with top-plate and mounting bolts to match pole base flange and strength required to support pole, luminaire, and accessories.

G. Breakaway Supports: Frangible breakaway supports, tested by an independent testing agency acceptable to authorities having jurisdiction, according to AASHTO LTS-4-M.

2.6 STEEL POLES

A. Poles: Comply with ASTM A 500, Grade B, carbon steel with a minimum yield of 46,000 psig; one-piece construction up to 40 feet in height with access handhole in pole wall.

1. Shape: Round, tapered
2. Mounting Provisions: Butt flange for bolted mounting on foundation or breakaway support.

B. Pole-Top Tenons: Fabricated to support luminaire or luminaires and brackets indicated, and securely fastened to pole top.

C. Grounding and Bonding Lugs: Welded 1/2-inch threaded lug, complying with requirements in Section 260526 "Grounding and Bonding for Electrical Systems," listed for attaching grounding and bonding conductors of type and size listed in that Section, and accessible through handhole.

D. Cable Support Grip: Wire-mesh type with rotating attachment eye, sized for diameter of cable and rated for a minimum load equal to weight of supported cable times a 5.0 safety factor.

E. Platform for Lamp and Ballast Servicing: Factory fabricated of steel with finish matching that of pole.

F. Prime-Coat Finish: Manufacturer's standard prime-coat finish ready for field painting.

G. Galvanized Finish: After fabrication, hot-dip galvanize complying with ASTM A 123/A 123M.

H. Factory-Painted Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or with SSPC-SP 8, "Pickling."
2. Interior Surfaces of Pole: One coat of bituminous paint, or otherwise treat for equal corrosion protection.
3. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.

a. Color: As indicated by manufacturer's designations.

2.7 POLE ACCESSORIES

A. Base Covers: Manufacturers' standard metal units, arranged to cover pole's mounting bolts and nuts. Finish same as pole.

B. Transformer Type Base: Same material and color as pole. Coordinate dimensions to suit pole's base flange and accept indicated accessories.

PART 3 - EXECUTION

3.1 LUMINAIRE INSTALLATION

A. Install lamps in each luminaire.

B. Fasten luminaire to indicated structural supports.

1. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.

C. Adjust luminaires that require field adjustment or aiming. Include adjustment of photoelectric device to prevent false operation of relay by artificial light sources, favoring a north orientation.

3.2 POLE INSTALLATION

A. Alignment: Align pole foundations and poles for optimum directional alignment of luminaires and their mounting provisions on the pole.

B. Clearances: Maintain the following minimum horizontal distances of poles from surface and underground features unless otherwise indicated on Drawings: Refer to documents for center-point of pole layout and site reference.

1. Fire Hydrants and Storm Drainage Piping: 60 inches
2. Water, Gas, Electric, Communication, and Sewer Lines: 10 feet
3. Trees: 15 feet

C. Concrete Pole Foundations: Set anchor bolts according to anchor-bolt templates furnished by pole manufacturer. Concrete materials, installation, and finishing requirements are specified in Section 033000 "Cast-in-Place Concrete."

D. Foundation-Mounted Poles: Mount pole with leveling nuts, and tighten top nuts to torque level recommended by pole manufacturer.

1. Use anchor bolts and nuts selected to resist seismic forces defined for the application and approved by manufacturer.
2. Grout void between pole base and foundation. Use non-shrink or expanding concrete grout firmly packed to fill space.
3. Install base covers unless otherwise indicated.
4. Use a short piece of 1/2-inch diameter pipe to make a drain hole through grout. Arrange to drain condensation from interior of pole.

3.3 CORROSION PREVENTION

A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.

B. Steel Conduits: Comply with Section 260533 "Raceways and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

3.4 GROUNDING

A. Ground metal poles and support structures according to Section 260526 "Grounding and Bonding for Electrical Systems."

1. Install grounding electrode for each pole unless otherwise indicated.
2. Install grounding conductor pigtail in the base for connecting luminaire to grounding system.

B. Ground nonmetallic poles and support structures according to Section 260526 "Grounding and Bonding for Electrical Systems."

1. Install grounding electrode for each pole.
2. Install grounding conductor and conductor protector.
3. Ground metallic components of pole accessories and foundations.

3.5 FIELD QUALITY CONTROL

A. Inspect each installed fixture for damage. Replace damaged fixtures and components.

B. Illumination Observations: Verify normal operation of lighting units after installing luminaires and energizing circuits with normal power source.

1. Verify operation of photoelectric controls.

C. Illumination Tests:

1. Measure light intensities at night. Use photometers with calibration referenced to NIST standards. Comply with the following IESNA testing guide(s):

    a. IESNA LM-5, "Photometric Measurements of Area and Sports Lighting Installations."
    b. IESNA LM-50, "Photometric Measurements of Roadway Lighting Installations."
    c. IESNA LM-52, "Photometric Measurements of Roadway Sign Installations."
    d. IESNA LM-64, "Photometric Measurements of Parking Areas."
    e. IESNA LM-72, "Directional Positioning of Photometric Data."

D. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

3.6 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain luminaire lowering devices.

END OF SECTION

SECTION 265613.A

SITE LANDSCAPE LIGHTING APPENDIX

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes cut sheets and data information for the various lighting or related fixtures for the site/exterior scope of work and provide the proper information for procurement of said fixtures as shown on the Contract Drawings, and as specified herein this Section.

B. This section is a supplement to Section 265613 “Site Landscape Lighting”

1.2 SUBMITTALS

A. Refer to Section 265613 “Site Landscape Lighting” for Submittal requirements.

B. Contractor shall verify and provide own developed cut sheets and submittal information and not rely on or use this information for said submittal requirements.

C. Shop Drawings: Refer to Section 265613 “Site Landscape Lighting” for requirements.

D. Samples: Refer to Section 265613 “Site Landscape Lighting” for requirements.

PART 2 - PRODUCTS

2.1 LUMINARIES:

A. Refer to fixture schedule in contract documents for additional information.

PART 3 - EXECUTION

3.1 Refer to Contract Documents and Section 265613 “Site Landscape Lighting” for information related to Execution.

END OF SECTION

SECTION 266010

LIGHTNING PROTECTION

PART 1 - GENERAL

1.1 DESCRIPTION

A. All work specified in this Section shall comply with the provisions of Section 260100.

B. Provide a building lightning protection system complete with air terminals, conductors, down conductors, bonding connections and grounding electrodes, to the extent specified, shown and detailed for the building and parking deck.

C. The system shall be installed by a company with a minimum of five years' experience in the lightning protection field.

D. All equipment shall be as manufactured by East Coast Lightning Equipment, Inc., Winsted, CT, Independent Protection Co. of Goshen, Indiana or by an approved equal.

E. L. P. Installer shall submit proof of current U. L. listing and L. P. I. Certification.

1.2 CODES, STANDARDS AND REGULATIONS

A. All work shall be in compliance with the provisions of Underwriters' Laboratories, Inc., (U.L.) Installation Requirements Codes, U.L. 96A; National Fire Protection Associates (NFPA) Lightning Protection Standard No. 780 and the Lightning Protection Institute (LPI) Installation Requirements, LPI-175.

B. Materials shall comply in weight, size and composition with the requirements of U.L., NFPA and LPI relating to this type structure.

C. The Underwriters' Laboratories "Master Label Certification" shall be furnished along with the Lightning Protection Institute's Certification as evidence that the installation has met all code requirements.

1.3 SHOP DRAWINGS

A. Shop drawings shall show all air terminals, conductors, bonding connections and grounding methods. Description of all equipment shall be included.

B. Locations of air terminals, grounding equipment and conductors shall be shown on 1/8" = 1'-0" drawings which shall be included with the shop drawing submittal.

PART 2 - PRODUCTS

2.1 AIR TERMINALS

A. Provide the required number of air terminals on the roof and other prominent parts of the building.

B. Air terminals shall extend a minimum of 10" above the object, which it protects. They shall have a proper base support for the surface on which they are used and shall be securely anchored to the surface.

2.2 CONDUCTORS

A. Conductors shall be commercially pure copper cable complying with the weight and construction requirements of the lightning protection codes and shall be coursed to interconnect with air terminals and provide a two-way to ground. The angle of any turn shall not exceed 90 degrees and a horizontal or downward course shall be maintained.

B. Provide the required number of down conductors evenly distributed on the outer walls of the building. Building copper downlead cables up in the column construction tie wrapped to rebar. Splicing is permitted as required with 2-bolt pressure U. L. 96 listed clamps.

2.3 FASTENERS

A. Conductor fasteners shall be of non-corrosion metal having ample strength to support the conductor.

B. Fasteners shall be spaced on not more than 3’-0" centers for horizontal and 3'-0" for vertical runs.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Ground connections shall be made in accordance with requirements of the lightning protection codes. Soil conditions shall determine the type of ground to be used. Buildings more than 100’ AFG shall have a counterpoise (ground loop conductor) installed per code requirements.

B. The installation shall be made in a neat inconspicuous manner with all conductors coursed to conceal the equipment as much as possible.

END OF SECTION

SECTION 266100

EMERGENCY SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION

A. All work specified in this Section shall comply with the provisions of Section 260100.

B. Provide all labor and material necessary to install a standby diesel engine-generator set in a complete and operating condition.

C. The engine-generator set shall be suitable for indoor use.

D. Codes and Standards:

1. The generator set shall be listed to UL 2200 or submitted to an independent third party certification process to verify compliance as installed.
2. The generator set shall conform to the requirements of the following codes and standards:

a. CSA C22.2, No. 14-M91 Industrial Control Equipment.
b. EN50082-2, Electromagnetic Compatibility-Generic Immunity Requirements, Part 2: Industrial.
c. EN55011, Limits and Methods of Measurement of Radio Interference Characteristics of Industrial, Scientific and Medical Equipment.
d. IEC8528 part 4, Control Systems for Generator Sets.
e. IEC Std 61000-2 and 61000-3 for susceptibility, 61000-6 radiated and conducted electromagnetic emissions.
f. IEEE446 Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications.
g. NFPA 70, National Electrical Code, Equipment shall be suitable for use in systems in compliance to Article 700, 701, and 702.
h. NFPA 99, Essential Electrical Systems for Health Care Facilities.
i. NFPA 110, Emergency and Standby Power Systems. The generator set shall meet all requirements for Level 1 systems. Level 1 prototype tests required by this standard shall have been performed on a complete and functional unit. Component level type tests will not substitute for this requirement.

1.2 SUBMITTALS

A. Furnish information showing manufacturers' model numbers, dimensions and weights for the engine, generator and major auxiliary equipment.

B. Submit copies of pertinent drawings and schematic diagrams for approval and include the following:

1. Engine generator set including plans and elevations clearly indicating entrance points for each of the interconnections required.
2. Engine generator/exciter control cubicle.
3. Fuel consumption rate at various loads, ventilation and combustion CFM requirements.
4. Exhaust mufflers

5. Battery charger, battery and battery racks.
6. Automatic load transfer control switch.
7. Actual electrical diagrams including schematic diagrams and inter-connection wiring diagrams for all equipment to be provided.
8. Legends for all devices on all diagrams.
9. Vibration isolators with minimum 95% efficiency (provide shop drawing with calculations)

C. The specified standby KW shall be for continuous electrical service during interruption of the normal utility source and shall be certified by the manufacturer for the actual unit supplied.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. The equipment shall be as manufactured by Cummins's, Detroit Diesel Caterpillar/Olympian, Generac, or Kohler of the size and ratings indicated.

B. Motor starting performance and voltage dip determinations shall be based on the complete generator set. With a maximum instantaneous voltage dip of 35%, as measured by a digital RMS transient recorder in accordance with IEEE standard 115. Motor starting performance and voltage dip determination that does not account for all components affecting total voltage dip i.e. engine, alternator, voltage regulator and governor will not be acceptable. As such, the generator set shall be prototype tested to optimize and determine performance as a generator set system.

2.2 ENGINE

A. The engine shall be governed at a speed of 1800 rpm, and shall be equipped with the following:

1. Electronic isochronous governor capable of 0.25% steady-state frequency regulation.
2. 24-volt positive-engagement solenoid shift-starting motor.
3. 30-ampere automatic battery charging alternator with a solid-state voltage regulation.
4. Positive displacement, full-pressure lubrication oil pump, cartridge oil filters, dipstick, and oil drain.
5. Dry-type replaceable air cleaner elements for normal applications.
6. Engine-driven or electric fuel-transfer pump including fuel filter and electric solenoid fuel shutoff valve capable of lifting fuel.

B. The turbocharged engine shall be fueled by diesel.

C. The engine shall be liquid-cooled by Unit Mounted Radiator 122°F/50°C.

D. The engine shall be EPA certified from the factory.

2.3 ALTERNATOR

A. The alternator shall be salient-pole, brushless, 2/3-pitch, 10 lead, self-ventilated with drip-proof construction and amortisseur rotor windings and skewed for smooth voltage waveform. The ratings shall meet the NEMA standard (MG1-32.40) temperature rise limits. The insulation shall be class H per UL1446 and the varnish shall be a fungus resistant epoxy. Temperature rise of the rotor and stator shall be limited to Standby 130°C. The excitation system shall be of brushless construction controlled by a solid- state voltage regulator capable of maintaining voltage within ±.25%% at any constant load from 0% to 100% of rating. The AVR shall be capable of proper operation under severe nonlinear loads and provide individual adjustments

for voltage range, stability and volts-per-hertz operations. The AVR shall be protected from the environment by conformal coating. The waveform harmonic distortion shall not exceed 5% total RMS measured line-to-line at full rated load. The TIF factor shall not exceed 50.

B. The alternator shall have a single maintenance-free bearing, designed for 40000 hour B10 life. The alternator shall be directly connected to the flywheel housing with a semi-flexible coupling between the rotor and the flywheel.

C. The generator shall be inherently capable of sustaining at least 250% of rated current for at least 10 seconds under a 3-phase symmetrical short circuit without the addition of separate current-support devices.

2.4 GENERATOR

A. The generator shall be rated for continuous standby service at ratings indicated with 0.8 power factor, 277/480 volts, three-phase, four wire, 60 hertz, 1800 RPM.

B. The generator shall be a three phase, 60 hertz, single bearing, rotating field, synchronous type built to NEMA standards. A voltage regulator shall be provided to match the characteristics of the generator and engine. Voltage regulation shall be +/- 2% from no load to full rated load. Readily accessible voltage-droop, voltage level and voltage gain controls shall be provided. Voltage level adjustment shall be a minimum of +/- 5%. Generator and exciter shall be inherently capable of parallel operation with other power sources of equivalent electrical characteristics, and stator shall include a twelve lead, reconnectable bus system for each load reconnection. Generator shall be brushless permanent magnet, and shall sustain short circuit current at 300% of rated current up to 10 seconds.

2.5 COOLING SYSTEM

A. A radiator with blower type fan shall be provided to maintain safe operation at 110 degrees F. ambient temperature. Air flow restriction from the radiator shall not exceed 0.5" H20. Provide ductwork with flexible connecting section between radiator and discharge louver frame. Provide an engine coolant heater with thermostat to maintain coolant temperature at not lower than 60 degrees F. Heater shall operate on 120 VAC. Heater shall have an oil pressure disconnect to turn heater off when engine is operating.

B. The engine cooling system shall be pretreated by the system supplier for the inhibition of internal corrosion and freezing. Obtain necessary connection to heater from base building panel in core (HM or L as necessitated by voltage required).

2.6 FUEL SYSTEM

A. Generator shall be natural gas. Natural gas piping will be provided by the plumbing contract. Electrical contractor to provide cut sheet to plumbing contractor to coordinate gas requirements.

2.7 SOUND-ATTENTUATED ENCLOSURE

A. All enclosures are to be constructed from high strength, low alloy steel, galvanized steel.

B. The enclosure shall be finish coated with powder baked paint for superior finish, durability and appearance. Enclosures will be finished in the manufacturer's standard color.

C. The enclosures shall allow the generator set to operate at full load in an ambient of 40°C - 45°C

with no additional derating of the electrical output.

D. Enclosures shall be equipped with sufficient side and end doors to allow access for operation, inspection, and service of the unit and all options. Minimum requirements are two doors per side. When the generator set controller faces the rear of the generator set, an additional rear facing door is required. Access to the controller and main line circuit breaker must meet the requirements of the National Electric Code.

E. Doors must be hinged with stainless steel hinges and hardware and be removable.

F. Doors shall be equipped with lockable latches. Locks must be keyed alike.

G. The enclosure roof shall be pitched to prevent accumulation of water.

H. A duct between the radiator and air outlet shall be provided to prevent re-circulation of hot air.

I. The complete exhaust system shall be internal to the enclosure or optional with external mounted silencer.

J. All acoustical insulation shall be fixed to the mounting surface with pressure sensitive adhesive or mechanically fastened. In addition, all acoustical insulation mounted on a horizontal plane shall be mechanically fastened. The acoustical insulation shall be flame retardant.

K. The enclosures shall include an exhaust scoop to direct the cooling air in a vertical direction.

L. Walk in enclosures shall be provided with lighting and convenience outlets connected to load center mounted within the enclosure. All miscellaneous generator equipment requiring electrical circuits shall be connected to this panel. Receptacle outlets shall be weatherproof-while-in-use and GFI protected. The light switch for the lighting fixtures shall be mounted on the interior strike side of the entry door and shall be weatherproof.

M. Enclosure shall have a maximum db rating of 72db at 7 meters.

2.8 AUTOMATIC STARTING SYSTEM

A. A DC electric starting system with positive engagement shall be provided. The motor voltage shall be as recommended by the engine manufacturer.

B. Fully automatic generator set start-stop controls in the generator control panel shall be provided. Controls shall provide shutdown for low oil pressure, high water temperature, over-speed and over-crank. Controls shall include a 45 second single cranking cycle limit with lockout.

C. A belt driven battery charging alternator shall be provided with transistorized voltage regulator. Voltage shall match the electric starting system.

D. A lead-acid storage battery set of the heavy duty starting type shall be provided. Battery voltage shall be compatible with the starting system. The battery set shall be rated as required by generator manufacturer in amp hours. Necessary cables and clamps shall be provided.

E. Battery racks shall be provided for each battery and shall conform to NEC 480-7,a,1. They shall be constructed of metal and so treated as to be resistant to deteriorating action by battery electrolyte. Further, construction shall be such that non-conducting insulation material directly

supports the cells.

F. A current limiting battery charger shall be provided to automatically recharge batteries. It shall include overload protection, silicon diode full wave rectifiers, voltage surge suppressor, DC ammeter, DC voltmeter, equalize timer and fused AC input. AC input voltage shall be 120 volts, single phase. Amperage output shall be no less than 10 amperes. Alarm shall be provided for low-battery voltage and battery charger fault in the charger. Control circuit shall be wired from charger to generator control panel by electrical contractor for indication on control panel. Obtain power for battery charger from base building panel in core (HM or L as necessitated by voltage required).

2.9 GENERATOR CONTROL PANEL

A. A generator mounted NEMA 1 type vibration isolation control panel shall be provided. Panel shall contain, but shall not be limited to, the following equipment:

1. Frequency Meter, 3 1/2", dial type.
2. Voltmeter, 3 1/2", 2% accuracy.
3. Ammeter, 3 1/2", 2% accuracy.
4. Ammeter/Voltmeter phase selector switch.
5. Automatic starting controls as specified.
6. Voltage level adjustment rheostat.
7. Contacts for remote alarms wired to terminal strips.
8. Individual fault indicator lights for low oil pressure, high water temperature, over-speed, over-crank and low water temperature.
9. Three position function switch marked, RUN-STOP and REMOTE.
10. Running time meter, oil pressure, battery charging ammeter and water temperature gauges.

B. Remote Control Panel. The remote control panel shall be installed in the Fire Command Center and shall meet NFPA 110, Level 1 requirements and enable remote viewing of the generator status. The panel shall be connected to the generator controller via either network communication wires or via hard wired connections. Options shall be available to provide ATS source position, loaded test, and retransfer. The panel shall have the capability to remote start or turn off the generator and be either flush- mounted or surface-mounted. The panel shall meet UL508 requirements.

C. Provide a generator control panel at the reception desk, engineering office and in the main electrical room. 3 total.

2.10 MAIN LINE CIRCUIT BREAKERS

A. Provide main-line, molded case circuit breakers sized as shown and mounted upon the generator. The outputs of the generator shall be protected by load circuit interrupting and protection devices. They shall operate both manually for normal switching functions and automatically during overload and short-circuit conditions.

B. The trip unit for each pole shall have elements providing inverse time delay during overload conditions and instantaneous magnetic tripping for short circuit protection. The circuit breaker shall meet standards as established by U.L., NEMA and the N.E.C.

2.11 AUTOMATIC LOAD TRANSFER SWITCHES

A. Furnish and install automatic transfer switches with 4 Pole - Switched Neutral, and

amperage as shown. Each automatic transfer shall consist of an inherently double throw power transfer switch mechanism and a microprocessor controller to provide automatic operation. All transfer switches and controllers shall be the products of the same manufacturer.

B. The transfer switch shall be electrically operated and mechanically held with double throw construction, and operated by a momentarily energized solenoid-driven mechanism. Linear motors or gears shall not be acceptable.

C. All transfer switch sizes shall use only one type of main operator for ease of maintenance and commonality of parts.

D. The switch shall be positively locked and unaffected by momentary outages, so that contact pressure is maintained at a constant value and contact temperature rise is minimized for maximum reliability and operating life.

E. All main contacts shall be silver composition. Switches rated 600 amperes and above shall have segmented, blow-on construction for high withstand and close-on capability and be protected by separate arcing contacts.

F. Inspection of all contacts shall be possible from the front of the switch without disassembly of operating linkages and without disconnection of power conductors. Switches rated 600 amps and higher shall have front removable and replaceable contacts. All stationary and moveable contacts shall be replaceable without removing power conductors and/or bus bars.

G. Designs utilizing components of molded-case circuit breakers, contactors, or parts thereof, which are not intended for continuous duty, repetitive switching or transfer between two active power sources, are not acceptable.

H. Supervised Transfer Control Switch. The supervised transfer control switch shall provide a door mounted three position, selector switch with Auto, Manual and Transfer positions. The alarm module shall be required in order to activate this option.
   1. With the controller set to the automatic mode and the selector switch in the auto position, the user transfer switch shall operate normally.
   2. With the controller set to the automatic mode and the selector switch in the manual position, the user shall be required to toggle the selector switch to initiate a transfer from the emergency to the normal position.
   3. With the controller set to the non-automatic mode and the selector switch in the manual position, the user shall be required to toggle the selector switch to the transfer position to initiate a transfer either direction. In this mode, the ATS shall not automatically transfer to an acceptable source in the case of source failure, without the user toggling the selector switch to the transfer position.

I. Enclosure

   1. The ATS shall be furnished in a NEMA 1 (A) enclosure.
   2. All standard door mounted switches and long life super bright type indicating LEDs described in section 3 shall be integrated into a flush-mounted, interface membrane or equivalent in the enclosure door for easy viewing & replacement. The panel shall be capable of having manual locking feature to allow the user to lockout all membrane mounted control switches to prevent unauthorized tampering. This cover shall be mounted with hinges and have a latch that may be padlocked. The membrane panel shall be suitable for mounting by others when furnished on open

type units.

J. A four line, 20 character LCD display and dynamic 4 button keypad shall be an integral part of the controller for viewing all available data and setting desired operational parameters. Operational parameters shall also be available for viewing and limited control through the communications interface port. All instructions and controller settings shall be easily accessible, readable and accomplished without the use of codes, calculations, or instruction manuals. The following parameters shall only be adjustable via a password protected programming on the controller (dip switches shall not be acceptable):

1. Nominal line voltage and frequency
2. Single or three phase sensing
3. Operating parameter protection
4. Transfer operating mode configuration (Open transition, Closed transition, or Delayed transition)

K. Controller

1. Voltage (all phases) and frequency on both the normal and emergency sources shall be continuously monitored, with the following pickup, dropout, and trip setting capabilities (values shown as % of nominal unless otherwise specified):

Parameter	Dropout/Trip	Pickup/Reset
Under voltage	75 to 98%	85 to 100%
Over voltage	105 to 135%	95 to 100% of trip
Under frequency	85 to 99%	95 to 99%
Over frequency	105 to 120%	101 to 105%
Voltage unbalance	5 to 20%	3% to 18%

2. Repetitive accuracy of all settings shall be within ± 0.5% over an operating temperature range of -20°C to 70°C.
3. An adjustable dropout time for transient voltage and frequency excursions shall be provided. The time delays shall be 0.1 to 9.9 seconds for voltage and 0.1 to 15 seconds for frequency.
4. Voltage and frequency settings shall be field adjustable in 1% increments either locally with the display and keypad or remotely via the communications interface port.
5. The controller shall be capable of sensing the phase rotation of both the normal and emergency sources. The source shall be considered unacceptable if the phase rotation is not the preferred rotation selected (ABC or BAC). Unacceptable phase rotation shall be indicated on the LCD; the service required LED and the annunciation through communication protocol and dry contacts. In addition, the phase rotation sensing shall be capable of being defeated, if required.
6. The controller shall be capable of detecting a single phasing condition of a source, even though a voltage may be regenerated by the load. This condition shall be considered a failed source.
7. Source status screens shall be provided for both normal & emergency to provide digital readout of voltage on all 3 phases (phase to phase and phase to neutral), frequency, and phase rotation.

L. Time Delays

1. An adjustable time delay of 0 to 10 seconds shall be provided to override momentary

normal source outages and delay all transfer and engine starting signals. Capability shall be provided to extend this time delay to 60 minutes by providing an external 12 or 24 VDC power supply.

2. A time delay shall be provided on transfer to the emergency source, adjustable from 0 to 60 minutes, for controlled timing of transfer of loads to emergency.
3. A time delay shall be provided on re-transfer to normal. The time delays shall be adjustable from 0 to 60 minutes. Time delay shall be automatically bypassed if the emergency source fails and the normal source is acceptable.
4. A time delay shall be provided on shut down of engine generator for cool down, adjustable from 0 to 60 minutes.
5. A time delay activated output signal shall also be provided to drive external relay(s) for selective load disconnect control. The controller shall be capable of controlling a maximum of 9 individual output time delays to step loads on after a transfer occurs. Each output may be individually programmed for their own time delay of up to 60 minutes. Each sequence shall be independently programmed for transferring from normal to emergency and transferring from emergency to normal. The controller shall also include the following built-in time delays for the following operations:

    a. 0 to 60 minute time delay on failure to acquire the acceptable electrical parameters from the emergency source.
    b. 0 to 60 minute time delay for a failure to synchronize on an in-phase operation.
    c. 60 minute time delay for the load disconnect position for delayed transition operation.

6. All time delays shall be adjustable in 1 second increments.
7. All time delays shall be adjustable by using the display and keypad or with a remote device connected to the communications interface port through a security-password system.
8. All time delays shall be adjustable by using the display and keypad or with a remote device connected to the communications interface port through a security-password system.
9. Each time delay shall be identified and a dynamic countdown shall be shown on the display.

M. Additional Features

1. The controller shall have 3 levels of security. Level 1 shall allow monitoring of settings and parameters only. The Level 1 shall be capable of restricted with the use of a lockable cover. Level 2 shall allow test functions to be performed and Level 3 shall allow setting of all parameters.
2. Membrane-type switches shall be provided for the test functions and be maintained until the end test function is activated. The test function shall be allowed through password security. It shall be possible to defeat the password requirement by way of a circuit board mounted dip switch setting. The test function shall be load, no load or auto test. The auto test function shall request an elapsed time for test. At the completion of this time delay the test shall be automatically ended and a retransfer sequence shall commence. All loaded tests shall be immediately ended and retransfer shall occur if the emergency source fails and the normal source is acceptable.
3. A SPDT contact, rated 5 amps at 30 VDC, shall be provided for a low-voltage engine start signal. The start signal shall prevent dry cranking of the engine by requiring the generator set to reach proper output, and run for the duration of the cool down setting, regardless of whether the normal source restores before the load is

transferred.

4. Auxiliary contacts, rated 10 amps, 250 VAC shall be provided consisting of two contacts, closed when the ATS is connected to the normal source and two contacts closed, when the ATS is connected to the emergency source.
5. LED indicating lights shall be provided; one to indicate when the ATS is connected to the normal source (green) and one to indicate when the ATS is connected to the emergency source (red).
6. LED indicating lights shall be provided and energized by controller outputs. The lights shall provide true source availability of the normal (green) and emergency sources (red), as determined by the voltage, frequency and phase rotation sensing trip and reset settings for each source.
7. A membrane switch shall be provided on the membrane panel to test all indicating lights and display when pressed.
8. Provide the ability to select “commit/no commit to transfer" to determine whether the load should be transferred to the emergency generator if the normal source restores before the generator is ready to accept the load.
9. Terminals shall be provided for a remote contact which opens to signal the ATS to transfer to emergency and for remote contacts which closes to inhibit transfer to emergency and/or retransfer to normal. Both of these inhibit signals can be activated through the keypad or the communications interface port. A “not-in-auto" LED shall indicate anytime the controller is inhibiting transfer from occurring.
10. An in-phase monitor shall be a standard feature in the controller. The monitor shall control transfer so that motor load inrush currents do not exceed normal starting currents, and shall not require external control of power sources. The in-phase monitor shall be specifically designed for and be the product of the ATS manufacturer. The in-phase monitor shall be capable of being enabled or disabled for the user interface.
11. Engine Exerciser - The controller shall provide an internal engine exerciser. The engine exerciser shall allow the user to program up to 21 different exercise routines based on a calendar mode. For each routine, the user shall be able to:

    a. Enable or disable the routine.
    b. Enable or disable transfer of the load during routine.
    c. Set the start time:
        - time of day
        - day of week
        - week of month (1^{st}, 2^{nd}, 3^{rd}, 4^{th}, alternate or every)
    d. Set the duration of the run.
    e. At the end of the specified loaded exercise duration, the switch shall transfer the load back to normal and run the generator for the specified cool down period. All loaded exercises shall be immediately ended and retransfer shall occur if standby source fails. The next exercise period shall be displayed on the main screen with the type of exercise, time and date. The type of exercise and the time remaining shall be displayed when the exercise is active. It shall be possible of ending the exercise event with a single-button push.

12. Date and time - The date shall automatically adjust for leap year and the time shall have the capability of automatically adjusting for daylight saving and standard times.
13. System Status - The controller shall have a default display the following on:

    a. System status
    b. Date, time and type of the next exercise event
    c. Average voltage of the preferred and standby sources

Scrolling through the displays shall indicate the following:

a. Line to line and line to neutral voltages for both sources
b. Frequency of each source
c. Load current for each phase
d. Single or three phase operation
e. Type of transition
f. Preferred source
g. Commit or no commit modes of operation
h. Source/source mode (Utility/Gen; Gen/Gen; Utility/Utility)
i. In phase monitor enable/disable
j. Phase rotation
k. Date and time

14. Controllers that require multiple screens to determine system status or display "coded" system status messages, which must be explained by references in the operator's manual, are not permissible.
15. Self-Diagnostics - The controller shall contain a diagnostic screen for the purpose of detecting system errors. This screen shall provide information on the status input signals to the controller which may be preventing load transfer commands from being completed.
16. Communications Interface - The controller shall be capable of interfacing, through a standard communications with a network of transfer switches and generators. It shall be able to be connected via an RS-485 serial communication (up to 4000 ft. direct connect or multi-drop configuration), an Ethernet connectivity (over standard 10baseT Ethernet networks utilizing a RJ-45 port or remotely utilizing a dial-up modem). This module shall allow for seamless integration of existing or new communication transfer devices and generators. Monitoring software shall allow for the viewing, control and setup of parameters of the genset and transfer switch network through a standard personal computer utilizing current Microsoft operating systems. Separate and specific transfer switch software interfaces shall not be acceptable.
17. The transfer switch shall also be able to interface to 3rd party applications using Modbus RTU and Modbus TCP/IP open standard protocols utilizing Modbus register maps. Proprietary protocols shall not be acceptable.
18. The controller shall contain a USB port for downloading the controller's parameters and settings; exercise event schedules; maintenance records and event history. The file designator shall be the unique serial number of the transfer switch.
19. Data Logging - The controller shall have the ability to log data and to maintain the last 2000 events, even in the event of total power loss. The following events shall be time and date stamped and maintained in a non-volatile memory. The controller shall be able to display up to the last 99 events. The remaining events shall be downloadable to be displayed on a computer.

    a. Event Logging
        - Data, date and time indication of any event
    b. Statistical Data
        - Total number of transfers*
        - Total number of fail to transfer*
        - Total number of transfers due to preferred source failure*
        - Total number of minutes of operation*
        - Total number of minutes in the standby source*
        - Total number of minutes not in the preferred source*
        - Normal to emergency transfer time

- Emergency to normal transfer time
- System start date
- Last maintenance date

* The statistical data shall be held in two registers. One register shall contain data, since startup and the second register shall contain data from the last maintenance reset.

20. External DC Power Supply - An optional provision shall be available to connect up to two external 12/24 VDC power supply to allow the LCD and the door mounted control indicators to remain functional when both power sources are dead for extended periods of time. This module shall contain reverse battery connection indication and circuit protection

N. Automatic transfer switches shall be by the generator manufacturer or by GE Zenith or ASCO. Any alternate shall be submitted for approval to the consulting engineer at least 10 days prior to bid date. Alternate bids shall include a line-by-line clarification of the specification marked with "D" for deviation; "E" for exception, and "C" for comply.

O. The automatic transfer switches and controls shall conform to the requirements of:

1. UL 1008 - Standard for Transfer Switch Equipment
2. IEC 947-6-1 Low-voltage Switchgear and Control gear; Multifunction equipment; Automatic Transfer Switching Equipment
3. NFPA 70 - National Electrical Code
4. NFPA 110 - Emergency and Standby Power Systems
5. IEEE Standard 446 - IEEE Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications
6. NEMA Standard ICS10-1993 (formerly ICS2-447) - AC Automatic Transfer Switches
7. CSA C22.2 No. 178 certification

2.12 TESTS AND CERTIFICATION

A. Upon request, the manufacturer shall provide a notarized letter certifying compliance with all of the requirements of this specification including compliance with the above codes and standards. The certification shall identify, by serial number(s), the equipment involved. No exceptions to the specifications, other than those stipulated at the time of the submittal, shall be included in the certification.

B. The ATS manufacturer shall be certified to ISO 9001 International Quality Standard and the manufacturer shall have third party certification verifying quality assurance in design/development, production, and installation and servicing in accordance with ISO 9001.

2.13 SERVICE REPRESENTATIVE

A. The manufacturer shall maintain a national service organization of employing personnel located throughout the contiguous United States. The service center's personnel must be factory trained and must be on call 24 hours a day, 365 days a year.

B. The manufacturer shall maintain records of each switch, by serial number, for a minimum of 20 years.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Mount generator on 4 inch thick re-enforced 3000 psi concrete pad. Concrete shall be 1 foot larger in all directions than footprint of generator.

3.2 MANUFACTURING

A. The unit shall be shipped to the job by the manufacturer's authorized dealer having a parts and service facility within a 120 mile radius of the job. In addition, and in order not to penalize the Owner for unnecessary or prolonged periods of time for service or repairs to the emergency system, the bidding generator set supplier must have replacement parts in stock at all times. Certified proof of this requirement shall be available from the dealer and a personal inspection of the dealer's facilities may be made by the Architect or his appointed representative to substantiate claims made by the generator set supplier.

3.3 TESTING

A. Prior to acceptance of the installation, equipment shall be tested to show it is free of any defects and will start automatically and be subjected to full load test through the use of portable, dry-type load banks supplied for this purpose at the job by the generator set supplier.

B. The load bank shall be capable of definite and precise incremental loading and shall not be dependent on the generator control instrumentation to read amperage and voltage of each phase. Rather, the test instrumentation will serve as a check of the generator set meters.

C. Saltwater brine tanks or those load banks requiring water as a source for cooling are not acceptable for this purpose and are disallowed and shall not be utilized for this test.

D. Load bank testing shall be done in the presence of the Owner or his appointed representative only after the unit is permanently installed in accordance with the Contract Documents. Testing shall be for a period of eight (8) hours under full load.

3.4 START UP AND INSTRUCTIONS

A. On completion of the installation, start-up shall be performed by the engine manufacturers' trained dealer service representative.

B. Operating and maintenance instruction manual shall be furnished and procedures explained to operating personnel.

3.5 SYSTEM SERVICE CONTRACT

A. The supplier of the standby power system must furnish a copy of, and make available to the Owner, his standard service contract which, at the Owner's option, may be accepted or refused. This contract will accompany any documents, drawings, catalog cuts, specification sheets, wiring or outline drawings, etc. submitted for approval. This contract shall be for the complete power system.

3.6 GUARANTEE

A. Equipment provided under this Section shall be guaranteed against defective parts and workmanship under terms of the manufacturer's and dealer's standard warranty. But in no event shall it be for a period of less than five (5) years from date of initial startup of the

system and shall include labor and travel time for necessary repairs at the job.

END OF SECTION

SECTION 266500

SURGE PROTECTIVE DEVICES

PART 1 - GENERAL

1.1 DESCRIPTION

A. All work in this Section shall comply with the provisions of Section 260100.

1.2 DEFINITIONS

A. $I_{nominal}$: Nominal discharge current

B. MCOV: Maximum continuous operating voltage

C. Mode(s), also Modes of Protection: The pair of electrical connections where the VPR applies

D. MOV: Metal-oxide varistor; an electronic component with a significant non-ohmic current-voltage characteristic

E. OCPD: Overcurrent protective device

F. SCCR: Short-circuit current rating

G. SPD: Surge protective device

H. VPR: Voltage protection rating

1.3 CODES AND REGULATIONS

A. The following codes and regulations shall govern the design of the surge protection device:

1. Underwriters Laboratories, Inc. Standard No. 1449 - Third Edition
2. Underwriters Laboratories, Inc. Standard No. 1283
3. National Electrical Manufacturers Association (NEMA LS1)
4. IEEE 587 A&B Waveforms, IEEE C62.41
5. National Electrical Code – NFPA 70

    a. Article 110.9 - Interrupting Capacity
    b. Article 240.21 - Equipment complying with tap conductor rules

1.4 SUBMITTALS

A. For each different model of device to be used, submit the following:

1. Dimensional drawings and installation instructions for the specified parallel connected unit.
2. The rated capacities, operational characteristics, electrical characteristics, and all furnished accessories and options.
3. Copy of the UL Category Code certification, listing the tested values for VPRs, $I_{nominal}$ ratings, MCOVs, type designations, any OPCD requirements, model numbers, system voltage, and modes of protection.

1.5 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to replace or replace SPDs that fail in materials or workmanship within specified warranty period of each Type of device.

1. Warranty period for all Type 1 SPDs shall be twenty (20) years.
2. Warranty period for all Type 2 SPDs shall be fifteen (15) years.

1.6 MANUFACTURERS

A. The surge protection system shall be manufactured by Current Technology.

B. The specific series of surge protection device shall be as defined by the application or as defined on the drawing.

PART 2 - PRODUCTS

2.1 GENERAL

A. All units shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. The MCOV of the SPD shall be the nominal voltage of the system to which it is connected. The MCOV of the device shall be a tested value per section 37.7.3 of UL 1449.

2.2 SERVICE ENTRANCE SURGE PROTECTION

A. Unit shall be listed as a Type I surge protection device per UL 1449, 3rd edition.

B. Unit shall have the following features:

1. It shall consist of parallel connections only. Series elements shall not be used.
2. Integral disconnect switch - unit shall not require disconnection of power to customer equipment for testing and/or maintenance.
3. The primary suppression path shall not be to ground.
4. The unit shall not short or crowbar the power flow resulting in an interruption to the load.
5. Internal thermal protection that disconnects the unit before damaging internal suppressor components.
6. Indicator LED light display for power and protection status. Lights indicating only internal component failure while continuing to allow the main power flow are NOT acceptable.
7. Form-C contacts, one normally open and one normally closed, for remote monitoring of protection status. Contacts shall reverse on failure of any surge diversion module or on opening of any current-limiting device. Coordinate connection requirements with building power monitoring and control system.
8. Compression lugs that can accept up to #2 AWG wire.
9. A low impedance cabling system shall be provided with unit, thereby improving the connection of the SPD to the electrical system. Cabling system shall utilize a minimum wire size of #6 AWG.

C. Unit shall have a maximum attenuation of 54dB based on 50 ohm insertion loss test per MIL-STD-220B.

D. Unit shall have a minimum single-phase pulse surge current rating of 200 kA per mode. The peak surge current rating shall not be the arithmetic sum of the ratings of the individual MOVs

in a given mode. Manufacturer shall provide independent 3rd party testing, validating that unit is capable of surviving a single surge at the specified rating.

E. Protection modes and UL 1449 VPR for grounded wye circuits with 480Y/277 V, three-phase, four-wire circuits shall not exceed the following:

1. Line to Neutral: 1200 V
2. Line to Ground: 1200 V
3. Line to Line: 1800 V

F. Unit shall have a short-circuit current rating of 200 kA.

G. Unit shall have an $I_{nominal}$ rating of 20 kA and shall comply with all UL96A requirements for ac surge protection.

H. Unit shall survive a minimum of 14,000 repetitive category C3 (20kV/10kA) surges with no more than 10% deterioration. Calculated repetitive surge values will not be accepted. Manufacturer shall provide repetitive surge test report.

I. Unit shall be able to withstand a minimum of 100 temporary over voltage events, defined as: 30A available fault current, 30 cycles duration, 10 second interval between events.

J. Unit shall be able to prevent common temporary over voltages from damaging the MOVs. Voltages shall be limited per the following:

Overvoltage seen by MOVs as % of Nominal				
	available current			
time	30A	100A	500A	1000A
1 cycle	120%	130%	150%	160%
10 cycles	130%	150%	160%	160%
30 cycles	140%	150%	160%	160%

2.3 DISTRIBUTION PANELBOARD SURGE PROTECTION

A. Unit shall be listed as a Type II surge protection device per UL 1449, 3rd Edition.

B. Unit shall have the following features:

1. It shall consist of parallel connections only. Series elements shall not be used.
2. The primary suppression path shall not be to ground.
3. The unit shall not short or crowbar the power flow resulting in an interruption to the load.
4. Internal thermal protection that disconnects the unit before damaging internal suppressor components.
5. Indicator LED light display for power and protection status. Lights indicating only internal component failure while continuing to allow the main power flow are NOT acceptable.
6. Form-C contacts, one normally open and one normally closed, for remote monitoring of protection status. Contacts shall reverse on failure of any surge diversion module or on opening of any current-limiting device. Coordinate connection requirements with building power monitoring and control system.
7. Compression lugs that can accept up to #2 AWG wire.
8. A low impedance cabling system shall be provided with unit, thereby improving the connection of the SPD to the electrical system. Cabling system shall utilize a minimum wire size of #6 AWG.

C. Unit shall have a maximum attenuation of 34dB based on 50 ohm insertion loss test per MIL-STD-220B.

D. Unit shall have a minimum single-phase pulse surge current rating of 100 kA per mode. The peak surge current rating shall not be the arithmetic sum of the ratings of the individual MOVs in a given mode. Manufacturer shall provide independent 3rd party testing, validating that unit is capable of surviving a single surge at the specified rating.

E. Protection modes and UL 1449 VPR for grounded wye circuits with 480Y/277 V, three-phase, four-wire circuits shall not exceed the following:

1. Line to Neutral: 1200 V
2. Line to Ground: 1200 V
3. Neutral to Ground: 1000 V
4. Line to Line: 2000 V

F. Unit shall have a short-circuit current rating of 200 kA.

G. Unit shall have an $I_{nominal}$ rating of 20 kA.

2.4 PHYSICAL REQUIREMENTS

A. Interior installations shall have a NEMA 250, Type 1 enclosure.

B. Exterior installations shall have a NEMA 250, Type 4X enclosure.

2.5 ENVIRONMENTAL REQUIREMENTS

A. The unit shall not add appreciably to air conditioning load. Heat load shall not exceed 0.2 kVA (0.682 BTU/hr.).

B. Average power consumption shall be less than 0.2 kVA. Average power factor inefficiencies or harmonic distortion shall not result from use (THD - 0%).

C. No audible noise shall be generated.

D. No appreciable magnetic fields shall be generated. All units shall be capable of use in any location (in a computer room) without danger to disc units, disc packs or tapes.

E. Operating Conditions:

1. -40 - 185 degrees F
2. 5% – 95% humidity non-condensing

PART 3 - EXECUTION

3.1 INSTALLATION

A. The unit must be installed in accordance with the manufacturer's printed instruction to maintain warranty. All local and national codes must be observed.

B. For service entrance units, wiring harness shall be connected to the line side bussing of the service entrance electrical equipment as shown on the drawings.

C. For distribution panelboard units, install OCPD as required to comply with the UL listing of the SPD.

D. Install SPDs with cabling system between suppressor and points of attachment as short and straight as possible. In panelboard applications, adjust circuit-breaker positions to achieve shortest and straightest leads. Do not splice and extend SPD leads. Do not exceed manufacturer's recommended lead length. Do not bond neutral and ground.

E. Use crimped connectors and splices only. Wire nuts are not acceptable.

3.2 STARTUP SERVICES

A. Complete startup checks according to manufacturer's written instructions.

B. Do not perform insulation-resistance tests of the distribution wiring equipment with SPDs installed. Disconnect SPDs before conducting insulation-resistance tests, and reconnect them immediately after the testing is over.

C. Energize SPDs after power system has been energized, stabilized, and tested.

D. Train owner’s maintenance personnel to operate and maintain SPDs.

END OF SECTION

SECTION 269200

MOTOR CONTROLS AND WIRING

PART 1 - GENERAL

1.1 SCOPE

A. All work specified in this Section shall comply with the provisions of Section 260100.

B. All motors shall be provided under Division 23.

C. A motor starter shall be provided under this Section for each motor except for those specified in Division 23 to be furnished with integral starters. Motor starters shall be installed either in a Motor Control Center or separately mounted adjacent to the motor served.

D. Motor power wiring is defined as those conductors between the energy source and the motor. This power wiring shall be terminated at the motor terminals.

E. All control wiring required for automatic starting and stopping of motors shall be provided under Division 15 unless specifically shown on the electrical drawings.

F. Power wiring shall be connected through all line voltage control devices such as firestats and thermostats.

PART 2 - PRODUCTS

2.1 MOTOR STARTERS

A. Starters for motors 1/3 horsepower or smaller shall be manual unless remote or automatic starting is required, in which case the starters shall be magnetic, full voltage, non-reversing, single-speed, unless otherwise indicated. All other starters shall be magnetic.

B. Each starter for a three-phase motor shall be furnished with three (3) overload relays sized for the full load running current of the motor actually provided. Provide an external "HAND-OFF-AUTO" selector switch with green "RUNNING" light. Provide a red pilot light to indicate motor "STOPPED". Each pilot light shall have a legend plate indicating reason for signal.

C. Each overload relay shall have a normally open alarm contact which will close only when actuated by an overload (not to be confused with N.O. or N.C. auxiliary contacts). These contacts shall be properly wired to their respective blue pilot light provided on the starter front cover and having a "TRIPPED" legend plate.

D. Individually mounted motor starters shall be in a NEMA Type 1 general purpose enclosure in unfinished areas and shall be flush mounted in all finished areas. All starters mounted in exterior areas shall have a NEMA 3R enclosure. Each starter shall have a laminated nameplate to indicate Division 23 unit number, function and circuit number.

E. A control power transformer shall be provided at each motor starter for connection to the to the controls provided under Division 23. The control power transformer shall be mounted inside the motor starter enclosure. All control transformers at 50 VA or greater shall have primary fusing. Coordinate all control equipments with Division 23 and equipment manufacturers.

F. All motor starters, push buttons and pilot lights shall be of the same manufacturer as the switchboard and shall be General Electric, Square D, Siemens I.T.E, Joslyn Clark Controls or

Cutler-Hammer.

2.2 COMBINATION STARTERS

A. Combination starters shall consist of a circuit breaker and a motor starter mounted in a common NEMA Type 1 general purpose enclosure.

B. The motor starter components shall be as specified in Paragraph 2.1 for motor starters.

C. The circuit breaker component shall be a minimum 22,000 RMS interrupting capacity and shall be as required in Section 262000.

2.3 MOTOR CONTROL CENTER

A. The Motor Control Center shall consist of a combination starter for each motor, plus other associated equipment. Combination starters shall be plug-in circuit breaker or switch and fuse type, as scheduled, with voidable cover interlock, provision for padlocking the cover closed and provision for padlocking the operating handle in either the open or closed position. Switches shall be quick-make, quick-break type of quantity, size and poles as scheduled. All switches shall be rated at 600 volts, fused as scheduled. Circuit breakers shall have the interrupting capacity scheduled with 22,000 RMS minimum.

B. Motor starters shall be mounted in individual steel compartment immediately below the breaker or the switch and fuse associated with it. A mechanical interlock shall prevent opening the starter compartment door unless the device is in the off position.

C. Each section in the Motor Control Center shall include an individual 480/120 volt control circuit transformer, with fused secondary.

D. Provide a control terminal strip in the Motor Control Center. The control wiring from these terminal strips, external to the Motor Control Center, to the respective control device, shall be included in Division 23.

E. All circuit breakers, motor starters, push buttons and pilot lights shall be of the same manufacturer as the main switchboard.

F. Each starter shall have a laminated nameplate engraved to indicate Division 23 unit number, function and Motor Control Center circuit number.

G. The Motor Control Center shall be General Electric, Square D, Siemens I.T.E., or Cutler-Hammer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Provide power wiring to and install all motor starters, unless integrally factory mounted on a piece of equipment.

B. Provide power wiring to all motors except packaged units that are prewired between the starter and motor.

C. Where line voltage control devices are mounted at, on or inside a unit, such as aquastats, firestat for single phase devices, etc., the power wiring to the unit shall be connected through

such a control device.

D. On final inspection, it shall be demonstrated to the Architect or his representative, that each overload relay control circuit is properly wired and functioning correctly by manually tripping each overload relay individually, one at a time. This inspection procedure shall not involve removing any wiring or disconnecting any current carrying parts.

END OF SECTION

SECTION 287210

LIFE SAFETY SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section of the specification includes the furnishing, installation, connection and testing of the microprocessor controlled, intelligent reporting fire alarm equipment required to form a complete, operative, and coordinated system.

B. The fire alarm system shall comply with requirements of 2011 NFPA Standard 72 for Protected Premises Signaling Systems and all local codes and regulations. The system shall be electrically supervised and monitor the integrity of all conductors.

C. Alarm, trouble and supervisory signals from all intelligent reporting devices shall be encoded onto the Signaling Line Circuits.

D. The system shall be an active/interrogative type system where each transponder is repetitively scanned, causing a signal to be transmitted to the local fire alarm control panel/node indicating that the transponder and its associated initiating device and notification appliance circuit wiring is functional. Loss of this signal at the local FACP shall result in a trouble indication on both the FACP display and at the network display, as specified hereinafter for the particular input.

E. The system shall be arranged such that not less than 20 percent additional transponders may be inserted into any network communication loop.

F. The FACP and peripheral devices shall be manufactured by Notifier, Edwards or Siemens.

G. The installing company shall employ NICET (minimum Level II Fire Alarm Technology) technicians on site. To guide the final checkout and to ensure the systems integrity, the submitting company shall employ NICET Level IV minimum managers and engineers. Proof of NICET level training shall be included as part of submittal package and kept on site with personnel.

H. The installing company shall be UL listed for fire alarm installations. UL certificate shall accompany submittal package. The certification listing category shall be UUJJ and shall be indicated in the project submittal.

I. The Contractor shall make arrangements and pay all fees in connection with the testing of the Life Safety System. All system devices shall be tested for their correct operation, except non-restorable type heat detectors which shall be sample tested. All tests carried out shall meet the requirements of the local authority having jurisdiction.

J. This project shall adhere to the Marriot life safety standards in Module 14 of the Marriott Brand Standards. Refer to owner literature for complete details.

1.2 SCOPE

A. A new intelligent reporting, microprocessor controlled fire detection system shall be installed in accordance to the project specifications and drawings.

B. Basic Performance

1. Each SLC loop shall be wired NFPA 72 Style 4 (Class A).
2. Initiation Device Circuits (IDC) shall be wired (NFPA Style B) as part of an addressable device connected by the SLC circuit.
3. Notification Appliance Circuits (NAC) shall be wired (NFPA Style Y) as part of an addressable device connected by the SLC circuit or a panel circuit.
4. NAC speaker circuits shall be arranged such that there is a minimum of one speaker circuit per floor of the building or smoke zone, which ever is greater.
5. NAC speaker circuits and control equipment shall be arranged such that loss of any one (1) speaker circuit will not cause the loss of any other speaker circuit in the system.
6. Two-way telephone communication circuits shall be supervised for open and short circuit conditions. Phone circuits shall be wire (NFPA Style Y) and wired so that each vertical riser is a single circuit.

C. Basic System Functional Operation

1. As part of the fire alarm and voice communication system; when a fire alarm condition is detected and reported by one of the system initiating devices (except the smoke detectors located in air supply path of the stairwell and/or elevator shaft pressurization fans), the following functions shall immediately occur:

    a. FACP will sound and display the alarm condition showing the device address, location, zone information, time/date, and device type.
    b. The remote annunciator will sound and display the same information as shown on the FACP display unit.
    c. The speaker outputs for the floor of the alarm, floor above, floor below, elevator cabs and stairwells shall be activated for alarm evacuation message until silenced. All speakers shall sound the fire alerting tone followed by an evacuation message. When the message ends, the alerting tone shall resume. Other sequences for alarm evacuation messaging may be directed by drawings.
    d. All strobes on floors with activated speaker outputs shall flash in a synchronized pattern per floor.
    e. Operation of the fire alarm microphone must immediately override either the message or the fire alerting tone without moving any switches except the one on the microphone. The voice communication system shall also function as a public address communication system and shall operate on a selective and general basis from the Fire Alarm Control Panel.
    f. Release all magnetically held smoke doors.
    g. Provide signals to the mechanical controls including smoke dampers to shut down or reroute air-handling systems to prevent the recirculation of smoke and to start the stair and elevator shaft pressurization fans.
    h. Activate signals to the stairwell electric door locks as applicable.
    i. Provide a DACT (Digital Alarm Communicator Transmitter) and a signal via DACT for connection to a central station or local municipal fire department (connection and leased line, if required, shall be provided by building owner).
    j. Initiate a preprogrammed timing sequence.
    k. Additionally, actuation of a lobby elevator smoke detector shall cause immediate non-stop return of all automatic elevators served by that lobby to the primary discharge level; except that, when the alarm has been initiated on the primary discharge level, the elevators, shall be returned to the designated alternate discharge level per the requirements of ANSI ASME A17.1.
    l. Additionally, actuation of any elevator equipment room or shaft smoke detector shall cause immediate non-stop return of all automatic elevators served by that equipment room or shaft, to the primary discharge level per the requirements of

ANSI ASME A17.1. Provide all required signals from FACP to elevator controls for smoke detector in elevator machine room per the requirements of ANSI ASME A17.1.

m. Additionally, actuation of any smoke detector located in the air handling units and/or equipment rooms shall activate signals to the mechanical controls indicating the floor of occurrence.

n. The fire alerting tone shall be a low to high "slow whoop" from 200 Hz to 830 Hz lasting 2.5 seconds. Operation of the hand held microphone button shall override the alarm tone.

o. It shall be possible to silence the alarm signals by operating the signal silence switch. However, the activation of another zone shall repeat the entire alarm process, thus causing the signals to resound.

p. Each speaker circuit will have a manual selector switch. Operation of this switch will activate the speakers and fire lights associated with that circuit.

q. Silencing the alarm shall cause all speakers to silence. Firelights will continue to flash.

r. Fire pump normal power availability, fire pump phase reversal and fire pump run status shall be monitored. Loss of normal power, phase reversal shall annunciate as supervisory alarms and pump running shall annunciate as an alarm.

s. Provide a signal to activate the elevator shunt trip breaker upon activation of the heat detector in the elevator shaft.

t. System shall be point addressable. Ganging of devices on a module is not permitted.

2. As part of the fire alarm and voice communication system; actuation of any smoke detector located in the air supply path of the stairwell and/or elevator shaft pressurization fans shall cause the LCD display on the control panel module and audible alarm signal to sound at the central control station and prevent the subject pressurization fan from operating, thus preventing the induction of smoke into the area served by the subject fan.

3. Fire Department Two-Way Radio Communication System

a. Provide a two-way Voice Communication radio system.

b. Minimum Radio Coverage into Building: A minimum voice quality of DAQ 3.4 (See TSB-88-B) (for Digital radio system) and Circuit Merit 3 (for Analog systems) be present in all areas of the building when transmitted from the agency's radio system. For purposes of this section, 95% building coverage is considered to be all areas of the building.

c. Minimum Signal Strength out of Building: A minimum signal strength of 20 db ± 5 db above the noise floor shall be provided to and from the agency's radio system when transmitted or received from all areas of the building. For purposes of this section, 95% building coverage is considered to be all areas of the building.

d. Technical Criteria Maintained by the Agency: The agency shall maintain a document of technical information specific to their requirements. This document shall contain as a minimum, the frequencies required, the location and effective radiated power (ERP) of radio sites used by the in-building system, the maximum propagation delay (in microseconds) and other supporting technical information.

e. Amplification Systems Allowed: Building and structures which cannot support the required level of radio coverage shall be equipped with a radiating cable system and/or a distributed antenna system (DAS) with FCC certified Bi-Directional Amplifiers (BDA's) (aka bi-directional amplifiers), or systems otherwise approved by the agency in order to achieve the required adequate radio coverage.

f. Battery Systems: The active components of the installed system or systems shall be capable of operating on an independent battery system for a period of at

least twelve (12) hours without external power input. The battery system shall automatically charge in the presence of external power input.

g. Bi-Directional Amplifier (BDA) Requirements: Bi-Directional Amplifiers (BDA's) shall meet the following requirements as well as any other requirements determined by the agency, as follows:

1) All Bi-Directional Amplifier (BDA) components shall be contained in one (1) NEMA 4 type waterproof cabinet. Permanent external filters and attachments are not permitted.
2) The battery system shall be contained in one (1) NEMA 4 type waterproof cabinet.
3) The system shall be capable of providing automatic alarming of malfunctions of the Bi-Directional Amplifier (BDA) and battery system. Any resulting alarm shall be transmitted to the agency's designated recipient by means specified by the agency, including but not limited to automatic standard telephone dial-up circuit, TCP/IP network circuit, RS232 interface, etc.
4) Products used in such systems must have FCC Certification prior to installation; pending FCC Certificaton is not acceptable.
5) All Bi-Directional Amplifiers (BDA's) must be compatible with both analog and digital communications simultaneously at the time of installation.

h. Additional Frequencies and Change of Frequencies: The building owner will be required to modify or expand the public safety in-building system at their expense in the event frequency changes are required by the FCC or additional frequencies are made available by the FCC. This is an advisory statement that the building owner may select equipment and distribution components that are capable of such changes. Prior approval of an in-building system on previous frequencies does not exempt this section.

i. Power Requirements: All associated devices such as amplifiers, repeaters, etc. shall be served power from the life safety branch of the electrical distribution system. Provide 120V emergency life safety power to the locations shown on manufacturer's shop drawings.

4. General Operation

a. Power failures, opens, grounds or any disarrangement of the system wiring or components shall be indicated by a visual and audible trouble signal. The audible trouble signal may be silenced, however, the trouble LED shall remain lit until the system has been returned to normal operating condition.

5. Mechanical Controls

a. Provide a separate panel with hand-off-auto switches for manual override of air handling units. The switches shall allow the person at the central control station to override the automatic operation of all air handling systems in the building individually. When the three position switch is in the "AUTO" position, the HVAC unit, fan or exhaust system shall run subject to the mechanical controls and life safety functions. When the three position switch is in the "ON" position, the HVAC unit, fan or exhaust system shall run, overriding the mechanical controls and life safety shutdowns. When the three position switch is in the "OFF" position, the HVAC unit, fans or exhaust system shall be turned off, overriding the mechanical controls and life safety controls. A green LED shall be illuminated whenever an HVAC unit, fan or exhaust system is running. An amber LED shall

be illuminated whenever an HVAC unit, fan or exhaust system is off. The LED's shall be labeled as such. Provide the wiring between each switch and its respective piece of mechanical equipment. Quantities of switches shall be confirmed with division 15 and cabinet size shall be as required by the quantities of switches.

1.3 SUBMITTALS

A. General

1. Copies of all submittals shall be submitted to the Architect/Engineer for review prior to acceptance of system.
2. All references to manufacturer's model numbers and other pertinent information herein is intended to establish minimum standards of performance, function and quality.

B. Shop Drawings

1. Drawings shall include the following minimum requirements for submittal:

a. Point-to-point wiring/conduit layout for all devices on 1/8" scale.
b. Device placement showing all addresses and device ID.
c. All panel and equipment terminations.
d. All circuit voltage drop and current calculations spread sheets.
e. All battery calculation spreadsheets.
f. Legend reflecting device description, manufacturer, model number, and backbox requirement.
g. Wiring legend reflecting wire function, type, and recommended manufacturer's part number.
h. Full sequence of operations.
i. Power supply and amplifier calculations.

2. Specification data sheets on each individual system component.

C. Data Sheets

1. Submit simultaneously with the shop drawings, complete manufacturer's technical data sheets showing product description, listings, and specs.
2. Copies of NICET II and IV certifications.
3. Copy of company UL listing certificate.

1.4 APPLICABLE STANDARDS AND SPECIFICATIONS

A. The specifications and standards listed below form a part of this specification. The system shall comply with the latest standards.

1. National Fire Protection Association (NFPA), 2000 Edition - USA:

No. 13	Sprinkler Systems
No. 13A	Halon 1301 Extinguishing Systems
No. 17	Dry Chemical Extinguishing Systems
No. 17A	Wet Chemical Extinguishing Systems
	Clean Agent Extinguishing Systems
No. 70	National Electrical Code
	Specifically Article 760
No. 72	1999 National Fire Alarm Code

No. 101 Life Safety Code
2. Standard Building Code, 2000 Edition
3. American National Standard A17.1-1980
4. Underwriter's Laboratories Fire Resistance Directory
5. Local and State Building Codes
6. ADA Public Law 101-336
7. All requirements of the Authority Having Jurisdiction (AHJ)

1.5 APPROVALS

A. The system shall have proper listing, approval and labeling from the following nationally recognized agencies:

FM	Factory Mutual Systems
UL	Underwriters Laboratories

1.6 SYSTEM FEATURES

A. The system shall include the following features as a minimum:

1. During an alarm condition, the LCD annunciator shall display the activated alarm until acknowledged. This shall allow determination of where the last alarm has taken place.
2. Ground fault detection in wiring on either plus or minus side.
3. Separate alarm and trouble shall be displayed on the LCD annunciator.
4. Resound feature.
5. Dead Front" design control panel with all LED alarm trouble and power on indicators and all switches located behind a locked tempered glass door.
6. Solid state construction.
7. All alarm initiating circuit wiring, signal circuit wiring, speaker circuit wiring and emergency phone circuit wiring shall be supervised.
8. Automatic transfer to standby batteries upon power failure.
9. Lightning and surge protection.

PART 2 - PRODUCTS

2.1 CONDUIT AND WIRE

A. All fire alarm wiring shall be installed in conduit. Conduit shall be installed as required by specification section 261000.

1. Wiring shall be in accordance with local, state and National codes (e.g., NEC Article 760) and as recommended by the manufacturer of the fire alarm system.
2. All wire and cable shall be listed and/or approved by a recognized testing agency for use with a protective signaling system.
3. The fire alarm control panel shall be connected to a separate dedicated branch circuit, maximum 20 amperes from the generator powered source.
4. Conduit and wire installations shall meet the survivability requirements of NFPA 72. Contractor shall include all means and methods of compliance in the shop drawings.

2.2 MAIN FIRE ALARM CONTROL PANEL

A. The FACP shall be completely microprocessor based.

B. System Capacity and General Operation:

1. Configure size of panel to operate number of SLC circuits in a fashion so that each circuit handles no greater than 70% load of capacity or a maximum of 5 floors per circuit.
2. The fire alarm control panel shall include a full-featured operator interface and backlit 80-character Liquid Crystal Display (LCD).
3. The system shall be fully field programmable from the display panel. Panels requiring the use of external keyboards for programming and changes are not acceptable.
4. The FACP shall provide the minimum following features:

    a. Drift compensation to extend detector accuracy over life.
    b. Detector sensitivity test, per NFPA 72, Chpt 7.
    c. Maintenance alert, to warn of excessive smoke detector dirt or dust accumulation.
    d. Multiple sensitivity levels for alarm, selected by detector.
    e. System status reports to display and printer. Provide printer.
    f. Alarm verification, with verification counters.
    g. Cross zoning with the capability of counting two detectors in alarm.
    h. Walk test.
    i. UL-1076 security monitor points.
    j. Control-by-time with holiday schedules.
    k. Day/night automatic adjustment of detector sensitivity.
    l. Device blink control for sleeping areas.
    m. Releasing capability.
    n. Pre-Alarm.
    o. Selectable sensitivity levels, three minimum.
    p. History Storage, with a minimum of 400 events.
    q. Point Enable/Disable.
    r. Point Read (status and level of obscuration).
    s. Output point for connection to any building EMS.

C. Signaling Line Circuits (SLC)

1. Each SLC interface shall provide power to communicate with 99 intelligent detectors (ionization, photoelectric or thermal) and 99 intelligent modules (monitor or control).
2. Each SLC circuit shall not exceed 70%, load capacity or cover more than 5 floors.

D. Serial Interface

1. The system shall include two serial EIA-232 interfaces. Each interface shall be a means of connecting UL Listed Electronic Data Processing (EDP) peripherals.

    a. One serial port shall support a serial printer.
    b. One serial port shall support a CRT/NRT device.
    c. The system shall include an EIA-485 port for the serial connection of annunciators and remote LCD displays.

E. Voice Telephone Command Center (VTCC)

1. The Voice Telephone Command Center (VTCC) shall contain equipment required for all audio control, telephone system control, signaling and supervisory functions. This shall include:

    a. Tone generators.
    b. Digital voice units.

c. Microphone for manual paging/all call.
d. Main telephone handset.
e. Speaker/phone circuit annunciation and control modules for manual activation of each individual speaker circuit and each individual microphone/annunciator circuit.
f. Integral Digital Message Generator with a capacity of up to 60 seconds. The Digital Message Generator shall be capable of primary and secondary messages (30 seconds each). These messages shall be field programmable without the use of additional equipment.
g. Built in alert tone generators with steady, slow whoop, high/low and chime tone field programmable.
h. Provide list of evacuation pre-recorded messages and pre-alert tones to owner before ordering for selection.
i. The Voice Control Panel shall have the ability to transmit up to 4 simultaneous evacuation message channels.

2. The one-way voice communications system shall be comprised of a local microphone, single channel audio controller/tone generator/digital message player and, if shown on the plans up to eight (8) remote microphone/annunciator panels.
3. Provide individual selector switches and indicator lights for each speaker circuit at the fire command center and at each remote microphone/annunciator.
4. Provide amplifiers. Size the amplifiers to accommodate each speaker being set at a one-watt tap with twenty watts reserve per floor.
5. Provide switch and LED modules for control of individual telephone circuits at the main fire alarm control panel and at any remote locations.

F. Field Charging Power Supply (FCPS): The FCPS is a device designed for use as either a remote 24-volt power supply or used to power Notification Appliances.

1. The FCPS shall offer up to 6.0 amps (4.0 amps continuous) of regulated 24-volt power. It shall include an integral charger designed to charge 7.0 amp hour batteries. Provide batteries to support 60-hour standby with ten minutes of alarm indication at the end of this period. Battery charger shall be capable of recharging all batteries to seventy percent capacity in twelve hours.
2. The Field Charging Power Supply shall have four outputs (two Style Y/Z and two style Y) shall be available for connection to the Notification devices.
3. Provide 20-watt spare capacity in each electrical room on each floor for tenant audible circuits. Locate in a junction box clearly labeled "tenant fire alarm audible circuits".
4. Provide 1ea. Field Charging Power Supply (DC) per floor to allow for tenant build-out expansion of NAC devices. At no time shall there exceed 70% load capacity of any FCPS on any of the common levels. Provide power capacity as follows:

Floor Size	Capacity
<25,000 gross sq. ft.	6 amps DC
25,001 to 35,000 gross sq. ft.	10 amps DC
35,001 gross sq. ft. and greater	consult engineer

5. Locate audible (where required) and visual power supplies adjacent to one another and in a location within each room approved by the engineer.
6. Provide battery capacity and amplifier capacity in the main fire control panel for addition of tenant devices described above.

G. Audio Amplifiers

1. The audio amplifiers will provide audio power (@ 25 Volts RMS) for distribution to the speaker circuits.

2. The amplifier shall include audio input and amplified output supervision; back up input, and automatic switchover to back up (if primary amplifier should fail).
3. Amplifiers shall be available in 30, 100, and 120-watt versions.
4. Provide amplifiers sized to accommodate each speaker being set at a one-watt tap with twenty watts reserve per floor.
5. Hardwired indicating appliance circuits (fire lights and speakers) shall be Style Y per NFPA 72. Provide one light circuit per floor and provide one speaker circuit per floor, one speaker circuit per stairwell and, one speaker circuit per elevator cab.
6. Hardwired telephone circuits shall be Style Y per NFPA 72. Provide one fire fighters telephone circuit per elevator, one per elevator lobby, one per stairwell and, one for the fire pump room.
7. Provide at least two on board relays to operate door holders etc.
8. Provide necessary modules to operate remote supervised relays for fan control, elevator control, etc.

2.3 SYSTEM COMPONENTS

A. Speakers

1. All speakers shall operate on 25 VRMS or with field selectable output taps from 0.25 to 2.0 Watts.
2. Speakers in corridors and public spaces shall produce a nominal sound output of 84 dBA at 10 feet (3m) when set at one watt as measured per UL Standard 1480.
3. Frequency response shall be a minimum of 400 HZ to 4000 HZ.
4. Provide mini-speaker in all guestroom bedrooms.
5. Provide mini-speaker in all ADA accessible and hearing impaired guestroom restrooms. All mini-speakers in ADA accessible and hearing impaired guestrooms shall include visual alarm.
6. The back of each speaker shall be sealed to protect the speaker cone from damage and dust.
7. Speakers shall be bone white in color.
8. Provide a unit cost to add 2 speakers per 25,000 s.f. This unit cost shall be applied to additional speakers that may be required at the request of the fire marshal during field inspections.

B. Strobe Lights

1. All Strobe Lights shall meet the requirements of the ADA, UL Standard 1971.
2. Strobe intensity and flash rate shall meet the requirements of UL 1971, ADA and NFPA 72.
3. Strobe unit shall mount to a four inch square electrical outlet box. The strobe light shall have a white lens with red “FIRE” imprinted on it. When the unit is combination speaker/strobe, the speaker portion shall comply with the requirements stated in A. above.
4. All strobes shall have selectable output intensities from 15 to 110 cd. The intensity selected shall meet NFPA 72 requirements for the layout shown on the drawings.
5. Strobe spacing shall be as follows:

    a. Strobes shall be spaced a maximum of 100’ apart in corridors and within 15’ of the end of every corridor to comply with the requirements of NFPA 72.
    b. Strobes in open areas shall be provided to comply with NFPA 72.
    c. Provide strobes in public spaces such as restrooms, kitchens, breakrooms, cafeterias, conference rooms, training rooms and any other space where six or more people are likely to gather.

6. Provide a unit cost to add 5 strobes including required signal circuits per 25,000 s.f. This unit cost shall be applied to additional strobes that may be required at the request of the fire marshal during field inspections.

C. Manual Fire Alarm Stations

1. Manual fire alarm stations shall be dual-action, non-coded, non-break glass type, equipped with key lock so that they may be tested without operating the handle.
2. Stations must be designed such that after an actual activation, they cannot be restored to normal except by key reset. Units shall be master keyed with control equipment.
3. An operated station shall automatically condition itself so as to be visually detected, as operated, at a minimum distance of 100 feet (30.5 m) front or side. This shall be achieved with the pull lever remaining at a right angle to the station body until reset.
4. The station body shall be constructed so that chips and scratches will not expose metal.
5. Manual fire alarm stations shall be located as required by NFPA101 and the Standard Building Code.

D. Duct Smoke Detectors

1. Duct smoke detectors shall be addressable type with visual alarm and power indicators. Provide remote LED/test station that is accessible from the floor.
2. Each detector shall be installed upon the composite supply/return air ducts(s), with properly sized air sampling tubes where required. Provide smoke detectors in each return air path of any mechanical equipment that moves air in excess of 2000 CFM to meet the requirements of NFPA 72 and 90A. Provide smoke detectors in each supply and return air path of any mechanical equipment that moves air in excess of 15,000 CFM to meet the requirements of NFPA 72 and 90A. Confirm quantities of smoke detectors required for mechanical equipment with Division 23. Room detectors may be used to accomplish smoke detection in the supply/return air paths if the application permits.
3. Each duct detector shall be installed along with addressable control module as needed for fan shutdown and/or smoke control. Detectors zoned with other devices shall be capable of operating its control module even if all other devices on their circuit have gone into alarm.
4. Duct detectors shall be installed by the mechanical contractor and electrically connected to the fire alarm system by the electrical contractor.

E. Smoke Dampers

1. Smoke dampers shall be provided by Division 23.
2. Provide a smoke detector at each smoke damper location to meet the requirements of NFPA 72. Confirm quantities of smoke detectors required for smoke dampers with Division 23. Provide 120 volt power as required for operation of smoke dampers.

F. LCD Alphanumeric Display Remote Annunciator

1. The alphanumeric display annunciator shall be a supervised, backlit LCD display containing a minimum of eighty, (80) characters for alarm annunciation in clear English text. Annunciator shall be located as shown on the drawings or at the location selected by the local fire department.
2. The LCD annunciator shall display all alarm, supervisory, and trouble conditions from the FACP via the serial card.

G. FAN/HVAC Annunciator

1. Furnish and install in the Fire Control Room/Central Control Station a fan status annunciator and control panel. It shall contain one three position switch (Hand/Off/Auto) and one green and one amber LED indicator for each one of the building fans and HVAC units noted on the drawings and these specifications. When switched on, the fan or HVAC unit will run, overriding any shut down device and the green LED will be lit. When switched off, the fan or HVAC unit will turn off and the amber LED will be lit. The panel shall be constructed with white photo emulsion graphics applied to smoke plexiglass, protected by a layer of non-glare plexiglass and framed with anodized aluminum. The panel shall be provided with descriptive custom labels for each LED and switch, green "POWER ON" LED indicator and a power supply rated for continuous operation of all connected relays and LED's. Provide relays at each point of control wiring back to the annunciator and control panel.
2. Surface mount the FAN/HVAC status and control panel in the fire control room. The 120 volt power shall be provided from the emergency circuits dedicated to the fire alarm control panel.
3. Provide relays at each point of control described below.
4. The logic, contact closures, switch inputs and status indicators for the FAN/HVAC status and control panel may be multiplexed via the Life Safety System if desired, however, all discrete operations shall function as specified.
5. Relays shall be mounted within 3'-0" of the device to be monitored. All wiring from the control panel to the relay shall be supervised.
6. Label each relay with name of the equipment controlled and function of each relay.
7. The following equipment shall be controlled:

    a. Stair Pressurization fans
    b. Pressure relief fans and louvers
    c. Atrium smoke exhaust fans
    d. Atrium supply air fans
    e. Parking deck supply air fans
    f. Parking deck exhaust fans
    g. Outside air fans
    h. Toilet exhaust fans
    i. Air handling fans
    j. Elevator pressurization fans (multiple fans serving a common shaft at a single location shall be controlled by a single switch, but have individual status LED's).
    k. Packaged rooftop units
    l. Smoke dampers

2.4 SYSTEM COMPONENTS - ADDRESSABLE DEVICES

A. Addressable Devices – General

1. Detectors shall be intelligent (analog) and addressable, and shall connect with Two wires to the fire alarm control panel signaling line circuits.
2. Addressable photoelectric smoke and thermal detectors shall provide alarm and power/polling LEDs. LED(s) shall flash under normal conditions and LED(s) shall be placed into steady illumination by the control panel, indicating an alarm condition.
3. The fire alarm control panel shall permit detector sensitivity adjustment through field programming of the system.
4. Detectors will operate in an analog fashion, where the detector simply measures its designed environment variable and transmits an analog value to the FACP based on real-time measured values. The FACP software, not the detector, shall make the

alarm/normal decision, thereby allowing the sensitivity of each detector to be set in the FACP program and allowing the system operator to view the current analog value of each detector.

5. All field wiring is to be terminated on the detector base, not on the sensor head. Addressing of detectors shall be via integral decade switches built into sensor. Devices requiring separate addressing means will not be accepted.
6. Any additional equipment required to program devices is not acceptable.
7. All devices shall be point addressable with ganging of devices or modules on the same address unacceptable.

B. Intelligent Photoelectric Smoke Detector

1. The detectors shall use the photoelectric (light-scattering) principal to measure smoke density and shall, on command from the control panel, send data to the panel representing the analog level of smoke density.
2. Provide photoelectric smoke detector heads with sounder bases as required. Detectors shall be of the solid state photoelectric type utilizing a stable LED light source and a silicone photo diode as the receiving element to form a highly accurate means of smoke detection. Internal detector circuits shall be shielded against electrical interference and resistant to transients, noise and, RF interference. Detector shall be low profile. Detector shall have a dual purpose red LED that flashes continuously to show that the device is operating and, that comes on steady to show that the device is in alarm.
3. Nominal detector sensitivity shall be 1.4% per foot obscuration with a range of 1% to. 1.84%. Regardless of sensitivity settings, the detector's stability shall be unaffected by high air velocity. No radioactive materials shall be used.
4. Provide smoke detectors in elevator lobbies, at stairwell doors, in telephone rooms, electrical rooms, mechanical rooms, elevator pits, the top of the elevator shaft, adjacent to the fire alarm control panel, fire pump room, computer rooms as defined by NFPA 90, chiller plants, pump rooms, UPS rooms, guestrooms and elevator machine rooms.

C. Linear Beam Smoke Detector

1. Each beam shall be comprised of a solid state infrared (IR) transmitter, photodiode receiver and microprocessor based control module. Should IR output be attenuated below the desired alarm obscuration level as a result of smoke interference an alarm will be annunciated. Total obscuration of the beam is annunciated as a beam blockage trouble signal. All wiring from the control module to the transmitter and receiver heads is supervised.
2. The projected beam smoke detector system shall have an operating range of 10M. (33 ft.) to 100M. (330 ft.) and be listed for spacing the beam 30 ft. from a wall and 60 ft. on center. The transmitter and receiver optical elements shall be adjustable +/- 90 degrees horizontally and +/- 30 degrees vertically. The sensitivity shall be field selectable from 7% to 50% obscuration.

D. Intelligent Thermal Detectors

1. Thermal detectors shall be intelligent addressable devices rated at 135 degrees Fahrenheit (58 degrees Celsius) and have a rate-of-rise element rated at 15 degrees F (9.4 degrees C) per minute. It shall connect via two wires to the fire alarm control panel signaling line circuit.

E. Addressable Dry Contact Monitor Module

1. Addressable monitor modules shall be provided to connect one supervised IDC zone of conventional alarm initiating devices (any N.O. dry contact device such as flow, tamper, release systems, etc.) to one of the fire alarm control panel SLCs.
2. The IDC zone shall be suitable for Style D or Style B operation. An LED shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.
3. For difficult to reach areas, the monitor module shall be available in a miniature package and shall be no larger than 2-3/4 inch (70 mm) x 1-1/4 inch (31.7 mm) x 1/2 inch (12.7 mm). This version need not include Style D or an LED.
4. Monitor module shall be provided for all sprinkler flow and tamper switches. Switches are furnished and installed by others and electrically connected to the fire alarm system by the electrical contractor. Verify quantities and coordinate installation of devices required with fire protection shop drawings.

F. Addressable Control Module:

1. Addressable control modules shall be provided to supervise and control the operation of one conventional NACs of compatible, 24 VDC powered, polarized audio/visual notification appliances. For fan shutdown and other auxiliary control functions, the control module may be set to operate as a dry contract relay. Each relay shall have a red LED mounted on its cover to indicate if that relay has been activated.
2. The control module NAC may be wired for Style Z or Style Y (Class A/B) with up to 1 amp of inductive A/V signal, or 2 amps of resistive A/V signal operation, or as a dry contact (Form-C) relay. The relay coil shall be magnetically latched to reduce wiring connection requirements, and to insure that 100% of all auxiliary relay or NACs may be energized at the same time on the same pair of wires.

G. Door Holders

1. Provide door holders for wall mounting and for floor mounting. Door holders shall operate on twenty-four volt dc power and each holder shall not draw more than seventy Mili Amp of power. Coordinate quantities of door holders required with architect’s door schedule.

2.5 BATTERIES

A. The batteries shall be sealed, 12 volt nominal (two required).

B. The battery shall have sufficient capacity to power the fire alarm system for the time required in NFPA 72. This time shall be based on the type of system installed. At the end of this period the system shall be capable of operating all alarm notification appliances used for evacuation or to direct aid to the location of an emergency for 5 minutes upon a normal AC power failure.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Provide all equipment, wiring, conduit and outlet boxes required for the erection of a complete and operating system in accordance with applicable local, state and national codes, the manufacturer's recommendations, these plans and specifications. Color code shall be used throughout.

3.2 TEST

A. The manufacturer's authorized representative shall provide supervision of final system panel connections, perform a complete functional test of the system and submit a written report to the contractor attesting to the proper operation of the system.

B. Testing and Proof of Compliance: Each owner shall submit a least one (1) in-building coverage test, as follows:

1. Acceptance testing prior to occupancy of any newly constructed building.
2. Whenever structural changes occur including additions to building that would materially change the original field performance tests.
3. Annually
4. When repairs of alterations are made to amplification systems, the performance test shall demonstrate that adequate radio coverage is available in all required areas of the building. At the conclusion of the testing, a report shall be submitted to the agency which shall verify compliance with Section 1.2.

C. Acceptance Test Procedure: When an in-building radio system is required, and upon completion of installation, it will be the building owner’s responsibility to have the radio system tested to ensure that two-way coverage on each floor of the building is a minimum of 95 percent.

1. Each floor of the building shall be divided into a grid of approximately forty (40) equal areas. A maximum of two (2) non-adjacent areas will be allowed to fail the test.
2. In the event that three (3) of the areas fail the test, in order to be more statistically accurate, the floor may be divided into forty (40) equal areas. A maximum of four (4) non-adjacent areas will be allowed to fail the test. After the forty (4) area test, if the system continues to fail, it will be the building owner’s responsibility to have the system altered to meet the 95 percent coverage requirement.
3. The test shall be conducted using a calibrated portable radio of the latest brand and model used by the agency talking through the agency’s radio communications system.
4. A test location approximately in the center of each grid area will be selected for the test, then the radio will be enabled to verify two-way communications to and from the outside of the building through the agency’s radio communication system. Once the test location has been selected, prospecting for a better spot within the grid areas will be permitted within 3’ in any direction of the original selected test location.

D. Isolation Testing: As part of the installation, a spectrum analyzer or other suitable test equipment shall be utilized to insure spurious oscillations are not being generated by the subject Bi-Directional Amplifier (BDA) due to coupling (lack of sufficient isolation) between the input and output antenna systems. This test will be conducted at time of installation and subsequent annual inspections.

E. System Settings: The gain and power values of all Bi-Directional Amplifiers (BDA’s) shall be measured. The test measurement results shall be recorded on as-built drawings and kept on file with the building owner so that the measurements can be verified each year during the annual tests. In the event that the measurement results become lost, the building owner will be required to rerun the acceptance test to re-establish the gain values.

F. Annual Test: When an in-building radio system is required, it shall be the building owner’s responsibility to have all active components of the system, such as Bi-Directional Amplifiers (BDA’s), power supplies and backup batteries tested to a minimum of once every twelve (12) months. Bi-Directional Amplifiers (BDA’s) shall be tested to ensure that the gain and power are the same as it was upon initial installation and acceptance. Backup batteries and power supplies shall be tested under load of a period of one (1) hour to verify that they will properly

operate during an actual power outage. If within the one (1) hour test period, and in the opinion of the agency's representative, the battery exhibits symptoms of failure, the test shall be extended for additional one (1) hour periods until the integrity of the battery can be determined. All other active components shall be checked to determine that they are operating within the manufacturers specifications for the intended purpose.

G. Field Testing: Police and Fire Personnel shall at any time have the right to enter onto the property to conduct its own field-testing to be certain that the required level of radio coverage is present.

H. Minimum Qualifications of Personnel: The minimum of qualifications of the system engineer and integration organization shall include the following:

1. A valid Professional Engineering Certification
2. Certification of in-building system training issued by the manufacturer of the equipment being installed.

I. Other Code Compliance: The in-building system installation and components shall comply with all applicable local codes, including but not limited to, Federal Communications Rules (47 CFR 90.219), NEC, NFPA, IBC, IFC, TIA/EIA, etc.

3.3 FINAL INSPECTION

A. Upon completion of the installation, the electrical contractor shall provide to the architect, with a copy to the manufacturer's representative, a signed written statement attesting that all system equipment was installed in accordance with these specifications and in accordance with wiring diagrams, instructions and directions provided to the contractor by the manufacturer.

3.4 INSTRUCTION

A. Instruction shall be provided as required for operating the system. Hands-on demonstrations of the operation of all system components shall be provided and shall include one session for a period of 8 hours. Additional time that may be required for end-user training will be at added cost to owner.

3.5 GUARANTEE

A. All equipment and wiring shall be guaranteed against defects in materials and workmanship for a two year period from the start up and beneficial use of the system. Warranty service for the equipment shall be provided by the manufacturer's factory trained representative during normal working hours, Monday through Friday excluding holidays. Emergency service provided at times other than as stipulated above shall be available from the same source at additional cost to the owner.

3.6 INSPECTIONS

A. Upon satisfactory completion of the system test, the manufacturer's representative shall present for the owner's consideration, a proposal to provide semi-annual inspection and tests of the system.

END OF SECTION

SECTION 312219

LANDSCAPE AND FINE GRADING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes materials, labor, apparatus, tools, equipment, temporary construction, transportation, and services necessary for and incidental to performing the proper completion of Work for Finished Grading in Landscape Planting Areas, as shown in the Contract Drawings, and as specified herein this Section.

B. Work under this Section consists of, but is not necessarily limited to, furnishing and installing the following:

1. Finish grading of pavement areas.
2. Sub-grade and sub-base preparation for pavement areas and site foundations.
3. Finish grading of landscape planting areas.
4. Machinery restrictions.
5. Excavation, filling and backfilling of on-site material.
6. Transporting, spreading and fine grading of stockpiled site soil.
7. Prevention of excessive weed growth.
8. Temporary and surface drainage.

C. Related Documents: The following Documents contain requirements that relate to Work in this Section:

1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
2. Division 31
3. Section 329113 "Soil Preparation”.
4. Section 334300 "Landscape Drainage".

1.2 SITE CONDITIONS

A. Dust Nuisance: Contractor shall assume full responsibility for alleviation or prevention of dust as a result of Work under this Section.

B. Excessive rock, dead or declining vegetation, trash, debris, or other items that has accumulated shall be removed from the Project Site by the Contractor, and as directed by the Landscape Architect, prior to completion of Finish Grading operations.

C. Work under this Section shall be performed only during the period when beneficial and optimum Landscape Grading results may be obtained. If the moisture content of the soil should reach such a level that working it would destroy soil structure or cause compaction, landscape grading operations shall be suspended until, in the opinion of the Landscape Architect, the moisture content is increased or reduced to acceptable levels and the desired results are likely to be obtained.

D. Soil moisture level prior to Landscape Grading shall be no less than 75% of field capacity. The determination of adequate soil moisture for Landscape Grading shall be in the sole judgment of the Landscape Architect.

1.3 COORDINATION, SCHEDULING, AND OBSERVATIONS

A. Complete Finish Grading prior to installation of Sprinkler Irrigation (Refer to Section 328400) in each area graded.

B. Re-grade, as required, to acceptable Landscape Grades established by Landscape Architect once irrigation system is installed.

C. Utilities: Determine location of above grade and underground utilities and perform Work in a manner which will avoid damage to utilities. Hand excavate, as required.

D. Maintain grade stakes until removal is mutually agreed upon by parties concerned.

E. Excavation: When conditions detrimental to adequate Finish Grading operations are encountered, such as rubble fill, adverse drainage conditions, or obstructions, cease operations and notify Landscape Architect for further direction.

F. Perform Finish Grading operations only when weather and soil conditions are suitable in accordance with locally accepted practices.

G. Construction Site Observations: Periodic site observations shall be made by the Landscape Architect during the installation of Work under this Section for compliance with requirements. Landscape Architect retains right to observe Work for defects and to reject unsatisfactory or defective work under this Section at any time during progress of Work. The Contractor shall request, in writing, at least one (1) week in advance of the time when mandatory site observation(s) by the Landscape Architect are required.

1.4 SUBMITTALS

A. General: Refer to Division 01 for project submittal requirements and timelines. If provided in hardcopy submittal booklets submit each item in this Article in required copies with four (4) copies for review by Landscape Architect. Three (3) copies shall be returned (One for Client, one for Owner and one for Contractor) and one copy maintained by Landscape Architect. Provide one (1) sets of Material Samples for review by the Landscape Architect unless requested otherwise.

B. Submittal Booklets: Each Submittal Booklet under this Section shall be tabbed into specific sections, containing clearly identified (through yellow highlighter or other specific identification methods) and legible information on the following information indicated in this Article.

C. Electronic Submittals: Electronic Submittal shall be provided in a single bound file, PDF format preferred, unless otherwise noted in Division 01.

D. Product/Material Data. Submit available product/material literature (including color charts) supplied by manufacturer's, indicating that their products comply with specified requirements. Provide manufacturing source (name, address, and telephone number), and distributor source (name, address, and telephone number) for each type of product/material.

E. Qualification Data: Submit names for firms and persons specified in the "Quality Assurance and Control" Article to demonstrate their capabilities and experience on similar Landscape Planting Accessories installations.

F. Submittals under this Article will be rejected and returned without the benefit of review by the Landscape Architect if they are difficult to read due to insufficient scale, poor image quality, or

poor drafting quality; or if all of the required information is missing or not presented in the format as requested. Partial Submittals will not be accepted.

1.5 GENERAL PROVISIONS

A. Finished grading shall be defined as placing and grading of onsite stockpiled soil or additional soil that may be required to establish the required grades for lawns, shrub and groundcover beds.

B. Additional fill materials shall generally be defined as on site topsoil as specified herein.

C. Where practicable and as directed, the use of heavy machinery shall be kept to a minimum in landscape areas. Overly compacted areas from machine access or use during previous construction shall be loosened by ripping soil to relieve compaction, not less than 12 inches deep and 12 inches on center prior to commencing landscape work except no machines are permitted in existing tree protection areas during general construction work.

D. Work within existing tree zones:

1. No fill and only limited machinery will be permitted under the canopy of existing trees to remain.
2. Work shall be accomplished in tree protection areas with limited machine grading.
3. Care shall be taken in any Post Oak area due to the sensitive nature of their root systems to compaction and soil disturbance.
4. Machines are allowed in tree protection zones only to the extent they are absolutely required. Limit work specifically from machine grading and generally accomplish the majority of grading and soil preparation work with hand labor within the tree protection areas.

PART 2 - PRODUCTS

2.1 FILL

A. General Qualifications: Fill shall be a clean, dry soil of a loamy character, well drained and well graded with a plasticity index not to exceed 20 or fall below 8. Fill material shall contain no oils, alkalizes, acids, rubbish or other deleterious materials. The pH shall be similar to the on-site topsoil.

2.2 TOPSOIL

A. Topsoil material that may be required for finish grading operations shall conform to the requirements included within this Section.

B. General Qualifications: Topsoil shall be considered acceptable which conforms to the following minimum criteria:

1. Natural, friable, loamy soil, typical of local topsoil which produces heavy vegetative growth, free from subsoil, weeds, sods, stiff clay, stones larger than one (1") inch, toxic substances, debris, or other substances which may be harmful to plant growth. Do not deliver in muddy condition.
2. Acidity/Alkalinity: pH 5.0 to pH 7.2.

C. Grading Analysis:

1. General Fill Material

    a. Two (2") inch - 100 percent minimum passing.
    b. Number 4 sieve - 90 percent minimum passing.
    c. Number 10 sieve - 80 percent minimum passing.

2. Sand, Silt, and Clay Content (from ASSHTO M146) as required and approved as being similar to existing site soil

    a. Sand 20 to 75 percent
    b. Silt 10 to 60 percent
    c. Clay 5 to 30 percent

3. All topsoil shall be free from all herbicides and insecticides which might adversely affect subsequent growth of turf or plantings or which might otherwise contain materials toxic to humans and pets.

D. Non-Conforming Material: The Contractor shall not be permitted to use on-site material which does not conform to the above minimum criteria for fine grade operations. At the discretion of the Landscape Architect, such material can either be amended to meet the minimum requirements or shall be removed from the site and replaced with suitable material as specified herein.

E. It shall be the Contractor's responsibility to verify that the existing topsoil conforms to these specifications. Topsoil determined to be non-conforming subsequent to the award of a contract shall not be means for extra compensation unless otherwise provided for herein.

F. Soil Analysis: Obtain soil analysis of topsoil from the approved accredited agricultural testing laboratory, Wallace Laboratories, El Segundo CA, 310-615-0116., at Owner’s cost. Submit results of soil analysis to the Landscape Architect for review.

2.3 SAND: Shall be "Sharp Sand" to A.S.T.M. C-33. Sample shall be submitted for approval. Sand shall not be permitted for fill purposes if the depth exceeds two (2") inches to achieve the finished grade.

PART 3 - EXECUTION

3.1 EXAMINATION

A. NO WORK UNDER THIS SECTION SHALL COMMENCE UNTIL SUBMITTALS UNDER THIS SECTION HAVE BEEN REVIEWED ACCORDINGLY BY THE LANDSCAPE ARCHITECT.

B. Prior to commencing Work under this Section, Contractor shall examine previously installed Work from other trades and verify that such Work is complete and to the point where Work herein may commence properly. Do not proceed with Work until unsatisfactory conditions have been corrected.

C. Contractor shall notify the Landscape Architect, in writing, on the anticipated commencement date and length of duration of the Work installation herein this section.

3.2 WORKMANSHIP: Work shall be performed by personnel trained and experienced in this work and shall be done under the direction of a superintendent on Contractor's staff.

3.3 EXCAVATION

A. Make excavations to relative dimensions and elevations indicated on Drawings.

B. Excavated material determined suitable for use as fills or topsoil may be dispersed or stored on the site in locations as directed. Excavated material unsuitable for fills shall be disposed of, legally, off site.

C. Where unmarked utility lines or other underground obstructions or piping may be uncovered within the work area, notify the Landscape Architect or the agencies or service utility companies having jurisdiction thereof, and take necessary measures to prevent interruption of service (if live). Should such lines or services be damaged, broken, or interrupted through the Contractor's own negligence, those services shall be repaired immediately and restored by him at his own expense. Abandoned lines, meters, and boxes, obstructions or piping shall be removed, plugged, or capped in accordance with the requirements and approval of the agencies affected, or as directed by the Landscape Architect.

D. Maintain all excavated areas free from water throughout progress of the work. All surface or subsurface seepage encountered shall be run to temporary sumps located where required or directed. From the sumps, water shall be pumped out and legally disposed of in a manner that will keep the entire site reasonably dry and in an accessible and workable condition at all times.

3.4 FILLING AND GRADING

A. Where existing valve boxes, water meter pits or related items are found in areas to receive fill for berms, the Contractor shall notify the Owner so that he may make any required adjustments.

B. The placement of fills shall be done under the supervision of the Landscape Architect.

C. All areas to receive fills shall be scarified to a depth of six (6") inches and moisture conditioned as required to obtain the required compaction. Where slopes exceed one vertical to four horizontal the sub-grade shall be plowed, stepped, or benched in such a manner that fills will bond with base material.

D. Fill material shall be spread in uniform lifts of not more than eight (8") inches uncompacted thickness. Prior to commencing compaction, fills shall be brought to water content that will permit proper compaction by either aerating the material if it is too wet, or spraying the material with water if it is too dry. Thoroughly mix each lift before compaction to assure uniform distribution of water content. Bring all fills to suitable elevations above grade to provide for anticipated settlement and shrinkage thereof.

E. Fill shall not be dropped on any structure.

F. No fill or additional soil is to be installed in any protected tree zones or within the canopy or drip line of any existing trees.

G. No additional runoff into existing tree area or existing tree drip lines beyond the already occurring natural runoff is to be created by fill operations. Advise the Landscape Architect of conditions which will impact runoff into existing tree areas.

H. Grade to finished grade as required by the Drawings.

3.5 COMPACTION

A. Where fill is required, compact each layer of fill and scarify sub-grade to not less than eighty five (85%) percent maximum density in planting areas and as required by the engineer in paving areas.

B. Perform all compaction using compacting rollers, pneumatic or vibratory compactors, or other equipment and methods approved by the Owner.

3.6 PREPARATION OF SUBGRADE AND SPREADING OF TOPSOIL

A. The sub-grade soil shall be loosened to a depth of twelve (12") inches and graded to remove all ridges and depressions so that it will be everywhere paralleled to proposed finished grade. All stones over two (2") inches in any dimensions, sticks, rubbish and other extraneous matter shall be removed during this operation. No heavy objects except rollers shall be moved over lawn areas after the sub-grade soil has been prepared before topsoil is spread.

B. After the sub-grade soil has been prepared, topsoil from the stockpile areas shall be spread evenly therein to depth of six (6") inches by an approved method and the area then rolled with a 200 pound roller. No topsoil shall be spread in a frozen or muddy condition.

C. On all grass areas, the finished surface of the topsoil shall conform to the finished grade and shall be free from hollows or other inequalities, stones, sticks, and other extraneous matter.

3.7 FINISH GRADING

A. In areas to receive lawns not within the canopy of existing trees, the Contractor shall till, disc, or otherwise scarify the soil, removing all clods, stones, and related material one-half (1/2") inch or larger. Place and spread any additional material that may be required. Roll completely.

B. This Contractor shall be responsible for minor adjustments to the finished sub-grade if such treatment is required in the opinion of the Landscape Architect.

C. The Contractor may use machinery acceptable to the Landscape Architect to complete most of the work to re-establishing finished grade.

D. Hand-rake the surface, removing all clods and undesirable material greater than one-half (1/2") inch from ground surface. Fill all low spots and cut irregularities to the acceptance of the Landscape Architect. Roll the entire surface evenly with a 200 pound water ballast roller or other means acceptable.

E. During the finished grading operations, all swales and additional swales that may be required to drain areas where there are existing plant materials, shall be finished. In general, all grade adjustments shall be made so there are no areas that will have standing water.

F. To prevent excessive weed growth in the lawn areas, the Contractor should be prepared to immediately install the sod upon the approved, completed and acceptable finished grade.

G. Finish grade in existing tree areas which are to be graded shall be accomplished by light hand raking to a depth of ½" maximum and smoothing the area. No other grading, fill or other leveling is to occur

END OF SECTION

SECTION 321313

LANDSCAPE ARCHITECTURAL CEMENT CONCRETE PAVING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes materials, labor, apparatus, tools, equipment, temporary construction, transportation, and services necessary for and incidental to performing the proper completion of Work as required to make a complete Site Masonry Mortaring & Grouting installation, as shown on the Contract Drawings, and as specified herein this Section.

B. Work under this Section consists of, but is not necessarily limited to, furnishing and installing the following:

1. Cast-in-Place Concrete Ramps
2. Cast-in-Place Concrete Curbs and Gutters
3. Cast-in-Place Concrete Sidewalks (non-decorative or non-architectural)
4. Cast-in-Place Concrete Sub-slabs
5. Jointing (Expansion Joints, Contraction Joints, Isolation Joints, Keyway/Construction Joints and/or Architectural Score Joints)
6. Joint Sealants
7. Steel Dowels and Sleeves
8. Compacted Sub-Surface Materials.
9. Concrete Pavement Finishes.

C. Related Documents: The following Documents contain requirements that relate to Work in this Section:

1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
2. Section 044213 “Stone Slabs, Blocks and Boulders”.
3. Section 096340 "Site Stone Paving"
4. Section 116813 “Playground Equipment, Structures and Surfacing”.
5. Section 321316 "Decorative Cement Concrete Paving"
6. Section 321323 "Cast-in-Place Concrete for Landscape Architectural Elements"

1.2 DEFINITIONS AND APPLICABLE STANDARDS

A. References:

1. ASTM – American Society for Testing and Materials.
2. ANSI – American National Standards Institute.
3. ACI – American Concrete Institute.
4. PCA – Portland Cement Association.
5. CRSI – Concrete Reinforcing Steel Institute.
6. SWRI – Sealant, Waterproofing & Restoration Institute.
7. UBC – Uniform Building Code.
8. NRMCA – National Ready Mix Concrete Association.
9. ADAAG – American with Disabilities Act Accessibility Guidelines.
10. TAS – Texas Accessibility Standards

B. Definitions:

1. Cementitious Materials: Portland Cement alone or in combination with one or more of blended hydraulic cement, expansive hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume.
2. Percent Compaction: Per ASTM D1557, percentage of the maximum in-place dry density of the same material, as determined by Geotechnical Engineer.

C. Measurements:

1. PSI: Measurement, in pounds per square foot.
2. CU/FT: Measurement, in cubic-foot.

1.3 SUBMITTALS

A. General: Refer to Division 01 for project submittal requirements and timelines. If provided in hardcopy submittal booklets submit each item in this Article in required copies with four (4) copies for review by Landscape Architect. Three (3) copies shall be returned (One for Client, one for Owner and one for Contractor) and one copy maintained by Landscape Architect. Provide one (1) sets of Material Samples for review by the Landscape Architect unless requested otherwise.

B. Submittal Booklets: Each Submittal Booklet under this Section shall be tabbed into specific sections, containing clearly identified (through yellow highlighter or other specific identification methods) and legible information on the following information indicated in this Article.

C. Electronic Submittals: Electronic Submittal shall be provided in a single bound file, PDF format preferred, unless otherwise noted in Division 01.

D. Product/Material Data. Submit available Product/Material data, manufacturing source (name, address, and telephone number), and distributor source (name, address, and telephone number) for each type of material and product indicated:

1. Reinforcement and Forming Accessories.
2. Cementitious Materials.
3. Chemical Admixtures.
4. Jointing Materials and Systems, including Joint Sealants.
5. Finishing Materials (top-seeding materials, color hardeners, surface retarders, etc.)
6. Paving Surface Sealants.

E. Statement of Mix Design: Prepared by the batch plant servicing the Project, submit for each type or load delivered to Project. Include revised mix proportions when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments. Each Statement of Mix Design shall include following information:

1. Name, address, and telephone number of batch plant preparing Statement of Mix Design.
2. Date of Mix Design.
3. Project location.
4. Contractor requesting load delivery.
5. Mix Design Number.
6. Admixtures and Integral Color Admixtures (as required).
7. Gradations for sand and aggregate.
8. Material weights, specific gravity, and absolute volumes.
9. Water/Cementitious Materials Ratio (W/CM Ratio).
10. Slump.
11. PSI Rating.

F. Material Test Reports: Signed and stamped laboratory test reports for evaluation of concrete materials and mix design tests.

G. Material Samples: Samples of the material items indicated herein this Section shall be furnished for review and approval. Submit two (2) sets of samples that are consistent with the specified products for each item indicated:

1. One (1) pound sample of each seeded aggregate
2. One (1) pound sample of each aggregate.
3. One-foot (1'-0") section of each Joint Sealant material.

H. Scaled Shop Drawings for reinforcement, indicating type, size, layout, spacing, forms, shapes and placement for all concrete scope of Work reinforcing.

I. Qualification Data: Submit names for firms and persons specified in the "Quality Assurance and Control" Article to demonstrate their capabilities and experience on similar Concrete Paving installations. Include lists of completed projects with project names and addresses, names and addresses of Architects/Landscape Architects, Artists and Owners, and other information specified.

J. Submittals for Environmental Performance

1. Provide data indicating the percentage of post-industrial and post-consumer recycled content aggregate.
2. Provide product data indicating the percentage of post-consumer recycled steel content in each type of steel reinforcement as a percentage of the full product composite by weight.
3. Provide product data stating the location where all products were manufactured and where the raw materials were harvested, extracted or recovered.
4. For projects using FSC certified formwork, provide chain-of-custody documentation for all certified wood products.
5. For projects using reusable formwork, provide data showing how formwork is reused.
6. Provide MSDS product information data showing that form release agents meet any environmental performance goals such as using vegetable and soy based products.
7. Provide MSDS product information data showing that concrete adhesives meet any environmental performance goals including low emitting, low volatile organic compound products.

K. Field-Constructed Mock-up Samples:

1. General: Prior to the installation of Work under this Section, Contractor shall erect Field-Constructed Mock-up Samples for each type and pattern of Concrete Paving required for review and approval by the Landscape Architect, to verify selections made under the referee samples obtained by the Landscape Architect.
2. Build Field-Constructed Mock-up Samples to comply with the following requirements, using materials and same base construction including special features for form work, jointing, surface finishes, textures, color(s), and contiguous Work as indicated for the final unit of Work.

    a. Locate Field-Constructed Mock-up Samples on the Project Site in location(s) as directed by the Owner.
    b. Notify the Landscape Architect, in writing, at least one (5) days in advance of the dates and times when Field-Constructed Mock-up Samples will be erected.
    c. Demonstrate quality and range of aesthetic effects and workmanship in the Field-Constructed Mock-up Samples that will be produced in final unit of Work.

d. Obtain the Landscape Architect's acceptance of Field-Constructed Mock-up Samples, in writing, before start of installation of Work.
e. Retain and maintain Field-Constructed Mock-up Samples during construction in an undisturbed condition as a standard for judging the completed unit of Work.
f. When directed by the Owner, Contractor shall demolish and remove Field-Constructed Mock-up Samples from Project Site.

3. Size: Each Field-Constructed Mock-up Sample within this Section shall measure a minimum of three-feet (3'-0") wide x six-feet (6'-0") long to compare the aesthetics of material colors, textures, and finishes.
4. When the Landscape Architect determines that a Field-Constructed Mock-up Sample does not meet acceptable requirements, retain it for reference and cast another Field-Constructed Mock-up Sample (as required) until the Sample is accepted.
5. Accepted Field-Constructed Mock-up Samples will be the standard by which Work under this Section will be evaluated for technical and aesthetic merit. Accepted Field-Constructed Mock-up Samples are the prerequisite to the commencement of Work.

L. Minutes of Pre-Installation Conference, distributed and approved in writing as to the content of the conference by concerned parties in attendance.

M. No Work under this Section shall proceed until all information indicated herein this Article have been reviewed, accepted, and approved by the Landscape Architect, in writing.

1.4 QUALITY ASSURANCE AND CONTROL

A. Installer Qualifications: Engage an experienced Installer who has completed in the last two (2) years at least three (3) concrete paving installations similar in material, design, and extent to that indicated for this Project, and whose work has resulted in construction with a record of successful in-service performance.

B. Applicable Standards of Work:

1. Applicable specifications and recommended practices of American Concrete Institute (ACI), American Society for Testing and Materials (ASTM), The Uniform Building Code, with their individual designations, are to be considered part of this Specification. Refer to "Standards of Construction" under "Definitions & Applicable Standards" Article herein this Section.
2. Design and Control of Concrete Mixture, Thirteenth Edition, Portland Cement Association.
3. Manual of Standard Practice, Concrete Reinforcing Steel Institute (CRSI).
4. Sealants: The Professional's Guide, Sealant, Waterproofing & Restoration Institute (SWRI).

C. Single-Source Responsibility: Obtain each color, type, and variety of cementitious materials, aggregates (coarse and fine), chemical admixtures, water source, jointing materials, and other materials, from a single source, with resources to provide products and materials of consistent quality in appearance and physical properties without delaying the Work.

D. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM C1077 and ASTM E329 to conduct the testing indicated, as documented according to ASTM E548.

E. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixes.

F. Lines and Levels: To be established by a licensed Surveyor or registered Civil Engineer.

1.5 PREINSTALLATION CONFERENCE

A. Review methods and procedures related to concrete paving, including but not limited to, the following:

1. Concrete mixture design.
2. Quality control of concrete materials and concrete paving construction practices.
3. Mock-ups Requirements
4. Finishing and Surface intentions and requirements

B. Require representatives of each entity directly concerned with concrete paving to attend, including the following:

1. Contractor's superintendent.
2. Independent testing agency responsible for concrete design mixtures.
3. Ready-mix concrete manufacturer.
4. Concrete paving subcontractor.
5. Landscape Architect
6. Owner and Client Representative(s)

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in a timely manner to ensure un-interrupted progress of the Work.

B. Store materials in a dry and protected location. Protect reinforcing steel and dowels from rusting, deformation, staining, and moisture damage.

C. Store materials by methods that prevent damage and permit ready access for inspection and identification. Package cement delivered to the Project Site shall be in strong paper or jute bags with brand name and manufacturer's name stamped thereon. Store cement under cover. Remove packaged cement immediately from the Project Site should it become wet or show any signs of caking or deterioration.

D. Keep surface seeded/finishing materials dry prior to installation, as required.

1.7 PROJECT SITE CONDITIONS

A. Traffic Control: Maintain access for vehicular, bicycle, and pedestrian traffic as required for other construction activities. Access to the surrounding buildings shall also be unobstructed and maintained at all times to allow for entry and exit of emergency vehicles.

B. Establish and maintain required levels and grade elevations. Review installation procedures and coordinate Work herein this Section with other Work affected.

C. Do not place concrete during rain or adverse weather conditions without means to prevent damage. Conform to requirements specified hereinafter whenever concrete placement is required during cold or hot weather.

D. Water and Dust Control: Maintain control of concrete dust and water during duration of Contract. Do not permit adjacent planting areas to be contaminated. Clean up debris resulting from this work at the end of each day's work.

1.8 COORDINATION, SCHEDULING, AND OBSERVATIONS

A. Sequence and Scheduling: Notify contractors performing Work related to installation of Work under this Section in ample time so as to allow sufficient time for them to perform their portion of Work and that progress of Work is not delayed. Verify conditions at the Project Site for Work that affects installation under this Section. Coordinate items of other trades to be furnished and set in place, such as:

1. Irrigation Pipe Sleeves under paving. Refer to Section 328400 – Irrigation Systems.
2. Accessories embedded in the concrete, and for the provision of holes, openings, etc., necessary to the execution of the Work of the trades.
3. Future sleeves under paving.
4. Utility crossings

B. Field Measurements: Contractor shall take field measurements as required. Report major discrepancies between the Contract Drawings and field dimensions to the Landscape Architect prior to commencing Work.

C. Utilities: Determine location of above grade and underground utilities and perform Work in a manner which will avoid damage to utilities. Hand excavate, as required. Maintain grade stakes until removal is mutually agreed upon by parties concerned.

D. Excavation: When conditions detrimental to adequate installation operations are encountered, such as rubble fill, adverse drainage conditions, or obstructions, cease operations and notify Landscape Architect for further direction.

E. Environmental Conditions: Perform installation operations only when weather and soil conditions are suitable in accordance with locally-accepted practices.

F. Construction Site Observations: Periodic site observations shall be made by the Landscape Architect during the installation of Work under this Section for compliance with requirements for type, size, and quality. Landscape Architect retains right to observe Work for defects and to reject unsatisfactory or defective material at any time during progress of Work. Contractor shall remove rejected materials immediately from Project site. The Contractor shall request, in writing, at least one (1) week in advance of the time when mandatory site observation(s) by the Landscape Architect are required.

PART 2 - PRODUCTS

2.1 FORMS

A. Form Materials: Plywood, wood, MDO plywood, metal, metal-framed plywood, or other approved panel-type materials, of size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal.

1. Provide Forms that are full-depth, continuous, straight and free of distortions and defects, and level or sloping along exposed surfaces.
2. Provide Forms of sufficient strength and durability to hold concrete properly in place and prevent leakage of water from Forms.
3. Use flexible spring forms, laminated boards, or foam forms to form radius bends, as required.
4. No wood-textured finish from Forms will be permitted on exposed concrete unless specified as such.

B. 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 and finishes of concrete surfaces.

2.2 STEEL REINFORCEMENT

A. Steel Reinforcement Bars: Meet ASTM A615, Grade 60 deformed, clean and free of rust, dirt, grease or oils.

1. Provide material manufactured from 80-100% post-consumer recycled-content materials.

B. Steel Bar Mats: Meet ASTM A184 with ASTM A615, Grade 60 deformed bars; assembled with clips.

1. Provide material manufactured from 80-100% post-consumer recycled-content materials.

C. Steel Tie Wire: 16-gauge minimum, black annealed, plain cold-drawn steel conforming to ASTM A82, clean, and free of rust, dirt, grease or oils.

D. Construction/Expansion Joint Dowel Bars & Slip Dowel Sleeves:

1. Slip Dowel Sleeve System: A reusable base and plastic sleeve, manufactured from polypropylene plastic. Encase fifty percent (50%) of each dowel in a plastic sleeve to allow parallel lateral movement of each Dowel. Size of Sleeve to match size of Dowel.

a. Products & Manufacturers: Subject to compliance with requirements, provide products by one (1) of the following:
1) Speed Dowel, Greenstreak.
2) or equal (no known equal).
b. All dowels shall be held in place prior to pour with dowel chairs

E. Snap Ties: Snap-off metal of fixed length capable of leaving no metal within 1 1/2 in. of surface or causing fractures, spall, or other defects larger than one (1) in. diameter.

F. Hook Bolts: ASTM A307, Grade A internally and externally threaded. Design hook-bolt joint assembly to hold coupling against pavement form and in position during concreting operations, and to permit removal without damage to concrete or hook bolt.

G. Supports for Reinforcement: Lightweight, strong, non-corrosive, durable, and impervious to water. Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcement bars, welded wire fabric, and dowels in place, as manufactured from 100% recycled-content plastic or engineered resins from recycled ABS plastic, polycarbonates, and fiberglass.

2.3 CONCRETE MATERIALS

A. Portland Cement: Meet ASTM C150. Use one (1) brand of cement (single source) throughout the Project, unless otherwise acceptable to the Landscape Architect. Contractor shall verify the cement color with the Landscape Architect. Cement Type as follows:

1. Cement Type: Type I or II

B. Aggregate: ASTM C 33, uniformly graded, from a single source, gray in color only, with coarse aggregate as follows:

1. Class: 4M.
2. Maximum Aggregate Size: 3/4 inch nominal.
3. Do not use fine or coarse aggregates containing substances that cause spalling.

C. Water: Per ASTM C1602, from potable domestic source, free from deleterious materials such as oils, acids, and organic matter.

2.4 CHEMICAL ADMIXTURES FOR CONCRETE

A. General: Admixtures shall be certified by the Manufacturer to contain not more than 0.1 percent water-soluble chloride ions by mass of cement and to be compatible with other Admixtures. Use of Admixtures shall not relieve the Contractor of the designated concrete requirements, including strength.

B. Air-Entraining Admixture: Meet ASTM C260.

C. Water-Reducing Admixture: Meet ASTM C494, Type A.

D. Water-Reducing and Set Retarding Admixture: Meet ASTM C494, Type B and D.

E. Shrinkage-Reducing Admixture: Meet ASTM C157. Provide at dosage of 2% by weight of cement.

F. Integral Concrete Coloring Admixture: Provide materials specifically designed for use in ready-mix concrete, from a single source, and shall be like in color and visual appearance. Meet ASTM C979. Refer to Section 32 13 16 "Decorative Concrete Paving".

2.5 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 ounces / square yard 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. Products: Subject to compliance with requirements, provide one of the following:

1. Clear Waterborne Membrane-Forming Curing Compound which will not affect the final surface color or finish:

2.6 RELATED MATERIALS

A. Expansion Joint Materials:

1. W.R. Meadows or equal, Ceramar flexible foam expansion joint 1/4 inch
2. Metal keyway with 1/4 inch pull strip and foam expansion material.

2.7 CONCRETE MIXES AND PROPORTIONING

A. Prepare design mixes, proportioned according to ACI 211.1 and ACI 301, for each type and strength of normal-weight concrete determined by either laboratory trial mixes or field experience.

B. Use a qualified independent testing agency for preparing and reporting proposed mix designs for the trial batch method.

1. Do not use Owner's field quality-control testing agency as the independent testing agency.

C. Proportion mixes to provide concrete with the following properties:

1. Compressive Strength (28 Days): 3000 PSI
2. Maximum Water-Cementitious Materials Ratio: 0.45.
3. Slump Limit: 4 inches.
4. Slump Limit for Concrete Containing High-Range Water-Reducing Admixture: Not more than 8 inches after adding admixture to plant- or site-verified, 2- to 3-inch slump.
5. Cementitious Materials: Limit cementitious materials to Portland cement only. Fly ash or other Pozzolan is not permitted.

D. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content as follows within a tolerance of plus or minus 1.5 percent:

1. Air Content: 5.5 percent for 1-1/2-inch maximum aggregate.
2. Air Content: 6.0 percent for 1-inch and 3/4-inch maximum aggregate.

E. Concrete Mixing

1. Ready-Mixed Concrete: Comply with requirements and with ASTM C 94.

2.8 CONCRETE MIXING

A. Ready-Mixed Concrete: Comply with requirements and with ASTM C94.

B. When air temperature is between 85 deg. F. (30 deg. C.) and 90 deg. F. (32 deg. C.), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg. F. (32 deg. C.), reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 EXAMINATION

A. NO WORK UNDER THIS SECTION SHALL COMMENCE UNTIL SUBMITTALS UNDER THIS SECTION HAVE BEEN REVIEWED ACCORDINGLY BY THE LANDSCAPE ARCHITECT.

B. Prior to commencing Work under this Section, Contractor shall examine previously installed Work from other trades and verify that such Work is complete and to the point where Work herein may commence properly. Do not proceed with Work until unsatisfactory conditions have been corrected.

C. Contractor shall notify the Landscape Architect, in writing, on the anticipated commencement date and length of duration of the Work installation herein this section.

D. Examine exposed sub-grades and sub-base surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.

E. Surface Drainage:

1. Report in writing conflicts discovered on the site or prior Work done by others, which would prevent positive drainage.
2. Do not permit finished paving surfaces to vary more than 1/4 in. measured with a 10 ft. metal straightedge, except at grade changes.
3. No "birdbaths" or other surface irregularities shall be permitted. Properly correct irregularities.

3.2 PREPARATION

A. Templates: Use templates for anchor plates, bolts, inserts and/or other items embedded in concrete. Accurately secure so that they will not be displaced during placing of concrete.

B. Piping and Conduit: Do not embed piping, other than electrical conduit, in structural concrete. Locate conduit to maintain strength of structures at maximum. Verify size, length and location of electrical conduit.

C. Aggregate Base Course: Compact base course to thicknesses as shown on Contract Drawings or as indicated per the Geotechnical Report, to the relative compaction density as required per the Geotechnical Report. Aggregate Base Course shall be graded to the lines and levels indicated; no ruts or depressions shall be allowed.

D. Gravel Fill or Sand Beds: Re-compact disturbed gravel fill or sand beds and bring to correct elevation.

3.3 FORMWORK

A. Design, construct, erect, shore, brace, and maintain Formwork according to ACI 347 "Guide to Formwork for Concrete."

B. Contact Landscape Architect after form placement and prior to placement for review and field adjustment to form work.

C. Formwork shall be consistent with the orientation and pattern indicated on the Contract Drawings. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides to required lines, grades, and elevations. Install Formwork to allow continuous progress of Work and so that Formwork can remain in place at least twenty-four (24)-hours after concrete placement.

D. Coordinate locations of drainage piping requirements, irrigation piping stub-outs, electrical conduits, or other items scheduled to be embedded into cast concrete.

E. Check completed Formwork and screeds for grade and alignment to following tolerances:

1. Top of Forms: Not more than 1/8 inch in ten- (10) feet.
2. Vertical Face on Longitudinal Axis: Not more than 1/4 inch in ten-(10) feet.

F. Coat Formwork with Form Release Agent, as required, to ensure Formwork separates from cast concrete without damage to concrete.

1. Formwork surfaces shall be clean, dry, and free from contaminants (dirt, dust, rust, build-up, and existing form agents) prior to each use of Formwork
2. Prior to each use, Formwork that comes into direct contact with concrete shall be coated with Form Release Agent in accordance with the Manufacturer's written instructions.
3. Apply Form Release Agent in a uniform and even manner by low pressure spray, roller, or clean cloth, in accordance with the Manufacturer's written instructions.
4. Prior to coating new Formwork, apply one (1) or two (2) heavy coats to edges for waterproofing protection.
5. Excess Form Release Agent or dense form surfaces should be removed with a clean cloth.
6. Do not apply Form Release Agent to reinforcing steel.

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.

E. Install fabricated bar mats in lengths as long as practicable. Handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities, or replace units as required before placement. Set mats for a minimum 2-inch overlap of adjacent mats.

3.5 CONCRETE PLACEMENT

A. Preparation: Remove all free water from forms before concrete is deposited. Remove hardened concrete, debris, and foreign materials from interior surfaces of forms, exposed reinforcing, and from surfaces of mixing and conveying equipment.

B. Sub-Base: Sub-Base shall be free of ruts, holes, ridges, etc. Smooth and compact sub-base to an even plane.

C. Wetting: Wet wood forms sufficiently to tighten up cracks. Wet other materials sufficiently to reduce absorption and to help maintain concrete workability. Dampen earth sub-grade twenty-four (24) hours before placing concrete, but do not muddy. Re-roll where necessary for smoothness, and remove loose material from compacted sub-base surface prior to placing concrete.

D. Inspection: Before placing concrete, inspect and complete formwork installation, reinforcement steel, dowels/sleeves, and items to be embedded or cast in. Notify other trades to permit installation of their Work.

1. Reinforcement and Forms shall be secured firmly in position such that they will not be displaced during the placement of concrete.
2. Reinforcement Bars, Ties, and Welded Wire Reinforcement shall be completely encased in concrete, at a maximum of two-inches (2") from the edge of the concrete.
3. Do not place concrete around manholes or other structures until they are at the required finish elevation and alignment.

E. Comply with requirements and with recommendations in ACI 304R for measuring, mixing, transporting, and placing concrete.

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 by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures to consolidate concrete according to recommendations in ACI 309R.

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. When adjoining pavement lanes are placed in separate pours, do not operate equipment on concrete until pavement has attained eighty-five-percent (85%) of its fully hydrated compressive strength.

I. 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 air temperature has fallen to or is expected to fall below 40 deg. F. (4.4 deg. C.), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg. F. (10 deg. C.) and not more than 80 deg. F. (27 deg. C.) at point of placement.
2. Do not use calcium chloride, salt, or other materials containing anti-freeze agents or chemical accelerators, unless otherwise specified and approved in mix designs.

J. Hot-Weather Placement: Place concrete according to recommendations in ACI 305R and as follows when hot-weather conditions exist:

1. Cool ingredients before mixing to maintain concrete temperature at time of placement below 90 deg. F. (32 deg. C.). 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. Cover reinforcement steel with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
3. Fog-spray forms, reinforcement steel, and sub-grade just before placing concrete. Keep sub-grade moisture uniform without standing water, soft spots, or dry areas.

3.6 JOINTS

A. General: Refer to ACI 302 "Guide for Concrete Floor and Slab Construction" for work under this Article. Construct construction, isolation, expansion, and contraction joints and tool edgings 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 (1/2) hour, unless paving terminates at isolation joints.

1. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of pavement strips, unless otherwise indicated on the Contract Drawings.
2. Provide tie bars at sides of paving strips where indicated.
3. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Expansion Joints: Form expansion joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, walks, buildings, foundations, walls, other fixed objects, and in other locations as indicated on the Contract Drawings. Provide Expansion Joints at full depth of concrete paving where paving meets the vertical faces of buildings, structures, foundations, walls, etc.
1. Locate expansion joints at maximum intervals of twenty (20) feet, unless otherwise indicated on the Contract Drawings.
2. Extend joint fillers full width and depth of joint.
3. Provide Construction Joint Dowel Bars at the spacing distances indicated in the Contract Drawings.
4. Terminate Joint Filler less than 1/2 inch or more than one-inch (1") below finished surface if joint sealant is indicated.
5. Place top of Joint Filler flush with finished concrete surface if joint sealant is not indicated.
6. Furnish joint fillers in one (1)-piece lengths. Where more than one (1) length is required, lace or clip joint-filler sections together.
7. Protect top edge of joint filler during concrete placement with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.

D. Contraction Joints and Isolation Joints: Form weakened-plane contraction joints and isolation joints, sectioning concrete into areas as indicated on the Construction Drawings, or at spacing intervals as recommended by the PCA.

1. General Methodology: Contraction Joints shall be placed in Concrete Paving to minimize the occurrence of random cracking on the surface due to drying shrinkage or stress loading and to reduce the width of concrete cracks should they occur. When not indicated on the Contract Drawings, Contraction Joints shall be placed at 24x the thickness of the concrete paving.
2. Tooled (Grooved) Contraction Joints:

    a. Form Tooled (Grooved) Joints in fresh concrete after initial floating using a jointer to cut the groove so that a smooth, uniform impression is obtained. Strike joints before and after floating and troweling.
    b. Perform in a continuous operation to avoid misalignment of joints. Use snap-lines and forms, as required, to achieve consistent lines. Re-form crooked or misaligned joints at no cost to Owner.
    c. Tooled Radius of Joint Tool

        1) Radius: 1/8 inch.

    d. Depth: Construct depth equal to a minimum of one-fifth (1/5) of the concrete slab thickness.

3. Saw-Cut Contraction Joints:

    a. Construct Saw-Cut Contraction Joints with a circular power saw, equipped with a new, shatterproof abrasive or diamond-tipped blade. Cut 3/16-inch-wide joints (maximum width of saw-blade) into concrete surface. Cutting action shall not tear, abrade, spall, shatter, or otherwise damage the surface.

b. Saw-cut concrete surface when successful jointing results can be achieved and prior to uncontrolled random contraction cracking of concrete occurs.

1) Early-entry Sawcuts: When used, provide sawcuts into fresh concrete as indicated on the Contract Drawings.

c. Perform saw-cut joints cleanly and smoothly, to a constant and equal depth, in a continuous consistent line, with no over-cutting.
d. Depth:

1) Contraction Joints: Construct depth equal to a minimum of one-fifth (1/5) of the concrete slab thickness.
2) Isolation Joints: Construct depth equal to the full depth of the concrete thickness.

e. Perform in as continuous an operation as possible, to avoid misalignment of joints. Use chalk lines, forms, or templates as required, to achieve consistent lines.
f. Use a hand grinder with a 4-inch diamond blade to saw-cut up to vertical edges such as walls, steps, curbs and columns. Do not over-cut into vertical surfaces or adjacent concrete surfaces.

E. Edging: Tool edges of pavements, gutters, headers, curbs, joints in concrete, and other locations, as required, after initial floating, with an edging tool to the following radius. Repeat tooling of edges after applying surface finishes. Eliminate tool marks on concrete surfaces.

1. Radius: as indicated on the Contract Drawings

3.7 CONCRETE FINISHES

A. General:

1. Finished pavement surfaces indicated herein this Section shall be "slip-resistant", per the requirements outlined in and per ADAAG 4.5.1.

a. The minimum coefficient of friction shall meet or exceed 0.8 on exterior and 0.6 on interior surfaces.
b. Pavement surfaces shall have the following finish on all surfaces less than six percent (6%) slope:

1) Medium Broom Textured Finish, or a textured finish as specified which is equivalent to the finished texture of a Medium Broom Textured Finish.

c. Pavement surfaces shall have the following finish on all surfaces greater than six percent (6%) slope:

1) Heavy Broom Textured Finish, or a textured finish as specified which is equivalent to the finished texture of a Heavy Broom Textured Finish.

d. Color(s) and finish(es) specified herein shall match referee samples and field-constructed mock-up samples as approved by the Landscape Architect.
e. Wetting of concrete surfaces during screeding, initial floating, or finishing operations is strictly prohibited.

B. Broom-Textured Finish: Match Referee Sample, as acquired by the Landscape Architect, and the approved Field Constructed Mock-up, to compare for color, texture, finish, and other characteristics relating to aesthetic effects.
   1. Applications: Refer to the Cast-in-Place Concrete Paving Schedule indicated herein this Section for requirements. Provide in areas as indicated on Contract Drawings.
   2. Texture:

      a. Fine-to-Medium-Textured Broom Finish: Provide a fine-to-medium texture finish by striating the freshly-cast float-finished concrete surface with a soft bristle broom, perpendicular to line of traffic, to provide a uniform, consistent, fine-line texture.
      b. Medium-to-Coarse-Textured Broom Finish: Provide a medium-to-coarse-texture finish by striating the freshly-cast float-finished concrete surface 1/16 to 1/8 inch deep with a stiff-bristled broom, perpendicular to line of traffic, to provide a uniform, consistent, coarse-line texture.

   3. Provide contraction jointing and edging, as required, in the locations indicated in the Contract Drawings, and of the type(s) indicated herein this Section. Early-entry jointing of concrete may be required to prevent premature cracking of finished surfaces.
   4. After concrete is fully hydrated (approx. 30-days), seal broom texture finished concrete surface with two (2) coats of Sealer as specified herein this Section, per the Manufacturer's latest printed instructions.

      a. Refer to the Cast-in-Place Concrete Paving Schedule indicated herein this Section for Sealer requirements.

C. Acid-Etch Textured Finish: Match Referee Sample, as acquired by the Landscape Architect, and the approved Field Constructed Mock-up, to compare for color, texture, finish, and other characteristics relating to aesthetic effects.

   1. Applications: Refer to the Cast-in-Place Concrete Paving Schedule indicated herein this Section for requirements. Provide in areas as indicated on Contract Drawings.
   2. Float-finish the concrete surface to provide a uniform, consistent texture.
   3. Provide contraction jointing and edging, as required, in the locations indicated in the Contract Drawings, and of the type(s) indicated herein this Section. Early-entry jointing of concrete may be required to prevent premature cracking of finished surfaces. Do not use curing compounds.
   4. Approximately one (1) to two (2) days after the concrete has been cast, evenly spray-apply a muriatic acid wash (a diluted solution of approximately a 10:1 ratio of water to acid) or a top-cast solution to the concrete surface. Prevailing weather conditions will affect timing and strength of the acid-wash solution, and in cold and rainy conditions, more time may be needed for the concrete to start the hydration process before the acid-wash solution can be applied.
   5. Handle acid and acid wash solution with care to avoid spillage and staining. Protect areas adjacent to the Work from over-spray of the acid solution. Provide neutralizing solution(s) to the acid solution, as needed, to prevent chemicals from damaging or contaminating adjoining planting areas.
   6. After acid has adequately etched the concrete surface, gently flush the surface with fresh water to remove the acid solution. Do not use high pressure washed to apply water or to remove the acid solution from the surface.
   7. After concrete is fully hydrated (approx. 30-days), seal acid etched concrete finished surface with two (2) coats of Sealer as specified herein this Section, per the Manufacturer's latest printed instructions.
      a. Refer to the Cast-in-Place Concrete Paving Schedule indicated herein this Section for Sealer requirements.

D. Sandblast Textured Finish: Match Referee Sample, as acquired by the Landscape Architect, and the approved Field Constructed Mock-up, to compare for color, texture, finish, and other characteristics relating to aesthetic effects.

1. Applications: Refer to the Cast-in-Place Concrete Paving Schedule indicated herein this Section for requirements. Provide in areas as indicated on Contract Drawings.
2. Work shall conform to CAL OSHA /MSDS for application and clean up procedures.
3. After concrete is fully hydrated (approx. 30-days), provide a sandblast-textured finish to the exposed concrete surfaces, revealing the desired aggregates, with the following surface texture:

    a. Light Sandblast Texture.
    b. Medium Sandblast Texture:
    c. Heavy Sandblast Texture.

4. Provide jointing in the locations indicated in the Contract Drawings.
5. Seal sandblast texture finished concrete surface with two (2) coats of Sealer as specified herein this Section, per the Manufacturer's latest printed instructions.

    a. Refer to the Cast-in-Place Concrete Paving Schedule for Sealer requirements.

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. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

3.9 INSTALLATION OF JOINT SEALANTS

A. Provide a Joint Sealant that is compatible with the substrate material(s) to which it is being applied. Do not use a Joint Sealant that has exceeded shelf life or has jelled and can not be discharged in a continuous flow from the application tool.

B. Ambient Temperature Criteria: The ambient temperature shall be within the limits of 40d. F. and 90d. F. when the Joint Sealant is being applied.

C. Sealant Installation Standard: Comply with recommendations of ASTM C1193 for use of Joint Sealants as applicable to materials, applications and conditions indicated.

D. Surface Preparation of Joints:

1. Remove foreign material from joint substrates which could interfere with adhesion of Joint Sealant, including dust, surface dirt, dirt, moisture, water repellents, grease, oil, wax, lacquer, paint, waterproofing, or other foreign matter that would tend to destroy or impair adhesion.
2. Remove oil and grease with solvent. Surfaces must be wiped dry with clean cloths.
3. Clean porous surfaces, by brushing, grinding, blast cleaning, mechanical abrading, or acid washing to produce a clean, sound substrate. Remove loose particles remaining from cleaning operations by vacuuming or blowing out joints.
4. Where surfaces have been treated with curing compounds, oil, or other such materials, remove materials by sandblasting or wire brushing.

5. Clean non-porous surfaces by chemical cleaners or other means which are not harmful to substrates or leave residues capable of interfering with adhesion of Joint Sealants.

E. Sealant Preparation: Do not add liquids, solvents, or powders to the Joint Sealant material (for single-component materials). Where specified, mix multi-component elastomeric Joint Sealants in accordance with manufacturer's instructions.

F. Primer: Immediately prior to application of the Joint Sealant, clean out loose particles from joints. Where recommended by the sealant manufacturer, apply Primer to joints in accordance with sealant manufacturer's instructions. Do not apply Primer to exposed finish surfaces. Do not allow spillage or migration of Primer onto adjoining surfaces.

G. Installation of Sealant Backings: Install sealant backings to comply with the following requirements:

1. Install Joint Fillers to provide sealant support for optimum performance cross-sectional shapes and depths.

   a. Do not leave gaps between ends of Joint Fillers.
   b. Do not stretch, twist, puncture or tear Joint Fillers.
   c. Remove absorbent Joint Fillers which have become wet prior to sealant application and replace with dry material.

2. Install Bond Breaker to the back or bottom of the joint cavity (between sealants and joint-fillers, compression seals or back of joints where required), as recommended by the Joint Sealant manufacturer, for each type of joint and sealant used, to prevent "third-side" adhesion of the Joint Sealant to the back of the joint. Carefully apply the Bond Breaker to avoid contamination of adjoining surfaces or breaking bond with surfaces other than those covered by the Bond Breaker.

H. Installation of Joint Sealants:

1. Install Joint Sealant after concrete substrate material has been cast and allowed to cure. Remove protective cap from preformed Joint Filler. Remove any excess Joint Filler material that will inhibit an adequate depth and bond of the Joint Sealant material.
2. Place masking tape where required along the joint cavity to prevent contact of the Joint Sealant with adjoining surfaces. Remove masking tape within ten (10) minutes after joint has been filled and tooled.
3. Apply the Joint Sealant in accordance with the manufacturer's printed instructions with an application tool having a nozzle that fits the width of the joint cavity. Install Joint Sealant by proven techniques to contact and solidly full wet joint substrates, completely filling the recesses provided for each joint configuration, providing uniform, optimum performance cross-sectional shapes and depths. Do not allow spillage or migration of Joint Sealant onto adjoining surfaces.

I. Tooling of Non-Sag Joint Sealants: Tool Non-Sag Joint Sealants to form smooth, uniform beads of configuration indicated, free of wrinkles, streaks, gouges, boils, air holes, etc. and to ensure contact and adhesion of the Joint Sealant with the sides of the joint. Remove excess Joint Sealants from surfaces adjacent to joint. Do not use tooling agents which discolor Joint Sealants or adjacent surfaces or are not approved by Sealant Manufacturer.

J. Sanding of Joint Sealant: Lightly apply dry sand to cover freshly-poured elastic Joint Sealant material. When Joint Sealant has hardened, remove excess sand that has not bonded to Joint Sealant.

K. Protection and Curing:

1. Protect installed Joint Sealants during and after curing period from contact with contaminating substances or from damage.
2. Cut out and remove damaged or deteriorated Joint Sealers and reseal joints with matching new materials.
3. Clean off excess Joint Sealants or sealant smears adjacent to joints as Work progresses by methods and with cleaning materials approved by the Sealant Manufacturer.

3.10 REPAIRS AND PROTECTION

A. Remove in its entirety (from joint to joint) and replace concrete pavement that is broken, cracked, damaged, or defective, or concrete which does not meet requirements of this Section.

B. Drill test cores where directed by the Landscape Architect, when necessary, to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement areas with Portland cement concrete bonded to pavement with epoxy adhesive.

C. Protect concrete from damage. Exclude traffic from pavement for at least fourteen (14) days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials as they occur.

D. Maintain concrete pavement free of stains, discoloration, dirt, and other foreign material. Sweep concrete pavement not more than two (2) days before date scheduled for Substantial Completion inspections.

END OF SECTION

SECTION 321316

DECORATIVE CONCRETE PAVING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes materials, labor, apparatus, tools, equipment, temporary construction, transportation, and services necessary for and incidental to performing the proper completion of Work as required to make a complete Site Masonry Mortaring & Grouting installation, as shown on the Contract Drawings, and as specified herein this Section.

B. Work under this Section consists of, but is not necessarily limited to, furnishing and installing the following:

1. Standard Color Concrete with architectural finishes.
2. Integral Color for concrete paving.
3. Surface Retardant for concrete paving.

C. Related Documents: The following Documents contain requirements that relate to Work in this Section:

1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section:
2. Section 312213 “Rough Grading”.
3. Section 312219 “Landscape and Fine Grading”.
4. Section 321313 "Landscape Architectural Cement Concrete Paving".
5. Section 321323 "Cast-in-Place Concrete for Landscape Features".

1.2 DEFINITIONS AND APPLICABLE STANDARDS

A. References:

1. ASTM – American Society for Testing and Materials.
2. ANSI – American National Standards Institute.
3. ACI – American Concrete Institute.
4. PCA – Portland Cement Association.
5. CRSI – Concrete Reinforcing Steel Institute.
6. SWRI – Sealant, Waterproofing & Restoration Institute.
7. UBC – Uniform Building Code.
8. NRMCA – National Ready Mix Concrete Association.
9. ADAAG – American with Disabilities Act Accessibility Guidelines.
10. TAS – Texas Accessibility Standards

B. Definitions:
1. Cementitious Materials: Portland Cement alone or in combination with one or more of blended hydraulic cement, expansive hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume.
2. Percent Compaction: Per ASTM D1557, percentage of the maximum in-place dry density of the same material, as determined by Geotechnical Engineer.

C. Measurements:

1. PSI: Measurement, in pounds per square foot.
2. CU/FT: Measurement, in cubic-foot.

1.3 SUBMITTALS

A. General: Refer to Division 01 for project submittal requirements and timelines. If provided in hardcopy submittal booklets submit each item in this Article in required copies with four (4) copies for review by Landscape Architect. Three (3) copies shall be returned (One for Client, one for Owner and one for Contractor) and one copy maintained by Landscape Architect. Provide one (1) sets of Material Samples for review by the Landscape Architect unless requested otherwise.

B. Submittal Booklets: Each Submittal Booklet under this Section shall be tabbed into specific sections, containing clearly identified (through yellow highlighter or other specific identification methods) and legible information on the following information indicated in this Article.

C. Electronic Submittals: Electronic Submittal shall be provided in a single bound file, PDF format preferred, unless otherwise noted in Division 01.

D. Product/Material Data. Submit available Product/Material data, manufacturing source (name, address, and telephone number), and distributor source (name, address, and telephone number) for each type of material and product indicated:

1. Reinforcement and Forming Accessories.
2. Cementitious Materials.
3. Integral Aggregates (Coarse and Fine).
4. Chemical Admixtures.
5. Jointing Materials and Systems, including Joint Sealants.
6. Finishing Materials (top-seeding materials, color hardeners, surface retarders, etc.)
7. Paving Surface Sealants.

E. Statement of Mix Design: Prepared by the batch plant servicing the Project, submit for each type or load delivered to Project. Include revised mix proportions when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments. Each Statement of Mix Design shall include following information:

1. Name, address, and telephone number of batch plant preparing Statement of Mix Design.
2. Date of Mix Design.
3. Project location.
4. Contractor requesting load delivery.
5. Mix Design Number.
6. Admixtures (as required).
7. Integral Color Admixtures (as required).
8. Gradations for sand and aggregate.
9. Material weights, specific gravity, and absolute volumes.
10. Water/Cementitious Materials Ratio (W/CM Ratio).
11. Slump.
12. PSI Rating.

F. Material Test Reports: Signed and stamped laboratory test reports for evaluation of concrete materials and mix design tests.

G. Material Samples: Samples of the material items indicated herein this Section shall be furnished for review and approval. Submit two (2) sets of samples that are consistent with the specified products for each item indicated:

1. One (1) pound sample of each seeded aggregate
2. One (1) pound sample of each aggregate
3. One-foot (1'-0") section of each Joint Sealant material.

H. Scaled Shop Drawings for reinforcement, indicating type, size, layout, spacing, forms, shapes and placement for all concrete scope of Work reinforcing.

I. Samples for Initial Selection: For each type of product, ingredient, or admixture requiring color, pattern, or texture selection.

J. Samples for Verification: For each type of exposed color, pattern, or texture indicated.

K. Miscellaneous Submittals:

1. Design Mixtures: For each decorative concrete paving mixture. Include alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

L. Qualification Data: For qualified Installer and ready-mix concrete manufacturer.

M. Material Certificates: For the following, from manufacturer:

1. Cementitious materials.
2. Steel reinforcement and reinforcement accessories.
3. Fiber reinforcement.
4. Admixtures.
5. Curing compounds.
6. Applied finish materials.
7. Bonding agent or epoxy adhesive.
8. Joint fillers.

N. Material Test Reports: For each of the following:

1. Aggregates.

O. Field quality-control reports.

1.4 QUALITY ASSURANCE AND CONTROL

A. Installer Qualifications: An employer of workers trained and approved by manufacturer of decorative concrete paving systems or with experience in material application of one (1) or more years.

B. 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.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities" (Quality Control Manual - Section 3, "Plant Certification Checklist").

C. 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.

D. Source Limitations: Obtain decorative concrete paving products and each type or class of cementitious material of the same brand from same manufacturer's plant, and obtain each aggregate from single source.

E. Concrete Testing Service: Engage a qualified testing agency to perform material evaluation tests and to design concrete mixtures.

F. ACI Publications: Comply with ACI 301 (ACI 301M) unless otherwise indicated.

G. Mockups: Refer to Contract Drawings for Mock-up requirements or at minimum provide the following:

1. Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
2. Build mockups of full-thickness sections of decorative concrete paving to demonstrate typical joints; surface color, pattern, and texture; curing; and standard of workmanship.
3. Build mockups of decorative concrete paving in the location and of the size indicated or, if not indicated, build mockups where directed by Landscape Architect and not less than 4’-0” by 4’-0” at full depth.
4. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Landscape Architect specifically approves such deviations in writing.
5. Approved mockups may become part of the completed Work if approved by Landscape Architects.

H. Lines and Levels: To be established by a licensed Surveyor or registered Civil Engineer.

I. Design of Concrete Mix: Employ approved commercial testing laboratory to design concrete mixes as follows:

1. Minimum Compressive Strength at 28 Days:

a. Pedestrian pavement: 3000 psi
b. Vehicular Pavement: 3000 psi

2. Concrete Slump:

a. Minimum: Two (2) inches
b. Maximum: Four (4) inches

3. Maximum Water-Cement Ratio:

a. Foundations: 6.75 gallons per sack of cement

J. Colored Concrete: Achieve color by integrally mixing coloring agent with concrete. Refer to finish schedule for concrete finishes and colors.

K. Permits, Fees, Bonds, and Inspections: Contractor shall arrange and pay for permits, fees, bonds, and inspections necessary to perform and complete Work under this Section.

1.5 PRE-INSTALLATION CONFERENCE

A. Review methods and procedures related to concrete paving, including but not limited to, the following:

1. Concrete mixture design.
2. Quality control of concrete materials and concrete paving construction practices.
3. Mock-ups requirements
4. Finishing and Surface intentions and requirements

B. Require representatives of each entity directly concerned with concrete paving to attend, including the following:

1. Contractor's superintendent.
2. Independent testing agency responsible for concrete design mixtures.
3. Ready-mix concrete manufacturer.
4. Concrete paving subcontractor.
5. Landscape Architect
6. Owner and Client Representative(s)

1.6 PROJECT CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

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 of a radius of 100 feet or less. Do not use notched and bent forms.

B. Forms for Textured Finish Concrete: Units of face design, size, arrangement, and configuration indicated. Provide solid backing and form supports to ensure stability of textured form liners.

C. 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. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420); deformed.

B. Steel Bar Mats: ASTM A 184/A 184M; with ASTM A 615/A 615M, Grade 60 (Grade 420), deformed bars; assembled with clips.

C. Plain-Steel Wire: ASTM A 82/A 82M, as drawn.

D. 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.

E. 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 the same type, brand, and source, throughout Project:

1. Portland Cement: ASTM C 150, gray or white portland cement Type I or Type II as required to meet surface retardant manufacturer requirements.

a. Fly Ash: ASTM C 618, Class C or F.
b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.

2. Blended Hydraulic Cement: ASTM C 595, Type IP, portland-pozzolan cement.

B. Normal-Weight Aggregates: ASTM C 33, uniformly graded. Provide aggregates from a single source.

1. Maximum Aggregate Size: ¾ 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 [colored].

F. Color Pigment: ASTM C 979, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, nonfading, and resistant to lime and other alkalis.

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

a. Davis Colors.
b. Dayton Superior Corporation.
c. Scofield, L. M. Company.
d. Solomon Colors, Inc.
e. Specialty Concrete Products, Inc.
f. SureCrete Design Products.
g. Or other, as approved by Landscape Architect.

2.4 FIBER REINFORCEMENT

A. Synthetic Fiber: Monofilament polypropylene fibers engineered and designed for use in decorative concrete paving, complying with ASTM C 1116/C 1116M, Type III, 1/2 to 1-1/2 inches long.

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

a. Monofilament Fibers:

1) Grace, W. R. & Co. - Conn.; Grace MicroFiber.
2) Or other, as approved by Landscape Architect.

2.5 ARCHITECTURAL SURFACE RETARDANTS

A. Surface Retardant Application: Water-based surface applied top-surface retarder for surface finish development in various levels of aggregate exposure and texturing.

1. Products: Subject to compliance with requirements, provide the following:

a. Grace Top-Cast Top Surface Retardant by W.R. Grace and Company, 877-423-6491 in level or finish as indicated in the “Finish Schedule” in the Contract Drawings.
b. Or other, as approved by Landscape Architect.

2.6 INTEGRAL COLOR

A. Product: The color together with color conditioning admixtures shall be a single – component, colored, water – reducing, set controlling admixture, factory formulated and packaged in cubic yard dosage increments, not multiple additives and pigments added separately into the mix. It shall comply with ASTM C 494 and ASTM C979.

1. Refer to finish schedule on Contract Drawings for Manufacturer/Type.
2. If other manufacturers pigment colors are used, concrete contractor shall provide mix design with water reducing and setting agents to comply with ASTM C494 and ASTM C979.
3. Color: As indicated on the drawings. Match approved sample

B. Do not place disintegrating bags in the hopper, carefully pour the contents of the bag at the approved rate and scrape any excess into the concrete mixer, discard the bags. Wear recommended safety equipment during color addition and avoid pigment and color agent dust.

2.7 CHEMICAL ADMIXTURES FOR CONCRETE

A. General: Admixtures shall be certified by the Manufacturer to contain not more than 0.1 percent water-soluble chloride ions by mass of cement and to be compatible with other Admixtures. Use of Admixtures shall not relieve the Contractor of the designated concrete requirements, including strength.

B. Air-Entraining Admixture: Meet ASTM C260.

C. Water-Reducing Admixture: Meet ASTM C494, Type A.

D. Water-Reducing and Set Retarding Admixture: Meet ASTM C494, Type B and D.

E. Shrinkage-Reducing Admixture: Meet ASTM C157. Provide at dosage of 2% by weight of cement.

F. Integral Concrete Coloring Admixture: Provide materials specifically designed for use in ready-mix concrete, from a single source, and shall be like in color and visual appearance. Meet ASTM C979.

2.8 RELATED MATERIALS

A. Expansion Joint Materials:

1. Expansion Joint:

a. W.R. Meadows or equal, Ceramar flexible foam expansion joint 1/4 inch
b. Metal keyway with 1/4 inch pull strip and foam expansion material.

2.9 CURING AND SEALING MATERIALS

A. Curing Paper: Nonstaining, waterproof paper, consisting of two layers of kraft paper cemented together and reinforced with fiber, and complying with ASTM C 171.

B. Evaporation Retarder: Waterborne, monomolecular, film forming, manufactured for application to fresh concrete.

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

a. BASF Construction Chemicals, LLC; Confilm.
b. Brickform; Evaporation Retarder.
c. Conspec by Dayton Superior; Aquafilm.
d. Dayton Superior Corporation; Sure Film (J-74).
e. Kaufman Products, Inc.; VaporAid.
f. Meadows, W. R., Inc.; EVAPRE.
g. Sika Corporation, Inc.; SikaFilm.
h. SpecChem, LLC; Spec Film.
i. Symons by Dayton Superior; Finishing Aid.
j. Or other as approved by landscape architect.

C. Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type I, Class B, manufactured for colored concrete.

1. For integrally colored concrete, curing compound shall be pigmented type approved by coloring admixture manufacturer.
2. For concrete indicated to be sealed, curing compound shall be compatible with sealer.

D. Clear, Solvent-Borne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type I, Class A, manufactured for use with colored concrete.

E. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type I, Class A, manufactured for use with colored concrete.

F. Clear Acrylic Sealer: Manufacturer's standard, waterborne, non-yellowing and UV-resistant, membrane-forming, medium-gloss, acrylic copolymer emulsion solution, manufactured for colored concrete, containing not less than 15 percent solids by volume.

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

   a. Bomanite Corporation; Bomanite Hydrocoat.
   b. Brickform; Satin-Seal.
   c. Scofield, L. M. Company; CEMENTONE Clear Sealer.
   d. Or others as approved by landscape architect.

2.10 RELATED MATERIALS

A. Joint Fillers: ASTM D 1752, cork or self-expanding cork in preformed strips.

B. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

C. 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 I and II, non-load bearing for bonding hardened or freshly mixed concrete to hardened concrete.

D. Polyethylene Film: ASTM D 4397, 1 mil (0.025 mm) thick, clear.

2.11 CONCRETE MIXTURES

A. Prepare design mixtures, proportioned according to ACI 301 (ACI 301M), 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.

B. Proportion mixtures to provide normal-weight concrete with the following properties:

1. Compressive Strength (28 Days): 3000 psi (20.7 MPa).
2. Maximum Water-Cementitious Materials Ratio at Point of Placement: 0.50
3. Slump Limit: 5 inches (125 mm) plus or minus 1 inch (25 mm).

C. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:

1. Air Content: 4-1/2 percent plus or minus 1.5 percent for 1-1/2-inch (38-mm) nominal maximum aggregate size.
2. Air Content: 4-1/2 percent plus or minus 1.5 percent for 1-inch (25-mm) nominal maximum aggregate size.

D. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

E. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.
1. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.

F. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:

1. Fly Ash or Pozzolan: 25 percent.
2. Combined Fly Ash or Pozzolan, and Ground Granulated Blast-Furnace Slag: 50 percent, with fly ash or pozzolan not exceeding 25 percent.

G. Synthetic Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than 1.0 lb/cu. yd.

H. 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.

2.12 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 (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 EXAMINATION

A. NO WORK UNDER THIS SECTION SHALL COMMENCE UNTIL SUBMITTALS UNDER THIS SECTION HAVE BEEN REVIEWED ACCORDINGLY BY THE LANDSCAPE ARCHITECT.

B. Prior to commencing Work under this Section, Contractor shall examine previously installed Work from other trades and verify that such Work is complete and to the point where Work herein may commence properly. Do not proceed with Work until unsatisfactory conditions have been corrected.

C. Contractor shall notify the Landscape Architect, in writing, on the anticipated commencement date and length of duration of the Work installation herein this section.

D. Examine exposed sub-grades and sub-base surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.

E. Proof-roll prepared sub-base surface below concrete paving to identify soft pockets and areas of excess yielding.

1. Completely proof-roll sub-base in one direction. Limit vehicle speed to 3 mph (5 km/h).
2. Proof-roll with a pneumatic-tired and loaded, 10-wheel, tandem-axle dump truck weighing not less than 15 tons.
3. Correct sub-base with soft spots and areas of pumping or rutting exceeding depth of 1/2 inch according to requirements in Section 31 22 13 "Rough Grading."

3.2 PREPARATION

A. Remove loose material from compacted sub-base surface immediately before placing concrete.

B. Protect adjacent construction from discoloration and spillage during application of color hardeners, release agents, stains, curing compounds, and sealers.

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 fabricated bar mats in lengths as long as practicable. Handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities, or replace units as required before placement. Set mats for a minimum 2-inch overlap to adjacent mats.

3.5 JOINTS

A. General: Form construction, expansion, 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. Butt Joints: Use epoxy bonding adhesive at joint locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
3. Keyed Joints: Provide preformed keyway-section forms or bulkhead forms with keys unless otherwise indicated. Embed keys at least 1-1/2 inches into concrete.
4. Dowelled 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. Expansion Joints: Form expansion joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, walks, other fixed objects, and where indicated.

1. Locate expansion joints at intervals of 60 feet unless otherwise indicated.
2. Extend joint fillers full width and depth of joint.
3. Terminate joint filler not less than 1/2 inch (13 mm) or more than 1 inch (25 mm) 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. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3-mm-) wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.

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.

E. Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool to a 1/4-inch where indicated or approved radius. Repeat tooling of edges after applying surface finishes. Eliminate edging tool marks on concrete surfaces.

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 sub-base surface and steel reinforcement before placing concrete. Do not place concrete on frozen surfaces.

C. Moisten sub-base 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 (ACI 301M) 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 (ACI 301M)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. 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 (4.4 deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F (10 deg C) and not more than 80 deg F (27 deg C) at point of placement.
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.

K. Hot-Weather Placement: Comply with ACI 301 (ACI 301M)and as follows when hot-weather conditions exist:

1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F (32 deg C) 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 sub-grade just before placing concrete. Keep sub-grade 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.

3.8 INTEGRALLY COLORED CONCRETE FINISH

A. Integrally Colored Concrete Finish: After final floating, apply the following finish:

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 (1.6 to 3 mm) deep with a stiff-bristled broom, perpendicular to line of traffic.

3.9 SURFACE RETARDENT APPLICATION

A. Protect adjacent surfaces, vertical and horizontal, from receipt of application.

B. Prepare product, shaking application to thoroughly mix product contents prior to application per manufacturer.

C. Apply product evenly and at concrete mix curing time, equally and consistently at rate per manufacturer using sprayer applicator clean and rinsed of previous products.

D. Allow product to dry at rate per manufacturer, cover as required from adverse weather conditions until time as noted by manufacturer as protected.

E. Remove product upon proper cure time as described by manufacturer to reach approved, through mock-up, sample to meet texture with pressure washing equipment. Contractor to verify pressure, nozzle type and hold off distance with manufacturer.

F. Refer to manufacturer for further information on product cure time, rate and removal procedures.

3.10 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 Compound: Apply curing compound immediately after final finishing. 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 application. Maintain continuity of coating, and repair damage during curing period.

1. Cure integrally colored concrete with a pigmented curing compound.

F. Curing and Sealing 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. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

G. Curing Paper: Cure with unwrinkled curing paper in pieces large enough to cover the entire width and edges of slab. Do not lap sheets. Fold curing paper down over paving edges and secure with continuous banks of earth to prevent displacement or billowing due to wind. Immediately repair holes or tears in paper.

3.11 SEALER

A. Clear Acrylic Sealer: Apply uniformly in two coats in continuous operations according to manufacturer's written instructions. Allow first coat to dry before applying second coat, at 90 degrees to the direction of the first coat using same application methods and rates.

1. Begin sealing dry surface no sooner than 14 days after concrete placement.
2. Allow stained concrete surfaces to dry before applying sealer.

3. Thoroughly mix slip-resistance-enhancing additive into sealer before applying sealer according to manufacturer's written instructions. Stir sealer occasionally during application to maintain even distribution of additive.

3.12 PAVING TOLERANCES

A. Comply with tolerances in ACI 117 and as follows:

1. Elevation: 1/4 inch.
2. Thickness: Plus 3/8 inch (10 mm), minus 1/4 inch.
3. Surface: Gap below 10-foot- (3-m-) long, unleveled straightedge not to exceed 1/2 inch.
4. Lateral Alignment and Spacing of Dowels: 1 inch.
5. Vertical Alignment of Dowels: 1/4 inch.
6. Alignment of Dowel-Bar End Relative to Line Perpendicular to Paving Edge: 1/4 inch per 12 inches of dowel.
7. Joint Spacing: 3 inches.
8. Contraction Joint Depth: Plus 1/4 inch, no minus.
9. Joint Width: Plus 1/8 inch, no minus.

3.13 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. 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 (4.4 deg C) and below and when it is 80 deg F (27 deg C) 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 (3.4 MPa).

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. Decorative 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.

3.14 REPAIRS AND PROTECTION

A. Remove and replace decorative concrete paving that is broken or damaged or does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by Landscape Architect.

B. Detailing: Grind concrete "squeeze" left from tool placement. Color ground areas with slurry of color hardener mixed with water and bonding agent. Remove excess release agent with high-velocity blower.

C. Protect decorative 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 decorative 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

SECTION 321323

CAST-IN-PLACE CONCRETE FOR LANDSCAPE ELEMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes materials, labor, apparatus, tools, equipment, temporary construction, transportation, and services necessary for and incidental to performing the proper completion of Work for Reinforced Cast-in-Place Site Concrete, as shown in the Contract Drawings, and as specified herein this Section.

B. Work under this Section consists of, but is not necessarily limited to, furnishing and installing the following:

1. Cast-in-Place Site Concrete for miscellaneous footings or sub-grade foundations
2. Cast-in-Place Site Concrete for stairs
3. Cast-in-Place Concrete Retainer, Header or Edging for pavers, planting and aggregate paving.
4. Jointing (Expansion Joints, Contraction Joints, Isolation Joints, Keyway/Construction Joints and/or Architectural Score Joints).
5. Steel Reinforcement
6. Steel Dowels and Sleeves
7. Compacted Sub-Surface Materials

C. Related Documents: The following Documents contain requirements that relate to Work in this Section:

1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
2. Section 044213 “Site Stone Slabs, Blocks and Boulders”.
3. Section 062013 “Site Finish Carpentry”.
4. Section 116813 “Playground Equipment, Structures and Surfacing”.
5. Section 312219 "Landscape and Fine Grading".
6. Section 321500 “Aggregate Surfacing”.
7. Section 323316 "Landscape Architectural Cement Concrete Paving".
8. Section 334300 "Landscape Drainage".

1.2 DEFINITIONS AND APPLICABLE STANDARDS

A. References:

1. ASTM – American Society for Testing and Materials.
2. ANSI – American National Standards Institute.
3. ACI – American Concrete Institute.
4. PCA – Portland Cement Association.
5. CRSI – Concrete Reinforcing Steel Institute.
6. SWRI – Sealant, Waterproofing & Restoration Institute.
7. UBC – Uniform Building Code.
8. NRMCA – National Ready Mix Concrete Association.
9. ADAAG – American with Disabilities Act Accessibility Guidelines.
10. TAS – Texas Accessibility Standards.

B. Definitions:

1. Cementitious Materials: Portland Cement alone or in combination with one or more of blended hydraulic cement, expansive hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume.
2. Percent Compaction: Per ASTM D1557, percentage of the maximum in-place dry density of the same material, as determined by Geotechnical Engineer.

C. Measurements.

1. PSI: Measurement, in pounds per square foot.
2. CU/FT: Measurement, in cubic-foot.

1.3 SUBMITTALS

A. General: Refer to Division 01 for project submittal requirements and timelines. If provided in hardcopy submittal booklets submit each item in this Article in required copies with four (4) copies for review by Landscape Architect. Three (3) copies shall be returned (One for Client, one for Owner and one for Contractor) and one copy maintained by Landscape Architect. Provide one (1) sets of Material Samples for review by the Landscape Architect unless requested otherwise.

B. Submittal Booklets: Each Submittal Booklet under this Section shall be tabbed into specific sections, containing clearly identified (through yellow highlighter or other specific identification methods) and legible information on the following information indicated in this Article.

C. Electronic Submittals: Electronic Submittal shall be provided in a single bound file, PDF format preferred, unless otherwise noted in Division 01.

D. Product Data: Manufacturers' current catalog cuts and specifications for the following:

1. Expansion joint filler, sealant, backer rod and bond breaker.
2. Dampproofing material.
3. Air-entrainment.
4. Curing Compound.
5. Joint Sealant: Color chart.

E. Statement of Mix Design: Prepared by the batch plant servicing the Project, submit for each type or load delivered to Project. Include revised mix proportions when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments. Each Statement of Mix Design shall include following information:

1. Name, address, and telephone number of batch plant preparing Statement of Mix Design.
2. Date of Mix Design.
3. Project location.
4. Contractor requesting load delivery.
5. Mix Design Number.
6. Admixtures (as required).
7. Integral Color Admixtures (as required).
8. Gradations for sand and aggregate.
9. Material weights, specific gravity, and absolute volumes.
10. Basis of testing, i.e. UBC 2605 D4 and CBC Title 24 2604 D4.
11. Water/Cementitious Materials Ratio (W/CM Ratio).
12. Slump.
13. PSI Rating.

F. Certificates:

1. Reinforcing Steel: Certificate of compliance
2. Concrete Mix Design: Ticket for each batch delivered showing the following:

a. Mix identification.
b. Weight of cement, aggregate, water, and admixtures, aggregate sizes/proportion, and air entrainment.

G. Material Test Reports: Signed and stamped laboratory test reports for evaluation of concrete materials and mix design tests.

H. Material Samples: Samples of the material items indicated herein this Section shall be furnished for review and approval. Submit two (2) sets of samples that are consistent with the specified products for each item indicated:

1. One (1) pound sample of each aggregate
2. One-foot (1'-0") section of each Joint Sealant material.

I. Scaled Shop Drawings for reinforcement, indicating type, size, layout, spacing, forms, shapes and placement for all concrete scope of Work reinforcing.

1.4 QUALITY ASSURANCE AND CONTROL

A. Installer Qualifications: Engage an experienced Installer who has completed in the last two (2) years at least three (3) concrete installations similar in material, design, and extent to that indicated for this Project, and whose work has resulted in construction with a record of successful in-service performance.

B. Mock-up for exposed finished work: Refer to Contract Documents for Mock-up requirements or at minimum provide one (1) 3 ft. x 3 ft. surface areas (minimum 4” thick) for each type of concrete finish and color to serve as standard of quality for all work. Mock-up shall include all jointing details (and insets) for acceptance.

C. Lines and Levels: To be established by a licensed Surveyor or registered Civil Engineer.

D. Design of Concrete Mix: Employ approved commercial testing laboratory to design concrete mixes as follows:

1. Minimum Compressive Strength at 28 Days:

a. Walls and Foundations: 3000 psi

2. Concrete Slump:

a. Minimum: Two (2) inches
b. Maximum: Four (4) inches

3. Maximum Water-Cement Ratio:

a. Foundations: 6.75 gallons per sack of cement

E. Colored Concrete: Achieve color by integrally mixing coloring agent with concrete. Refer to finish schedule for concrete finishes and colors.

F. Permits, Fees, Bonds, and Inspections: Contractor shall arrange and pay for permits, fees, bonds, and inspections necessary to perform and complete Work under this Section.

1.5 PRE-INSTALLATION CONFERENCE

A. Review methods and procedures related to concrete paving, including but not limited to, the following:

1. Concrete mixture design.
2. Quality control of concrete materials and concrete paving construction practices.
3. Mock-ups Requirements
4. Finishing and Surface intentions and requirements

B. Require representatives of each entity directly concerned with concrete paving to attend, including the following:

1. Contractor's superintendent.
2. Independent testing agency responsible for concrete design mixtures.
3. Ready-mix concrete manufacturer.
4. Concrete paving subcontractor.
5. Landscape Architect
6. Owner and Client Representative(s)

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in a timely manner to ensure un-interrupted progress of the Work.

B. Store materials in a dry and protected location. Protect reinforcing steel and dowels from rusting, deformation, staining, and moisture damage.

C. Store materials by methods that prevent damage and permit ready access for inspection and identification. Package cement delivered to the Project Site shall be in strong paper or jute bags with brand name and manufacturer's name stamped thereon. Store cement under cover. Remove packaged cement immediately from the Project Site should it become wet or show any signs of caking or deterioration.

1.7 PROJECT SITE CONDITIONS

A. Traffic Control: Maintain access for vehicular, bicycle, and pedestrian traffic as required for other construction activities. Access to the surrounding buildings shall also be unobstructed and maintained at all times to allow for entry and exit of emergency vehicles.

B. Establish and maintain required levels and grade elevations. Review installation procedures and coordinate Work herein this Section with other Work affected.

C. Do not place site concrete during rain or adverse weather conditions without means to prevent damage. Conform to requirements specified hereinafter whenever concrete placement is required during cold or hot weather.

D. Keep Work area clean, and in a safe and workmanlike condition so that rubbish, waste, and debris does not interfere with Work of other trades.

E. Water and Dust Control: Maintain control of concrete dust and water during duration of Contract. Do not permit adjacent planting areas to be contaminated. Clean up debris resulting from this work at the end of each day's Work.

1.8 COORDINATION, SCHEDULING, AND OBSERVATIONS

A. Sequence and Scheduling: Notify contractors performing Work related to installation of Work under this Section in ample time so as to allow sufficient time for them to perform their portion of Work and that progress of Work is not delayed. Verify conditions at the Project Site for Work that affects installation under this Section. Coordinate items of other trades to be furnished and set in place, such as:

1. Accessories embedded in the site concrete, and for the provision of holes, openings, etc., necessary to the execution of the Work of the trades.

B. Field Measurements: Contractor shall take field measurements as required. Report major discrepancies between the Contract Drawings and field dimensions to the Landscape Architect prior to commencing Work.

C. Utilities: Determine location of above grade and underground utilities and perform Work in a manner which will avoid damage to utilities. Hand excavate, as required. Maintain grade stakes until removal is mutually agreed upon by parties concerned.

D. Excavation: When conditions detrimental to adequate installation operations are encountered, such as rubble fill, adverse drainage conditions, or obstructions, cease operations and notify Landscape Architect for further direction.

E. Environmental Conditions: Perform installation operations only when weather and soil conditions are suitable in accordance with locally-accepted practices.

F. Construction Site Observations: Periodic site observations shall be made by the Landscape Architect during the installation of Work under this Section for compliance with requirements for type, size, and quality. Landscape Architect retains right to observe Work for defects and to reject unsatisfactory or defective material at any time during progress of Work. Contractor shall remove rejected materials immediately from Project site. The Contractor shall request, in writing, at least one (1) week in advance of the time when mandatory site observation(s) by the Landscape Architect are required.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cement: ASTM C150, Type I or II Portland Cement. Use only one brand and type for entire job.

B. Aggregate Base for On-grade Slabs:

1. Description: Class II aggregate base shall be free from vegetation matter and other deleterious substances, and shall be of such nature that it can be compacted readily under watering and rolling to form a firm, stable base.
2. Grading Requirements:

Percent Passing	Sieve Size
100	1 in.
90-100	3/4 in.
0- 10	#4
0- 3	#100

3. Quality Requirements:

   a. Minimum "R" value 40
   b. Max. Expansion Pressure; Calif. Test Method No. 301 to be 100 psf
   c. Maximum Plasticity Index 12
   d. Sand Equivalent 20 min

C. Coarse Aggregate:

1. Description: ASTM C33, hard, durable, uncoated, washed, graded, cleaned and screened crushed rock or gravel aggregate for regular weight concrete. Do not use crusher-run stone or bank-run gravel.
2. Grading: Do not use aggregate which has a maximum size exceeding 1/5 of the narrowest dimension between sides of forms of the member for which the concrete is to be used, nor larger than 3/4 of the minimum clear spacing between reinforcing bars. Do not use coarse aggregate which exceeds 3/4 in. for paving.
3. All aggregate is to be gray in color. Mixed color aggregate is not permitted. All aggregate is to be sourced from a single supplier throughout the entirety of the job.

D. Fine Aggregate:

1. Description: ASTM C33, clean, hard and durable sand. Do not use sand coated with injurious amounts of silt, loam, clay or other deleterious matter.
2. Grading Requirements:

Percent Passing	Sieve Size
45-70	#16
15-30	#50
3- 8	#100

E. Water: Clean, potable concrete mixing water free from injurious amounts of salts, oils, acids, alkalis, organic materials or other deleterious matter. As available from Owner. Transport as required.

F. Air Entrainment: ASTM C260.

2.2 MIXTURE COMPONENTS

A. Coloring Agent:

1. Type: Commercially pure mineral pigments.
2. Percentage: Maximum 10% of the cement content by weight.
3. Product: CHROMIX Admixtures as produced by L.M. Scofield Co.,
4. Or approved equal

B. Color: Refer to finish schedule in contract drawings for any coloring or aggregate required.

2.3 ACCESSORIES

A. Reinforcements:

1. Reinforcing Bars: ASTM A615 Grade 40, or 60 deformed billet-steel bars, clean and free from rust, scale, or coating that will reduce bond.
2. Smooth Dowels for Expansion Joints: ASTM A615, Grade 40 smooth, billet-steel bars, shop painted with iron-oxide zinc-chromate primer.

3. Tie Wires: 18 ga. min. black annealed.
4. Snap Ties: Snap-off metal of fixed length capable of leaving no metal within 1 1/2 in. of surface nor causing fractures, spall or other defects larger than one (1) in. diameter.

B. Expansion Joint Materials:

1. Premolded Joint Filler: ASTM D1751, non-extruding and bituminous type resilient filler, compatible with sealant, and having a "guide strip" removable depth gauge.
2. Joint Sealant: ASTM C290, non-snag sealant
3. Bond Breaker: Pressure-sensitive tape as recommended by sealant manufacturer to suit application.

C. Forms:

1. Steel or wood of size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal.
2. Use forms that are straight and free of distortions and defects.
3. Use flexible spring forms or laminated boards to form radius bends as required.
4. All Surfaces not exposed: Of sufficient strength to hold concrete properly in place and prevent leakage of water from forms.
5. Exposed Surfaces: A-Matte, Two-step MDO plywood made for forming l. No wood-textured finish will be permitted on exposed concrete unless specified as such.

D. Form Release Agent: Colorless non-staining, free from oils. Chemical agent shall not impair bonding of paint or other proposed coatings.

E. Wood Headers:

1. Wood: Construction Heart grade rough Redwood header and stake or pressure-treated rough Douglas Fir stake.
2. Nails: Hot-dipped galvanized.

F. Dampproofing: ASTM C836-81, Fluid-V single component, bitumen-modified, moisture-curing polyurethane "Tremproof 60" by Tremco, (800) 321-7906.

G. Curing Compound: ASTM C309, Type I-D, Class A.

H. Chamfer Strips: Rigid PVC, or hardwood per drawings in maximum possible lengths

I. Slip Sheet: 40 mil PVC sheet or 15 lb. felt

PART 3 - EXECUTION

3.1 EXAMINATION

A. NO WORK UNDER THIS SECTION SHALL COMMENCE UNTIL SUBMITTALS UNDER THIS SECTION HAVE BEEN REVIEWED ACCORDINGLY BY THE LANDSCAPE ARCHITECT.

B. Prior to commencing Work under this Section, Contractor shall examine previously installed Work from other trades and verify that such Work is complete and to the point where Work herein may commence properly. Do not proceed with Work until unsatisfactory conditions have been corrected.

C. Contractor shall notify the Landscape Architect, in writing, on the anticipated commencement date and length of duration of the Work installation herein this section.

D. Proof-roll prepared sub-base surface for foundations to check for unstable areas and verify need for additional compaction. Verify that sub-grade preparation for site concrete has been completed including base course prior to commencement of Work.

E. Surface Drainage:

1. Report in writing conflicts discovered on the site or prior Work done by others, which would prevent positive drainage.
2. Do not permit finished site concrete surfaces to vary more than 1/4 in. measured with a 10 ft. metal straightedge, except at grade changes. Properly correct irregularities.

3.2 PREPARATION

A. Templates: Use templates for anchor plates, bolts, inserts and/or other items embedded in concrete. Accurately secure so that they will not be displaced during placing of concrete.

B. Piping and Conduit: Do not embed piping, other than electrical conduit, in structural concrete. Locate conduit to maintain strength of structures at maximum. Verify size, length and location of electrical conduit.

C. Aggregate Base Course: Compact base course to thicknesses as shown on Contract Drawings or as indicated per the Geotechnical Report, to the relative compaction density as required per the Geotechnical Report. Aggregate Base Course shall be graded to the lines and levels indicated; no ruts or depressions shall be allowed.

D. Gravel Fill or Sand Beds: Re-compact disturbed gravel fill or sand beds and bring to correct elevation.

3.3 FORMWORK

A. Design, construct, erect, shore, brace, and maintain Formwork according to ACI 347 "Guide to Formwork for Concrete."

B. Formwork shall be consistent with the orientation and pattern indicated on the Contract Drawings. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides to required lines, grades, and elevations. Install Formwork to allow continuous progress of Work and so that Formwork can remain in place at least twenty-four (24)-hours after concrete placement.

C. Coordinate locations of drainage piping requirements, irrigation piping stub-outs, electrical conduits, or other items scheduled to be embedded into cast concrete.

D. Check completed Formwork and screeds for grade and alignment to following tolerances:

1. Top of Forms: Not more than 1/8 inch in ten- (10) feet.
2. Vertical Face on Longitudinal Axis: Not more than 1/4 inch in ten-(10) feet.

E. Coat Form Work with Form Release Agent, as required, to ensure Form Work separates from casted concrete without damage to concrete's finished surface.

1. Formwork surfaces shall be clean, dry, and free from contaminants (dirt, dust, rust, build-up, and existing form agents) prior to each use of Formwork

2. Prior to each use, Formwork that comes into direct contact with concrete shall be coated with Form Release Agent in accordance with the Manufacturer's written instructions.
3. Apply Form Release Agent in a uniform and even manner by low pressure spray, roller, or clean cloth, in accordance with the Manufacturer's written instructions.
4. Prior to coating new Formwork, apply one (1) or two (2) heavy coats to edges for waterproofing protection.
5. Excess Form Release Agent or dense form surfaces should be removed with a clean cloth.
6. Do not apply Form Release Agent to reinforcing steel.

3.4 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating reinforcement and with recommendations in CRSI's "Placing Reinforcing Bars" for placing and supporting reinforcement.

B. Clean Reinforcement of loose rust and mill scale, earth, or other bond-reducing materials.

C. Arrange, space, and securely Tie Bars and Bar Supports to firmly hold and support the Steel Reinforcement in position during concrete placement and to prevent displacement before or during casting. Maintain a minimum of two inches (2") cover to the Reinforcement.

D. Install Steel Reinforcement Bars in sizes as indicated on the Contract Drawings, in lengths as long as practicable. Lap adjoining Bars at a minimum of fifty (50) bar diameters. Lace splices accordingly with Tie Wire. Offset laps of adjoining widths to prevent continuous laps in either direction. Erect and maintain Reinforcement Bars on chairs, secured firmly in position, in the middle of the concrete during casting operations. Do not extend Reinforcement Bars through expansion joints.

E. Install Construction Joint Dowel Bars & Sleeves per the Manufacturer's recommendation. Reinforcing dowels, or sleeves for the reinforcing dowels, shall be secured in place prior to placing concrete. Align dowels in straight, even alignments in the middle of the concrete profile during casting operations. Dowels and sleeves shall not be pressed into the concrete during casting and after the concrete has been placed.

F. Install fabricated Steel Bar Mats in lengths as long as practicable. Handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities, or replace units as required before placement. Set mats for a minimum two-inch (2") overlap to adjacent mats.

G. Vapor Barrier: If provided, do not cut or puncture Vapor Barrier. Repair damage and reseal Vapor Barrier before placing concrete.

3.5 CONCRETE PLACEMENT

A. Preparation: Remove all free water from forms before concrete is deposited. Remove hardened concrete, debris, and foreign materials from interior surfaces of forms, exposed reinforcing, and from surfaces of mixing and conveying equipment.

B. Sub-Base: Sub-Base shall be free of ruts, holes, ridges, etc. Smooth and compact sub-base to an even plane.

C. Wetting: Wet wood forms sufficiently to tighten up cracks. Wet other materials sufficiently to reduce absorption and to help maintain concrete workability. Dampen earth sub-grade twenty-four (24) hours before placing concrete, but do not muddy. Re-roll where necessary for smoothness, and remove loose material from compacted sub-base surface prior to placing concrete.

D. Inspection: Before placing concrete, inspect and complete formwork installation, reinforcement steel, dowels/sleeves, and items to be embedded or cast in. Notify other trades to permit installation of their Work.

1. Reinforcement and Forms shall be secured firmly in position such that they will not be displaced during the placement of concrete.
2. Reinforcement Bars, Ties, and Welded Wire Fabric shall be completely encased in concrete, at a minimum of two-inches (2") from any edge of the concrete.
3. Do not place concrete around manholes or other structures until they are at the required finish elevation and alignment.

E. Comply with requirements and with recommendations in ACI 304R for measuring, mixing, transporting, and placing concrete.

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 site concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures to consolidate concrete according to recommendations in ACI 309R.

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 surfaces with a straightedge and strike off. Commence initial floating using bull floats or darbies to form 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.

I. When adjoining concrete lanes are placed in separate pours, do not operate equipment on concrete until concrete has attained eighty-five-percent (85%) of its fully hydrated compressive strength.

J. 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 air temperature has fallen to or is expected to fall below 40 deg. F. (4.4 deg. C.), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg. F. (10 deg. C.) and not more than 80 deg. F. (27 deg. C.) at point of placement.
2. Do not use calcium chloride, salt, or other materials containing anti-freeze agents or chemical accelerators, unless otherwise specified and approved in mix designs.

K. Hot-Weather Placement: Place concrete according to recommendations in ACI 305R and as follows when hot-weather conditions exist:

1. Cool ingredients before mixing to maintain concrete temperature at time of placement below 90 deg. F. (32 deg. C.). 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. Cover reinforcement steel with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
3. Fog-spray forms, reinforcement steel, and sub-grade just before placing concrete. Keep sub-grade moisture uniform without standing water, soft spots, or dry areas.

3.6 JOINTS

A. A. General: Refer to ACI 302 "Guide for Concrete Floor and Slab Construction" for work under this Article. Construct construction, isolation, expansion, and contraction joints and tool edgings 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 site concrete and at locations where site concrete operations are stopped for more than one-half (1/2) hour, unless site concrete terminates at isolation joints.

1. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of site concrete strips, unless otherwise indicated on the Contract Drawings.
2. Provide tie bars at sides of site concrete strips where indicated.
3. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Expansion Joints: Form expansion joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, walks, buildings, foundations, walls, other fixed objects, and in other locations as indicated on the Contract Drawings. Provide Expansion Joints at full depth of site concrete where site concrete meets vertical faces of buildings, structures, foundations, walls, etc.

1. Locate expansion joints at maximum intervals of twenty (20) feet, unless otherwise indicated on the Contract Drawings.
2. Extend joint fillers full width and depth of joint.
3. Provide Construction Joint Dowel Bars at the spacing distances indicated in the Contract Drawings.
4. Terminate Joint Filler less than 1/2 inch or more than one-inch (1") below finished surface if joint sealant is indicated.
5. Place top of Joint Filler flush with finished concrete surface if joint sealant is not indicated.
6. Furnish joint fillers in one (1)-piece lengths. Where more than one (1) length is required, lace or clip joint-filler sections together.
7. Protect top edge of joint filler during concrete placement with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.

D. Contraction Joints and Isolation Joints: Form weakened-plane contraction joints and isolation joints, sectioning concrete into areas as indicated on the Construction Drawings, or at spacing intervals as recommended by the PCA.

1. General Methodology: Contraction Joints shall be placed in Site Concrete to minimize the occurrence of random cracking on the surface due to drying, shrinkage or stress loading and to reduce the width of concrete cracks should they occur. When not indicated on the Contract Drawings, Contraction Joints shall be placed at 24x the thickness of the site concrete.
2. Tooled (Grooved) Contraction Joints:

    a. Form Tooled (Grooved) Joints in fresh concrete after initial floating using a jointer to cut the above the groove so that a smooth, uniform impression is obtained. Strike joints before and after floating and troweling.
    b. Perform in a continuous operation to avoid misalignment of joints. Use snap-lines and forms, as required, to achieve consistent lines. Re-form crooked or misaligned joints at no cost to Owner.
    c. Radius: 1/8 inch.
    d. Depth: Construct depth equal to a minimum of one-fifth (1/5) of the concrete slab thickness.

3. Saw-Cut Contraction Joints:

    a. Construct Saw-Cut Contraction Joints with a circular power saw, equipped with a new, shatterproof abrasive or diamond-tipped blade. Cut 3/16-inch-wide joints (maximum width of saw-blade) into concrete surface. Cutting action shall not tear, abrade, spall, shatter, or otherwise damage the surface.
    b. Saw-cut concrete surface when successful jointing results can be achieved and prior to uncontrolled random contraction cracking of concrete occurs.

        1) Early-entry Sawcuts: When used, provide sawcuts into fresh concrete at 1" to 1-1/4" depth, or as indicated on the Contract Drawings.

    c. Perform saw-cut joints cleanly and smoothly, to a constant and equal depth, in a continuous consistent line, with no over-cutting.
    d. Depth:

        1) Contraction Joints: Construct depth equal to a minimum of one-fifth (1/5) of the concrete slab thickness.
        2) Isolation Joints: Construct depth equal to the full depth of the concrete thickness.

    e. Perform in as continuous an operation as possible, to avoid misalignment of joints. Use chalk lines, forms, or templates as required, to achieve consistent lines)
    f. Use a hand grinder with a 4-inch diamond blade to saw-cut up to vertical edges such as walls, steps, curbs and columns. Do not over-cut into vertical surfaces or adjacent concrete surfaces.

E. Edging: Tool edges of site concrete, as required, after initial floating, with an edging tool to the following radius or chamfer. Repeat tooling of edges after applying surface finishes. Eliminate tool marks on concrete surfaces.

    1. Radius: 1/4 inch (aka "Carpet Edger").

3.7 CONCRETE FINISHES

A. General:

1. Finished site concrete surfaces indicated herein this Section shall be "slip-resistant", per the requirements outlined in and per ADAAG 4.5.1.

    a. The minimum coefficient of friction shall meet or exceed 0.8 on exterior and 0.6 on interior horizontal pavement surfaces.
    b. Exposed site concrete surfaces shall have the following finish on all surfaces less than six percent (6%) slope unless noted otherwise:

        1) Medium Broom Textured Finish or a textured finish as specified which is equivalent to the finished texture of a Medium Broom Textured Finish.

    c. Exposed site concrete surfaces shall have the following finish on all surfaces greater than six percent (6%) slope unless noted otherwise:

        1) Heavy Broom Textured Finish or a textured finish as specified which is equivalent to the finished texture of a Heavy Broom Textured Finish.

    d. Color(s) and finish(es) specified herein shall match referee samples and field-constructed mock-up samples as approved by the Landscape Architect.
    e. Wetting of concrete surfaces during screeding, initial floating, or finishing operations is strictly prohibited.

B. Float Finish:

1. Applications: Provide Float finish for Veneer Unit Paving Sub-slabs. Provide in areas as indicated on Contract Drawings.
2. After initial screeding and floating, commence a second floating operation when bleed-water sheen has disappeared and the 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. Re-float surface immediately to uniform granular texture.

    a. Float Texture:

        1) Use aluminum or magnesium float to produce medium texture.

3. Provide contraction jointing and edging, as required, in the locations indicated in the Contract Drawings, and of the type(s) indicated herein this Section.
4. After concrete is fully hydrated (approx. 30-days), seal float texture finished concrete surface with two (2) coats of Sealer as specified herein this Section, per the Manufacturer's latest printed instructions.

C. Broom Finish:

1. Obtain by drawing a stiff bristled broom across a floated finish.
2. Direction of brooming to be perpendicular to direction of paving (or as shown on Drawings.)
3. Exposing of Aggregates: Do not dislodge or unevenly expose the aggregates. Avoid direct hosing of the surface and do not use a pressurized nozzle.

D. Steel-Trowel Finish:

1. Float finish as specified above.
2. After surface water disappears and floated surfaces have sufficiently hardened, power trowel to produce an even smooth surface.

E. After concrete has set enough to ring trowel, retrowel to a uniform smooth finish, free of trowel marks or other blemishes. Avoid excessive troweling that produces burnished areas.

3.8 CONCRETE PROTECTION 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 follow recommendations in ACI 305R for hot-weather protection during curing.

B. Protection:

1. Protect concrete against rapid drying and damage by rain and freezing conditions
2. Keep concrete moist for at least 7 days. Protect with liquid curing compound, or a covering that will not stain or discolor finished concrete surfaces. Obtain acceptance of proposed method prior to use.

C. Spraying: Spray concrete during the curing period as frequently as drying conditions may require.

D. Curing: Cure concrete in accordance with the ACI Manual of Concrete Practice. During curing period, maintain concrete above 70 degrees F. for at least 3 days or above 50 degrees F. for at least 5 days.

3.9 INSTALLATION OF JOINT SEALANTS

A. Provide a Joint Sealant that is compatible with the substrate material(s) to which it is being applied. Do not use a Joint Sealant that has exceeded shelf life or has jelled and can not be discharged in a continuous flow from the application tool.

B. Ambient Temperature Criteria: The ambient temperature shall be within the limits of 40d. F. and 90d. F. when the Joint Sealant is being applied.

C. Sealant Installation Standard: Comply with recommendations of ASTM C1193 for use of Joint Sealants as applicable to materials, applications and conditions indicated.

D. Surface Preparation of Joints:

1. Remove foreign material from joint substrates which could interfere with adhesion of Joint Sealant, including dust, surface dirt, dirt, moisture, water repellents, grease, oil, wax, lacquer, paint, waterproofing, or other foreign matter that would tend to destroy or impair adhesion.
2. Remove oil and grease with solvent. Surfaces must be wiped dry with clean cloths.
3. Clean porous surfaces, by brushing, grinding, blast cleaning, mechanical abrading, or acid washing to produce a clean, sound substrate. Remove loose particles remaining from cleaning operations by vacuuming or blowing out joints.
4. Where surfaces have been treated with curing compounds, oil, or other such materials, remove materials by sandblasting or wire brushing.
5. Clean non-porous surfaces by chemical cleaners or other means which are not harmful to substrates or leave residues capable of interfering with adhesion of Joint Sealants.

E. Sealant Preparation: Do not add liquids, solvents, or powders to the Joint Sealant material (for single-component materials). Where specified, mix multi-component elastomeric Joint Sealants in accordance with manufacturer's instructions.

F. Primer: Immediately prior to application of the Joint Sealant, clean out loose particles from joints. Where recommended by the sealant manufacturer, apply Primer to joints in accordance with sealant manufacturer's instructions. Do not apply Primer to exposed finish surfaces. Do not allow spillage or migration of Primer onto adjoining surfaces.

G. Installation of Sealant Backings: Install sealant backings to comply with the following requirements:

1. Install Joint Fillers to provide sealant support for optimum performance cross-sectional shapes and depths.

    a. Do not leave gaps between ends of Joint Fillers.
    b. Do not stretch, twist, puncture or tear Joint Fillers.
    c. Remove absorbent Joint Fillers which have become wet prior to sealant application and replace with dry material.

2. Install Bond Breaker to the back or bottom of the joint cavity (between sealants and joint-fillers, compression seals or back of joints where required), as recommended by the Joint Sealant manufacturer, for each type of joint and sealant used, to prevent "third-side" adhesion of the Joint Sealant to the back of the joint. Carefully apply the Bond Breaker to avoid contamination of adjoining surfaces or breaking bond with surfaces other than those covered by the Bond Breaker.

H. Installation of Joint Sealants:

1. Install Joint Sealant after concrete substrate material has been cast and allowed to cure. Remove protective cap from preformed Joint Filler. Remove any excess Joint Filler material that will inhibit an adequate depth and bond of the Joint Sealant material.
2. Place masking tape where required along the joint cavity to prevent contact of the Joint Sealant with adjoining surfaces. Remove masking tape within ten (10) minutes after joint has been filled and tooled.
3. Apply the Joint Sealant in accordance with the manufacturer's printed instructions with an application tool having a nozzle that fits the width of the joint cavity. Install Joint Sealant by proven techniques to contact and solidly full wet joint substrates, completely filling the recesses provided for each joint configuration, providing uniform, optimum performance cross-sectional shapes and depths. Do not allow spillage or migration of Joint Sealant onto adjoining surfaces.

I. Tooling of Non-Sag Joint Sealants: Tool Non-Sag Joint Sealants to form smooth, uniform beads of configuration indicated, free of wrinkles, streaks, gouges, boils, air holes, etc. and to ensure contact and adhesion of the Joint Sealant with the sides of the joint. Remove excess Joint Sealants from surfaces adjacent to joint. Do not use tooling agents which discolor Joint Sealants or adjacent surfaces or are not approved by Sealant Manufacturer.

J. Sanding of Joint Sealant: Lightly apply dry sand to cover freshly-poured elastic Joint Sealant material. When Joint Sealant has hardened, remove excess sand that has not bonded to Joint Sealant.

K. Protection and Curing:

1. Protect installed Joint Sealants during and after curing period from contact with contaminating substances or from damage.

2. Cut out and remove damaged or deteriorated Joint Sealers and reseal joints with matching new materials.
3. Clean off excess Joint Sealants or sealant smears adjacent to joints as Work progresses by methods and with cleaning materials approved by the Sealant Manufacturer.

3.10 REPAIRS AND PROTECTION

A. Remove in its entirety (from joint to joint) and replace site concrete that is broken, cracked, damaged, or defective, or concrete which does not meet requirements of this Section.

B. Drill test cores where directed by the Landscape Architect, when necessary, to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory site concrete areas with Portland cement concrete bonded with epoxy adhesive.

C. Protect concrete from damage. Exclude traffic from site concrete for at least fourteen (14) days after placement. When construction traffic is permitted, maintain site concrete as clean as possible by removing surface stains and spillage of materials as they occur.

D. Maintain exposed site concrete free of stains, discoloration, dirt, and other foreign material. Clean site concrete not more than two (2) days before date scheduled for Substantial Completion inspection.

3.11 DAMPPROOFING

A. Preparation of Surfaces:

1. Clean all surfaces to be dampproofed. Remove all dirt, grease, and other foreign matter which might interfere with adhesion and penetration. Allow surfaces to dry thoroughly.
2. Carefully repair all cracks, holes, voids, open areas and other defects in concrete surfaces to be dampproofed. Use Portland Cement mortar; strike flush, permit to dry.
3. Thoroughly clean all excess mortar from concrete surfaces after drying.

B. Application of Dampproofing Compound:

1. Cover entire retaining surface of backside of walls from top of footing to finished grade with specified dampproofing. Apply according to manufacturer's current printed instructions.
2. Apply dampproofing in a clean line conforming to finished ground grade.
3. Provide a completed dampproofing coating which is a continuous, uniform, unbroken, impervious film, free from pinholes and other surface breaks.

3.12 FIELD QUALITY CONTROL

A. Samples: Owner will select a qualified testing laboratory to take samples for testing during the course of the work as considered necessary.

B. Rejected Materials: Remove off the site all concrete below specified strength.

C. Cost of Removal and Retesting: Pay for full costs of removal of rejected concrete and its replacement with concrete of specified strength and retesting.

END OF SECTION

SECTION 323119

SITE DECORATIVE METAL FENCES AND GATES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes materials, labor, apparatus, tools, equipment, temporary construction, transportation, and services necessary for and incidental to performing the proper completion of Work as required to make a complete Decorative Metal Fences & Gates installation, bars, strips, tubes, pipes and castings not a part of structural steel or specified in other Sections, as shown on the Contract Drawings, and as specified herein this Section.

B. Work under this Section consists of, but is not necessarily limited to, products installed but not furnished under this Section, as follows:

1. Metal Panel Fences
2. Metal Gates (Swinging)
3. Fasteners, Hardware, etc.
4. Miscellaneous angles, plates, bars, rods and other items not specified in other Sections but shown or required to complete the Work.

C. Related Sections. The following Sections contain requirements that relate to Work in this Section:

1. Section 055013, "Site Miscellaneous Metal Fabrications"
2. Section 321323, "Site Cast-in-Place Concrete for Landscape Elements"

1.2 DEFINITIONS AND APPLICABLE STANDARDS

A. References:

1. ASTM – American Society for Testing and Materials.
2. ANSI – American National Standards Institute.
3. UBC – Uniform Building Code.
4. AWS – American Welding Society.
5. SSPC – The Society for Protective Coatings.
6. NAAMM – National Association of Architectural Metal Manufacturers.

1.3 SUBMITTALS

A. General: Refer to Division 01 for project submittal requirements and timelines. If provided in hardcopy submittal booklets submit each item in this Article in required copies with three (3) copies for review by Landscape Architect. Two (2) copies shall be returned and one (1) copy maintained by Landscape Architect.

B. Submittal Booklets: Each Submittal Booklet under this Section shall be tabbed into specific sections, containing clearly identified (through yellow highlighter or other specific identification methods) and legible information on the following information indicated in this Article.

C. Electronic Submittals: Electronic Submittal shall be provided in a single bound file, PDF format preferred unless otherwise noted in Division 01.

D. Provide three (3) sets of Material Samples (if any) for review by the Landscape Architect.

E. Submittals under this Article will be rejected and returned without the benefit of review by the Landscape Architect if they are difficult to read due to insufficient scale, poor image quality, or poor drafting quality; or if all of the required information is missing or not presented in the format as requested.

F. No Work under this Section shall proceed until all information indicated herein this Article have been reviewed, accepted, and approved by the Landscape Architect, in writing.

G. Product/Material Data. Submit available product data, manufacturing source (name, address, and telephone number), and distributor source (name, address, and telephone number) for each type of material and product as follows:

1. Material Samples
2. Finish Samples
3. Fasteners, Hardware, etc.
4. Paint and Coating Data
5. Paint and Coating Color Chart
6. Miscellaneous angles, plates, bars, rods and other items not specified in other Sections but shown or required to complete the Work

H. Material Samples: To be reviewed as part of the Field-Constructed Mock-Ups.

I. Scaled Shop Drawings: Provide enlarged scaled plans, elevations, sections, details, as required, for review by the Landscape Architect and Structural Engineer, indicating dimensioned fabrication and erection of each type of fabricated metal components and their connections.. Show construction including anchorage and accessory items. Furnish templates for anchors and bolts installed under other Sections.

J. Field-Constructed Mock-ups:

1. Provide a complete fabricated sample panel (4'-0" long, each type) for all respective materials receiving finishing which is to be used as the basis for judging quality of workmanship throughout the project, as follows:
2. Prepare surfaces and apply specified finishes in accordance with specified requirements.
3. Apply colors selected by Landscape Architect for each designated surface.
4. Prepare required samples on exterior surfaces at locations selected by the Landscape Architect, or as directed by the Owner.
5. Notify Landscape Architect when sample panels are ready for review.
6. Modify or correct Work as directed by Landscape Architect.

K. Exposed fasteners shall be of same materials, color and finish as material to which applied. Exposed surfaces throughout project shall have same inherent texture and color for similar locations.

L. Qualification Data: Submit names for firms and persons specified in the "Quality Assurance and Control" Article to demonstrate their capabilities and experience on similar Fabricated Metal installations.

M. No Work under this Section shall proceed until all information indicated herein this Article have been reviewed, accepted, and approved by the Landscape Architect, in writing.

1.4 QUALITY ASSURANCE AND CONTROL

A. Fabricator Qualifications: Engage an experienced Installer with experience in successfully demonstrating the fabrication, installation, and completion of Decorative Metal Fences & Gates Work similar in material, design, and extent to that indicated for this Project, with a record of successful performance, and with sufficient production capacity to produce required units without causing delay in the Work.

B. Welding Qualifications: Qualify welding processes and welding operators in accordance with AWS D1.1, D1.2, and D1.3, as applicable. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved.

C. Permits, Fees, Bonds, and Inspections: Contractor shall arrange and pay for permits, fees, bonds, and inspections necessary to perform and complete Work under this Section.

1.5 DELIVERY, STORAGE AND HANDLING

A. Provide new, unused materials indicated under this Section. Store and secure properly to prevent theft and damage.

B. Deliver manufactured materials in original, unopened packages or containers with manufacturer's labels intact and legible.

C. Store materials off ground and under cover, away from damp surfaces and inclement weather.

D. Deliver and install materials so as to not delay Work, and install only after preparations for installation have been completed.

1.6 COORDINATION, SCHEDULING, AND OBSERVATIONS

A. Notify the Contractors performing Work related to installation of Work under this Section in ample time so as to allow sufficient time for them to perform their portion of Work and that progress of Work is not delayed. Verify conditions at the Project Site for Work that affects installation under this Section. Coordinate items of other trades to be furnished and set in place,

B. Field Measurements: Contractor shall take field measurements as required. Report major discrepancies between the Contract Drawings and field dimensions to the Landscape Architect prior to commencing Work. Check actual locations of walls, pavement finished surface grades, finished grades, pilasters, and other construction to which Decorative Metal Fences & Gates must fit, by accurate field measurements before fabrication. Show recorded measurements on Shop Drawings.

C. Perform installation operations only when weather is suitable in accordance with locally accepted practices.

D. Grades and Levels: Maintain required levels and grade elevations. Review installation procedures and coordinate Work herein this Section with other Work affected.

E. Construction Site Observations: Periodic site observations shall be made by the Landscape Architect during the installation of Work under this Section for compliance with requirements for type, size, and quality. Landscape Architect retains right to observe Work for defects and to reject unsatisfactory or defective material at any time during progress of Work. Contractor shall remove rejected materials immediately from Project site. The Contractor shall request, in writing, at least one (1) week in advance of the time when mandatory site observation(s) by the Landscape Architect are required.

1.7 SUBSTITUTIONS

A. Consideration: Materials to be considered equal to the Materials indicated herein this Section shall be reviewed by the Landscape Architect. Materials with equal performance characteristics produced by other Manufacturer's and/or Distributors may be considered, providing deviations in dimensional size, color, composition, operation, and/or other characteristics do not change the design concept, aesthetic appearance, nor intended performance, as solely judged by the Landscape Architect. The burden of proof on product equality is on the Contractor.

B. Specific reference to Manufacturer's names and products specified herein are used as standards of quality. This implies no right to the Contractor to substitute other materials without prior written approval by the Landscape Architect for Work under this Section.

C. Materials substituted and installed by the Contractor, without prior written approval by the Landscape Architect, may be rejected. Contractor shall not be entitled to be compensated by the Owner where the Contractor has installed rejected substitutions without receiving prior written approval.

D. Contract Price: Substituted Materials under this Section shall not increase the Contract price.

PART 2 - PRODUCTS

2.1 CONCRETE: Refer to Section 321323 "Site Cast-in-Place Concrete for Landscape Elements".

2.2 MANUFACTURERS

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

1. Custom Steel Pipe and Tube Fences:

    a. Steel pipe and tube fences are generally fabricated by local ironworks. If retaining companies listed below, add names of local fabricators to list.
    b. Pisor Industries, Inc.
    c. Wagner, R & B, Inc.; a division of the Wagner Companies.
    d. Or approved equal by Landscape Architect.

2. Prefabricated Steel Pipe and Tubular Fences:

    a. ATR Technologies, Inc.
    b. Blum, Julius & Co., Inc.
    c. Braun, J. G., Company; a division of the Wagner Companies.
    d. CraneVeyor Corp.

e. Hollaender Manufacturing Company.
f. Kee Industrial Products, Inc.
g. Moultrie Manufacturing Company.
h. Pisor Industries, Inc.
i. Sterling Dula Architectural Products, Inc.; Div. of Kane Manufacturing.
j. Superior Aluminum Products, Inc.
k. Thompson Fabricating, LLC.
l. Tri Tech, Inc.
m. Tubular Specialties Manufacturing, Inc.
n. Tuttle Railing Systems; Div. of Tuttle Aluminum & Bronze, Inc.
o. Wagner, R & B, Inc.; a division of the Wagner Companies.
p. Or approved equal by Landscape Architect.

2.3 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.

2.4 STEEL

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Tubing: ASTM A 500 (cold formed) or ASTM A 513.

C. Pipe: ASTM A 53/A 53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.

D. Plates, Shapes, and Bars: ASTM A 36/A 36M.

E. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M, unless otherwise indicated.

F. Structural Steel: ASTM 500, clean and free from rust, scale, or coating that will reduce bond. Steel shall conform to dimensional requirements, straightness, and flatness of face.

G. Fastenings: Furnish all bolts, nuts, screws, clips, washers, and any other fastenings necessary for proper erection of items specified herein. For Ferrous Metal, use stainless steel or galvanized on exterior.

H. Welding Electrodes: Shall be E 70 XX.

I. Woven-Wire Mesh: Intermediate-crimp, woven-wire mesh, made from nominal diameter wire complying with ASTM A 510 (ASTM A 510M) of pattern , connection type and size per contract drawings.

2.5 ALUMINUM

A. Aluminum, General: Provide alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than the strength and durability properties of alloy and temper designated below for each aluminum form required.

B. Extruded Bars and Tubing: ASTM B 221 (ASTM B 221M), Alloy 6063-T5/T52.

C. Extruded Structural Pipe and Round or Square Tubing: ASTM B 429/B 429M, Alloy 6063-T6.

D. Provide Standard Weight (Schedule 40) pipe, unless otherwise indicated.

E. Drawn Seamless Tubing: ASTM B 210 (ASTM B 210M), Alloy 6063-T832.

F. Plate and Sheet: ASTM B 209 (ASTM B 209M), Alloy 6061-T6.

G. Die and Hand Forgings: ASTM B 247 (ASTM B 247M), Alloy 6061-T6.

H. Castings: ASTM B 26/B 26M, Alloy A356.0-T6.

I. Perforated Metal: Aluminum sheet, ASTM B 209 (ASTM B 209M), Alloy 6061-T6

2.6 STAINLESS STEEL

A. Tubing: ASTM A 554, Grade MT 316L.

B. Pipe: ASTM A 312/A 312M, Grade TP 316L.

C. Retain first option in first paragraph below with Type 304; second option, with Type 316 or 316L.

D. Castings: ASTM A 743/A 743M, Grade CF 8M or CF 3M.

E. Plate and Sheet: ASTM A 240/A 240M or ASTM A 666, Type 316L.

2.7 SETTING GROUT

A. Non-shrink, Non-metallic Setting Grout: Pre-mixed, factory-packaged, non-staining, non-corrosive, non-gaseous Setting Grout, suitable for exterior applications, complying with ASTM C1107.

1. Products & Manufacturers: Subject to compliance with requirements, provide products by one (1) of the following:

a. Euco N-S Grout, Euclid Chemical Co.
b. Crystex, L&M Construction Chemicals, Inc.
c. Masterflow 713, BASF Building Systems, Inc.
d. Conspec Enduro 50, CONSPEC Marketing and Manufacturing Co.
e. Rapidset Grout, Rapidset Products.
f. SikaGrout 212, Sika Corporation.
g. Quikcrete Commercial Grade Fast Set Non-Shrink Grout, Quikcrete Companies.
h. 588 Grout, W.R. Meadows.
i. Certi-Grout #1000, Vexcon Chemicals.

j. or equal, as approved by the Landscape Architect.

2.8 PAINT

A. Metal Primer: SSPC 20, Type 2.

1. Exterior Exposure: VOC-compliant zinc-rich epoxy primer.
2. Interior Exposure: VOC-compliant rust-inhibitive alkyd primer.
3. Exposed to view items to be field painted shall be primed with a primer compatible with final finish coats specified in Section 099113 – Exterior Painting and Staining.

B. Galvanizing Repair Paint: High-zinc dust content paint, for re-galvanizing welds in galvanized steel.

1. Products & Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Zinc-Rich Cold Galvanizing Compound, Rust-Oleum Corp.
b. Tremec 90-93, Tremec.
c. ZRC Cold Galvanizing Compound, ZRC Chemical Products Div. of Norfold Corp.
d. or equal, as approved by the Landscape Architect.

2.9 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. For aluminum and stainless-steel elements, provide type and alloy as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.

C. Low-Emitting Materials: Paints and coatings shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

D. Etching Cleaner for Galvanized Metal: Complying with MPI#25.

E. Shop Primers: Provide primers that comply with Section 099113 "Exterior Painting" Section 099600 "High-Performance Coatings”.

F. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.

1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

G. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.

H. Intermediate Coats and Topcoats: Provide products that comply with Section 099113 "Exterior Painting" and Section 099600 "High-Performance Coatings”.

I. Epoxy Intermediate Coat: Complying with MPI #77 and compatible with primer and topcoat.

J. Polyurethane Topcoat: Complying with MPI #72 and compatible with undercoat.

K. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

L. 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.

M. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.

1. Water-Resistant Product: At exterior locations and where indicated provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior use.

2.10 FABRICATION, GENERAL

A. Workmanship:

1. Use materials of size and thickness indicated or required to produce strength and durability in finished product for use intended.
2. Work to dimensions indicated.
3. Form exposed work true to line and level with accurate angles and surfaces and straight, sharp edges.
4. Ease exposed edges to a radius of approximately 1/32-inch, unless otherwise indicated.
5. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing Work.
6. Weld corners and seams continuously, complying with AWS recommendations. At exposed connections, grind exposed welds smooth and flush to match and blend with adjoining surfaces. Welds shall be imperceptible in the finished Work.
7. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners wherever possible. Use Phillips flat- head countersunk screws or bolts for exposed fasteners, unless tamperproof security screws are indicated.
8. Cut, reinforce, drill and tap miscellaneous Decorative Metal Fences and Gates Work as indicated to receive finish hardware and similar items.

B. Galvanizing: Provide zinc coating for items indicated or specified to be galvanized, as follows:

1. ASTM A153 for galvanizing iron and steel hardware.
2. ASTM A123 for galvanizing both fabricated and un-fabricated iron and steel products made of uncoated rolled, pressed, and forged shapes, plates, bars, and strip 0.0299-inch thick and heavier.

C. Fabricate joints exposed to the weather to exclude water or provide weep holes.

D. Shop Painting:

1. Shop paint miscellaneous metal work, except members or portions of members to be embedded in concrete or masonry, surfaces and edges to be field welded, and galvanized surfaces.

2. Remove scale, rust and other deleterious materials before applying shop coat. Clean off heavy rust and loose mill scale in accordance with SSPC SP-2, SP-3, or SP-7.
3. Remove oil, grease and similar contaminants in accordance with SSPC SP-1.
4. Brush or spray on primer in accordance with manufacturer's instructions, at a rate of 2.0-mils thickness for each coat.
5. Apply one (1) shop coat to fabricated metal items, except apply two (2) coats to inaccessible surfaces after assembly or erection. Change color of second coat to distinguish from the first.
6. Primer on exposed to view items to be field painted shall be smooth and suitable for application of final finish coats specified in Section 099113 – Exterior Painting and Staining.
7. Apply a heavy coat of bituminous paint, compounded for application in 30-mil coat, to metal surfaces in contact with concrete, masonry and dissimilar metals. Do not apply on exposed surfaces.

2.11 MISCELLANEOUS METAL FABRICATIONS

A. Loose Bearing and Leveling Plates: Provide for steel items bearing on masonry or concrete construction, made flat, free from warps or twists, and of required thickness and bearing area. Drill to receive anchor bolts and for grouting as required. Galvanize after fabrication.

B. Miscellaneous Framing and Supports:

1. Provide miscellaneous framing and supports not a part of structural steel framework, as required to complete Work.
2. Fabricate to sizes, shapes, profiles, and configurations shown or required.
3. Fabricate from structural steel shapes and plates and steel bars of welded construction using mitered joints for field connection.
4. Cut, drill and tap units to receive hardware and similar items.
5. Furnish integrally welded anchors for casting into concrete or building into masonry.
6. Finish: Galvanize frames and supports. Finish per Section 099113 – Exterior Painting and Staining.

C. Metal Fencing and Gates:

1. Fabricate from metal in sections to sizes, shapes, profiles, and configurations indicated, of welded construction using mitered joints for field connection.
2. Exposed welds shall be ground smooth, flush and imperceptible. Provide NAAMM Class 1 level of finish.
3. Cut, drill and tap units to receive hardware and similar items.
4. Provide pool code latching hardware on gates, comply with pool code and provide hardware for review in submittal process.
5. Furnish integrally welded anchors for casting into concrete or building into masonry.
6. Finish: Paint in accordance with the Architects section on exterior Painting and Staining.

2.12 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.

2.13 STEEL AND IRON FINISHES

A. Galvanized Railings:

1. Hot-dip galvanize[exterior] steel and iron railings, including hardware, after fabrication.
2. Hot-dip galvanize indicated steel and iron fence assemblies or elements, including hardware, after fabrication.
3. Comply with ASTM A 123/A 123M for hot-dip galvanized railings.
4. Comply with ASTM A 153/A 153M for hot-dip galvanized hardware.
5. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
6. Fill vent and drain holes that will be exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.

B. For nongalvanized steel elements and assemblies, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves, except galvanize anchors to be embedded in exterior concrete or masonry.

C. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning" or SSPC-SP 3, "Power Tool Cleaning" per requirements indicated below:

1. Exterior Fence and Fence Components: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
2. Fence assemblies indicated to receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
3. Fence assemblies indicated to receive Primers Specified in Section 099600 "High-Performance Coatings": SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
4. Other Fence assemblies: SSPC-SP 3, "Power Tool Cleaning."

A. Primer Application: Apply shop primer to prepared surfaces of railings unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

1. Shop prime uncoated railings with universal shop primer or primers specified in Section 099113 "Exterior Painting" unless primers specified in Section 099600 "High-Performance Coatings" are indicated.

B. Shop-Painted Finish: Comply with Section 099113 "Exterior Painting"

1. Color: As selected by Landscape Architect from manufacturer's full range.

C. High-Performance Coating: Apply epoxy intermediate and polyurethane topcoats to prime-coated surfaces. Comply with coating manufacturer's written instructions and with requirements in SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting. Apply at spreading rates recommended by coating manufacturer.

1. Color: As selected by Landscape Architect from manufacturer's full range.

2.14 ALUMINUM FINISHES

A. Mechanical Finish: AA-M12 (Mechanical Finish: nonspecular as fabricated).

B. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

C. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.

1. Color: As selected by Landscape Architect from full range of industry colors and color densities.

D. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils (0.04 mm). Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

1. Color and Gloss: As selected by Landscape Architect from manufacturer's full range.

E. High-Performance Organic Finish: Two-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

1. Color and Gloss: As selected by Landscape Architect from manufacturer's full range.

F. High-Performance Organic Finish: Three-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

1. Color and Gloss: As selected by Architect from manufacturer's full range.

2.15 STAINLESS-STEEL FINISHES

A. Remove tool and die marks and stretch lines, or blend into finish.

B. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.

C. 180-Grit Polished Finish: Oil-ground, uniform, directionally textured finish.

D. 320-Grit Polished Finish: Oil-ground, uniform, fine, directionally textured finish.

E. Polished and Buffed Finish: Oil-ground, 180-grit finish followed by buffing.

F. Directional Satin Finish: No. 4.

G. Dull Satin Finish: No. 6.

H. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

PART 3 - EXECUTION

3.1 PREPARATION

A. Coordinate and furnish anchors, setting drawings, diagrams, templates, instructions, and directions for installation of anchors, such as concrete inserts, sleeves, anchor bolts and miscellaneous items having integral anchors.

3.2 INSTALLATION

A. General:

1. Fastening to In-Place Construction: Provide threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws and other connectors, as required.

2. Cutting, Fitting and Placement:

a. Perform cutting, drilling and fitting required for installation of miscellaneous metal fabrications.
b. Set work accurately in location, alignment and elevation, plumb, level, true and free of rack, measured from established lines and levels.
c. Provide temporary bracing or anchors in formwork for items to be built into concrete, masonry or similar construction.

3. Fit exposed connections together forming tight hairline joints.

a. Weld connections not shop welded.
b. Grind exposed joints smooth and imperceptible, and touch-up shop paint coat.
c. Do not weld, cut or abrade the surfaces of exterior units which have been hot-dip galvanized after fabrication, and intended for bolted or screwed field connections.

4. Field Welding: Comply with AWS for procedures of manual shielded metal-arc welding, appearance and quality of welds, and methods used in correcting welding work.

B. Setting Loose Plates:

1. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve surface bond. Clean bottom surface of bearing plates.
2. Set loose leveling and bearing plates on wedges, or other adjustable devices.
3. Tighten anchor bolts after the bearing members have been positioned and plumbed.
4. Cut-off protruding ends of wedges flush with the edge of the bearing plate before packing with grout.
5. Use metallic non-shrink grout in concealed locations where not exposed to moisture; use non-metallic non-shrink grout in exposed locations.
6. Pack grout solidly between bearing surfaces and plates to ensure no voids remain.

3.3 ADJUST AND CLEAN

A. Touch-Up Painting: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material used for shop painting. Apply by brush or spray to provide a minimum dry film thickness of 2.0-mils.

B. Hot-Dip Galvanized Surfaces: Clean field welds, bolted connections and abraded areas and spot prime with specified primer applied to a minimum dry film thickness of 2.5-mils.

END OF SECTION

SECTION 328400

SITE IRRIGATION SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes materials, labor, apparatus, tools, equipment, temporary construction, transportation, and services necessary for and incidental to performing the proper completion of Work for Sprinkler Irrigation System, as shown in the Contract Drawings, and as specified herein this Section.

B. Work under this Section consists of, but is not necessarily limited to, furnishing and installing the following:

1. Furnishing and installing a complete irrigation system.
2. Trenching and backfill.
3. Furnishing and installing backflow prevention devices (and pressure reducing valves).
4. Boring under existing paving for irrigation piping and remote control valve wiring where indicated on plans.
5. Furnishing and installing sleeves for irrigation piping and remote control valves where indicated.
6. Coordination and installation of water meters and taps.
7. Coordination and installation of electrical meters, and related electrical equipment and wiring by others.
8. Inspections and tests.

C. Related Documents: The following Documents contain requirements that relate to Work in this Section:

1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
2. Division 26 – “Electrical”.
3. Section 015639 "Temporary Tree and Plant Protection".
4. Section 312219 "Landscape and Fine Grading".
5. Section 329200 "Lawns and Grasses".
6. Section 329300 "Trees, Shrubs, Vines and Groundcovers".
7. Section 329813 "Landscape Establishment Period".

1.2 SUBMITTALS:

A. General: Refer to Division 01 for project submittal requirements and timelines. If provided in hardcopy submittal booklets submit each item in this Article in required copies with four (4) copies for review by Landscape Architect. Three (3) copies shall be returned (One for Client, one for Owner and one for Contractor) and one copy maintained by Landscape Architect. Provide one (1) sets of Material Samples for review by the Landscape Architect unless requested otherwise.

B. Submittal Booklets: Each Submittal Booklet under this Section shall be tabbed into specific sections, containing clearly identified (through yellow highlighter or other specific identification methods) and legible information on the following information indicated in this Article.

C. Electronic Submittals: Electronic Submittal shall be provided in a single bound file, PDF format preferred, unless otherwise noted in Division 01.

D. Furnish required copies of manufacturer's literature, certifications, and operating instructions for the complete list of materials and related accessories, for the following items:

1. Irrigation Controller.
2. Gate Valves.
3. Pipe and Fittings and related solvents and connectors.
4. Remote Control Valves and wire connectors.
5. Wiring
6. Valve Boxes.
7. Quick Coupling Valves.
8. Sprinkler Heads and nozzles.
9. Bubbler Heads.
10. Dripline Tubing.
11. Dripline Tubing Accessories.
12. Dripline Header Piping.
13. Moisture Sensor and Mounting Device.
14. Isolation Valves.
15. Wye Strainers.
16. Backflow Preventer(s).
17. Master Valve(s).

E. Substitutions:

1. Specific reference to manufacturers' names and products specified in this Section are used as standards, but this implies no right to substitute other material or methods without written approval of the Landscape Architect.
2. Installation of any approved substitution is Contractor's responsibility. Any changes required for installation of any approved substitution must be made to the satisfaction of Landscape Architect and without additional cost to Owner.
3. Approval by Landscape Architect of substituted equipment and/or dimensional drawings does not waive these requirements.

F. Record Drawings:

1. The contractor shall transfer all information noted on the field record print to the sepia, vellum or AutoCAD disc as required by the owner. The drawings shall be to scale and all indications shall be recorded in a neat, orderly way. The record sepia or AutoCAD disc shall be turned over to the Landscape Architect before the Final Acceptance of the project for review.
2. Indicate the actual dimensioned location of valves and quick couplers, irrigation main line piping, sleeve crossing locations for main and wire, wire routing, meters, pumps and backflow devices and any wire splices.
3. Locate all valves by GPS coordinates. Indicate station numbers and GPS coordinates on the as builds and on metal tags connected to the valves.
4. Dimension mainline piping and wiring routes (if separate) at 100 foot intervals and at all changes in direction. Dimension all items from easily identified permanent features, such as buildings, curbs, fences, walks or permanent features and lines.
5. Drawings shall show approved substitutions, if any, of material including manufacturer's name, and catalogue number in a revised legend.

G. Prior to the end of the Landscape Establishment Period (refer to Section 329813), provide to the General Contractor or Owner’s Representative the record drawings:

1. Four sets of color-coded, laminated reduced size irrigation as built drawings for each different controller
2. Four sets of a one sheet composite of the record drawings

    a. The reduced drawings will be reduced to approximately 11" x 17" or as small as practical to read valve numbers and zone areas.
    b. The composite drawing will be approximately 30" x 42".
    c. The reduced drawings and composite shall be color-coded to clearly indicate zones or sections of valves and the approximate areas of coverage in different colors such that no adjacent areas are the same color. Laminate the reduced and composite drawing between two sheets of clear plastic.

3. One AutoCAD file of the dimensioned record drawing on a CD disc. Zones do not need to be colored coded on the disc. Include dimensions as described above and GPS information on the AutoCAD file.

1.3 CONTROLLER AND SYSTEM TRAINING:

A. Schedule and hold a controller and system training session with the owner's maintenance personnel prior to the end of the 90-day establishment period. Demonstrate operation of the controller and generally train the owner on manual and automatic operation of the controllers and valves, and. Instructions for the emergency shut down of the system main lines.

B. Contractor shall make a daily record of all work installed during each day on a construction progress drawing. Construction drawings shall be on the construction site at all times while the irrigation system is being installed. Update the drawings on a daily basis.

    1. All indications shall be recorded in a neat, orderly way.

1.4 INTENT OF THE DRAWINGS: Sprinkler lines shown on the drawings are essentially diagrammatic. Locations of all sprinkler heads, valves, piping, wiring, etc., shall be established by the Contractor at the time of construction. Spacing of the sprinkler heads and quick coupling valves are shown on the drawings and shall be exceeded only with permission of the Owner's authorized representative.

1.5 QUALITY ASSURANCE AND CONTROL

A. Requirements of Regulatory Agencies:

1. All work and materials shall be in full accordance with latest rules and regulations of safety orders of Division of Industrial Safety; the Uniform Plumbing Code and other applicable laws or regulations, including the City of Westlake Plumbing Code.
2. Nothing in these Drawings or Specifications is to be construed to permit work not conforming to these codes. Should the Contract Documents be at variance with the aforementioned rules and regulations, notify Landscape Architect and get his instructions before proceeding with the work affected.

B. Testing:

1. Preliminary review of completed installation will be made by Landscape Architect prior to backfilling of trenches and during hydrostatic testing.
2. Final review shall be made in conjunction with the final review of lawn, shrub and tree planting.

1.6 EXTRA MATERIALS/SPARE PARTS

A. Provide five (5) each type head and five (5) each type of nozzle used as spare parts. Provide two (2) sets of keys to each controller. Provide two (2) quick coupler keys with swivel hose ells for every eight (8) quick couplers installed, minimum of two (2). Provide one (1) each of tools required for adjustment of sprinklers, nozzles and valve operation. Deliver spare parts to the owner at or before the time of training.

1.7 PROJECT/SITE CONDITIONS

A. Contractor shall acquaint himself with all site conditions. Should utilities or other work not shown on the plans be found during excavations, Contractor shall promptly notify Landscape Architect for instructions as to further action. Failure to do so will make Contractor liable for any and all damage thereto arising from his operations subsequent to discovery of such utilities not shown on plans.

B. Contractor shall take necessary precautions to protect site conditions. Should damage be incurred, this Contractor shall repair damage to its original condition or furnish and install equal replacement at his expense.

C. Existing Irrigation System: All existing irrigation circuits shall be kept in operation at all times. If the existing system is damaged by this construction, Contractor shall be responsible for immediate repair of such damage. After each repair, all heads of the repaired circuit shall be removed so that the lines can be cleared of all dirt and foreign matter.

1.8 WARRANTY

A. In addition to manufacturer's guarantees or warranties, all work shall be warranted for one year from the date of Final Acceptance against defects in material, equipment and workmanship by Contractor. Warranty shall also cover repair of damage to any part of the premises resulting from leaks or other defects in materials, equipment and workmanship to the satisfaction of the Owner.

B. Contractor shall not be held responsible for failures due to neglect by Client, Owner, vandalism, etc., during Guarantee Period. Report such conditions to Landscape Architect in writing.

PART 2 - MATERIALS

2.1 MATERIALS: Materials throughout the system shall be as specified and/or noted on the Drawings, new and in perfect condition.

2.2 WATER METER(S): Shall be installed by the local water district in accordance with their requirements. Cost will be paid by Contractor.

2.3 PRESSURE REDUCING VALVE

A. Valve to be as listed below:

1. Valve to be 90-01-AB PRESSURE REDUCING VALVE as manufactured by the Cla-Val Company, Costa Mesa, California. 800-942-6326.
2. Or approved equal by Landscape Architect or Irrigation Designer.

2.4 DOUBLE CHECK - DOUBLE GATE VALVE ASSEMBLY

A. Assembly to be as listed below:

1. Clayton Model D Double Check - Double Gate Valve assembly as manufactured by Cla-Val Company, Costa Mesa, California. 800-942-6326
2. Febco Model 850 BV In-Line Double Check Valve assembly as manufactured by Febco (a Watts Brand), North Andover, Massachusetts. 800-767-1234.
3. Or approved equal by Landscape Architect or Irrigation Designer.

2.5 REDUCED PRESSURE BACKFLOW PREVENTER

A. Reduced pressure principle backflow preventer to be as listed below:

1. Clayton Model RP Backflow Preventer as manufactured by Cla-Val Company, Costa Mesa, California. 800-942-6326
2. Febco Model 825 Y, a “Y” Pattern Reduced Pressure Zone assembly as manufactured by Febco (a Watts Brand), North Andover, Massachusetts. 800-767-1234.
3. Or approved equal by Landscape Architect or Irrigation Designer.

2.6 PRESSURE-TYPE VACUUM BREAKER ASSEMBLY:

A. Assembly to be as listed below:

1. Rainbird #200 PVB
2. FEBCO #765 PVB, two (2") inch.
3. Or approved equal by Landscape Architect or Irrigation Designer.

2.7 ATMOSPHERIC VACUUM BREAKER ASSEMBLY

A. Atmospheric vacuum breaker to be SMR H403, or approved equal.

2.8 PIPE: All Piping shall be manufacturer dyed purple and labeled “Non-Potable”.

A. Piping on pressure side of irrigation control valves:

1. Four (4") inch and larger - AWWA C900, PVC 1120, SDR 18. Pipe to have push-on type joints and fittings. Bells to consist of an integral wall section with a solid cross-section rubber ring conforming to ASTM D-1869 "Rubber Rings for Asbestos Cement Pipe". The bell section shall be designed to be at least as strong as the pipe wall. Pipe O.D. to be compatible with standard cast iron pipe fittings.
2. Three (3") inch and larger - Polyvinyl chloride (PVC) 1120-1220, SDR 21.0, Class 200 rubber gasketed pipe, conforming to ASTM D-1784 and ASTM D-2241. Rubber gasket shall conform to ASTM D-1869 and shall be provided by pipe manufacturer.
3. Two and one-half (2 1/2") inch diameter and smaller - Polyvinyl chloride (PVC) 1120-1220, Schedule 40 and shall conform to ASTM D-1785-73.
4. Two and one-half (2 1/2") inch and smaller - To be polyvinyl chloride (PVC) 1120-1220, SDR 13.5, Class 315, and shall conform to ASTM D-2241-73.

B. Piping on non-pressure side of irrigation control valves:

1. Polyvinyl chloride (PVC) 1120-1220, SDR 26.0, Class 160, and shall conform to ASTM D-2241-73.
2. Polyvinyl chloride (PVC) 1120-1220, SDR 21.0, Class 200, and shall conform to ASTM D-2241-73, except one-half (1/2") inch diameter shall be Class 315.

C. Identification: All piping shall be continuously and permanently marked with the following:

1. Manufacturer's name or trademark, size, schedule, and type of pipe, working pressure at 73 degrees F. and National Sanitation Foundation (N.S.F.) approval.

2.9 FITTINGS:

A. Fittings for Rubber-Gasketed Pipe:

1. Connections of three (3") inch and four (4") inch mains to three (3") inch and four (4") inch mains - Class 200 PVC as provided by the same manufacturer as the pipe and conforming to ASTM D-2466 and ASTM D-1869.
2. Connections of three (3") inch and four (4") inch mains to two and one-half (2 1/2") inches and smaller mains to remote control and quick coupling valves - Schedule 40 PVC solvent-weld socket fittings and conforming to ASTM D-2466.
3. For push-on type, SDR 18 pipe - Cast iron, AWWA C11D mechanical joint pipe fittings.

B. Fittings for Solvent-Welded Pipe:

1. Schedule 40, polyvinyl chloride, standard weight, as manufactured by "Sloane", "Lasco", or approved equal, to meet ASTM D-2466-73 and D-2467-73.
2. Threaded PVC nipples - Schedule 80 PVC.

C. Fittings for Polyethylene Pipe (Flex-Joints):

1. Polyallomer as manufactured by "Flintkote" or approved equal.
2. Compression type of CPVC as manufactured by "Pepco".

D. Fittings for Swing Joints:

1. Supply three (3) Schedule 40 "Marlex" elbows.
2. Threaded PVC nipples - Schedule 80 PVC.

E. Copper Tubing (Bubbler and Shrub Risers):

1. Copper shall be "M" domestic hard copper, one-half (1/2") inch diameter.
2. Use brass heads for all copper riser installations.

2.10 GATE VALVES:

A. Up to three (3") Inch Size: 125 Pound bronze construction, non-rising stem type, sized to line. "Crane" #438; "NIBCO" #T113; or approved equal.

B. Four (4") Inch Size and Larger: Iron body, mechanical joint ends, bronze mounted, double disc with parallel or inclined seats, water working pressure 175 psi, AWWA C500, non-rising stem type, turning counter-clockwise to open. "Dresser" #67-01 or approved equal.

2.11 SLEEVE FOR CONTROL WIRE AND WATER LINE: PVC 1126-1220, Schedule 40 pipe or Schedule 40 galvanized steel pipe.

2.12 IRRIGATION CONTROLLER: Permanent controllers shall be as listed per contract drawings.

2.13 REMOTE CONTROL VALVES:

A. Valve to be of size and manufacturer shown on drawings, slow acting valves.

B. Valves to be of same manufacturer as controller.

2.14 VALVE KEYS: Furnish two keys.

2.15 CONTROL WIRE:

A. Wire: Solid copper wire, U.L. approved for direct burial in ground. ID1 14-2 wire cable by page electric or approved equal (to be spliced to each decoder).

B. Splicing Materials: 3M DBR-6 600V splice kits.

2.16 VALVE BOXES: To be as specified on Contract Drawings with metal lids being painted black by manufacturer.

2.17 SPRINKLER HEADS: Heads to be as shown on the drawings, where possible supply with black finish with purple indicator.

2.18 DRAINAGE VALVES: Automatic drain valve shall have a machined brass body, with stainless steel ball seat and one-half (1/2") inch male pipe thread as manufactured by "Rainbird".

2.19 RAIN AND FREEZE SENSOR: To be of same manufacturer as controller.

2.20 SAND BACKFILL: Sand for backfill shall be clean masonry sand free of stones or debris.

2.21 CONCRETE FOR THRUST BLOCKS: Shall be "Sakrete" or "Handi-Mix" concrete mix or equal.

2.22 CONDUITS: All conduits for irrigation mains and laterals shall be six (6") inch Schedule 40 PVC for remote control wiring and controller power feed, common conduit, unless otherwise specified on the drawings or existing in the field. Use galvanized steel pipe only under public roads for electrical power.

2.23 DRIP SYSTEM:

A. Remote Control Valve – As shown on Contract Drawings. Specified valve to be factory set up at 40 psi fitted with Y type strainer downstream of all remote control valves.

B. Backflow Device - Two (2") inch FEBCO vacuum breaker.

C. Controllers - As shown on Contract Drawings.

D. Mains - Schedule 40 PVC. (purple)

E. Lateral line three-quarter (3/4") inch flexible poly tubing. PEPCO poly plus 7-11 irrigation hose #P-940 or equal. (purple)

F. Distribution Tubing - As shown on Contract Drawings.

G. Filters - A.G. Products, one (1") inch Wye filter with standard 150 mesh screen, Model 4E-3/4-A or equal.

H. Fittings - A.G. Products, compression type or equal. Use standard PVC fittings with A.G. Products Adapter #900-CA.

I. End Cap - A.G. Products #GETC or equal.

J. Emitters - Rainbird "Drop-In" Bubbler Emitters.

PART 3 - EXECUTION

3.1 EXAMINATION

A. NO WORK UNDER THIS SECTION SHALL COMMENCE UNTIL SUBMITTALS UNDER THIS SECTION HAVE BEEN REVIEWED ACCORDINGLY BY THE LANDSCAPE ARCHITECT.

B. Prior to commencing Work under this Section, Contractor shall examine previously installed Work from other trades and verify that such Work is complete and to the point where Work herein may commence properly. Do not proceed with Work until unsatisfactory conditions have been corrected.

C. Contractor shall notify the Landscape Architect, in writing, on the anticipated commencement date and length of duration of the Work installation herein this section.

3.2 LAYOUT

A. No consideration will be given to any design changes until after the awarding of the contract. Should any changes be deemed necessary after award of contract, for proper installation and operation of the system, such changes shall be negotiated by the Landscape Architect (and based upon the Unit Price Schedule where applicable).

B. Layout work as accurately as possible to drawings. Drawings are diagrammatic to the extent that swing joints, offsets and all fittings are not shown.

C. Full and complete coverage is required. Contractor shall make any necessary minor adjustments to layout required to achieve full coverage of irrigated areas at no additional cost to Owner.

D. Where connections to existing stubouts are required, make necessary adjustments should stubs be located differently in the Drawings. Adjust layout as necessary to install around existing work. Where piping is shown to be under paved areas but running parallel and adjacent to planted area, the intent is to install piping in planted areas. Do not install directly over another line in same trench.

E. It shall be the Contractor's responsibility to establish the location of all sprinkler heads on all turf areas in order to assure proper coverage of all areas. In no case shall spacing of sprinkler heads exceed distances shown on the drawings and/or those specified. Pipe sizes shall conform to those shown on the drawings. No substitutions of smaller pipe sizes will be permitted but substitutions of larger sizes may be approved.

F. Layout shall occur such that no valve boxes of any size (for all equipment required to have a valve or utility box) shall occur in lawn or turf areas and to best extent possible in pavement areas. Review all valve and utility box locations with Landscape Architect prior to installation for approval and or adjustment.

G. The Contractor will stake out the location of each run of pipe and all sprinkler heads of sprinkler valve locations prior to trenching. Before installation is started in a given area, the Landscape Architect shall review each zone and area for approval and or adjustment of layout.

3.3 EXCAVATING AND TRENCHING

A. Perform all excavations as required for installation of work included under this Section, including shoring of earth banks, if necessary. Restore all surfaces, existing underground installations, etc., damaged or cut as a result of the excavations, to their original condition.

B. Should utilities not shown on the plans be found during excavations, Contractor shall promptly notify Landscape Architect for instructions as to further action. Failure to do so will make Contractor liable for any and all damage thereto arising from his operations subsequent to discovery of such utilities. Indicate such utility crossings on the Record Drawings promptly.

C. Dig trenches wide enough to allow a minimum of four (4") inches between parallel pipe lines. Trenches shall be of sufficient depth to provide minimum cover from finish grade as follows:

1. Over pipe on pressure side of irrigation control valve, control wires and quick coupling valves: 18 inches.
2. Over pipe on non-pressure side of irrigation control valve: 12 inches.
3. Where system is installed over structure, lay pipe on top of soil separator. Protect soil separator with two (2") inch layer of specified planting soil mix or sand.
4. All PVC pipe under paving shall be bedded with minimum of four (4") inches of sand backfill on all sides and have twenty four (24") inch cover.
5. All mains shall be sloped to drain valves where applicable.

D. Backfill all pressurized mains and marker boxes with a minimum of four (4") inches of sand Should existing paving require cutting, saw cut paving a minimum twelve (12") inches wide, compact backfill to ninety five (95%) percent dry density; dispose of waste off site. Patch to match existing pavement.

3.4 BORING UNDER EXISTING PAVEMENTS:

A. The boring shall proceed from a pit provided for the boring equipment and workmen. Excavation for pits and installation shall be as described under "Excavating and Trenching". The location of the pit shall not interfere with existing plant materials or structures designated to remain.

B. Holes shall be bored mechanically. Where holes required are larger than two (2") inches, the bore shall be completed using a pilot hole. The two (2") inch hole shall be bored the entire length of the crossing and shall be checked on the opposite end for line and grade. If acceptable, this hole shall serve as the centerline for the larger hole to be bored. Lateral and vertical tolerance is limited to one (1") inch in ten (10') feet, provided that the variation be regular and occur only in one direction.

C. The use of water or other fluids in connection with the boring operation will be permitted only to lubricate cutting. Jetting shall not be permitted. (In unconsolidated soil formations, a gel-forming colloidal drilling fluid consisting of at least ten (10%) percent of high-grade processed bentonite may be used to consolidate cuttings, seal the hole walls and furnish lubrication for subsequent removal of cuttings and installation of the pipe.)

D. Excavated material will be placed near the top of the working pit and disposed of as required.

3.5 CONCRETE THRUST BLOCKS:

A. Install where the rubber-gasketed irrigation main changes direction as at ells and tees and where the rubber-gasketed main terminates.

B. Pressure tests shall not be made for a period of thirty six (36) to forty eight (48) hours following the completion of pouring of the blocks.

C. Blocks for these mains shall be sized and placed in strict accordance with the pipe manufacturer's specifications and shall be of an adequate size and so placed as to take all thrust created by the maximum internal water pressure.

3.6 WATER METER(S): Install as per the requirements of the local water district and local codes. Costs will be paid by Owner.

3.7 PRESSURE REDUCING VALVE: Install according to local codes. House in a rectangular concrete box of sufficient size to easily allow repair or replacement of unit.

3.8 BACKFLOW PREVENTION DEVICE: Install according to local codes and manufacturer's latest printed instructions.

3.9 CONDUITS AND SLEEVES:

A. Furnish and install conduit where control wires pass under or through walls. Conduits to be of adequate size to accommodate retrieval for repair of wiring and shall extend twelve (12") inches beyond edge of walls.(not all conduits may be shown on plan)

B. Install sleeves for all pipes passing through or under walls, walks and paving as shown on Drawings. Sleeving to be of adequate size to accommodate retrieval for repair of wiring or piping and shall extend twelve (12") inches beyond edge of paving or other construction. (not all sleeves may be shown on plan)

C. Coordinate conduit and sleeve installation with other trades as required.

3.10 PIPE LINE ASSEMBLY:

A. General:

1. Install pipes and fittings in accordance with manufacturer's latest printed instructions.
2. Clean all pipes and fittings of dirt, scales and moisture before assembly.
3. All pipe, fittings and valves, etc., shall be carefully placed in the trenches. Interior of pipes shall be kept free from dirt and debris and when pipe laying is not in progress, open ends of pipe shall be closed by approved means.
4. All lateral connections to the mainline as well as all other connections shall be made to the side of the mainline pipe. No connections to the top of the line shall be allowed.

B. Solvent-Welded Joints for PVC Pipes:

1. Use solvents and methods by pipe manufacturer.
2. Cure joint a minimum of one hour before applying any external stress on the piping and at least twenty four (24) hours before placing the joint under water pressure.

C. Threaded Joints for Plastic Pipes:

1. Use Teflon tape on the threaded PVC fittings except where Marlex fittings are used.

2. Use strap-type friction wrench only. Do not use metal-jawed wrench.
3. When connection is plastic to metal, male adaptors shall be used. The male adaptor shall be hand tightened, plus one turn with a strap wrench. Joint compound shall be Teflon tape or equal upon approval.

D. Threaded Joints for Galvanized Steel Pipes:

1. Factory-made nipples shall be used wherever possible. Field-cut threads in pipes will be permitted only where absolutely necessary; when field threading, cut threads accurately on axis with sharp dies.
2. Use pipe joint compound to make threads only.

E. Joints for Polyethylene Pipes:

1. Double-clamp all connections one and one-quarter (1 1/4") inch diameter and greater.
2. Make all connections between polyethylene pipes and metal valves or pipes with threaded fittings using male adaptors.

F. Laying of Pipe:

1. Pipes shall be bedded in at least two (2") inches of finely divided material with no rocks or clods over one (1") inch diameter to provide a uniform bearing.
2. Pipe shall be snaked from side to side of trench bottom to allow for expansion and contraction. One additional foot per 100 feet of pipe is the minimum allowance for snaking.
3. Do not lay PVC pipe when there is water in the trench.
4. Plastic pipe shall be installed in a manner so as to provide for expansion and contraction as recommended by the manufacturer.
5. Plastic pipe shall be cut with PVC pipe cutters or hacksaw, or in a manner so as to ensure a square cut. Burrs at cut ends shall be removed prior to installation so that a smooth unobstructed flow will be obtained.
6. All plastic to plastic joints shall be solvent-weld joints or slip seal joints. Only the solvent recommended by the pipe manufacturer shall be used. All plastic pipe and fittings shall be installed as outlined and instructed by the pipe manufacturer and it shall be the Contractor's responsibility to make arrangements with the pipe manufacturer for any field assistance that may be necessary. The Contractor shall assume full responsibility for the correct installation.
7. Unless waived by the Landscape Architect, the Contractor shall install bell type or approved slip joint fitting at a minimum of twenty (20') feet OC for all pressurized mains.

3.11 GATE VALVES: Group valves together and locate in planted areas where possible. Box shall be flush with finish grade. (For three (3") inches or larger rubber-gasketed pipe, anchor valve with thrust block.)

3.12 IRRIGATION CONTROL VALVES: Install control valves in valve boxes where shown and group together where practical. Place no closer than twelve (12") inches to walk edges, buildings and walls. Valve boxes shall be flush with finish grade.

3.13 SPRINKLER HEADS:

A. Place all rotary pop-up sprinkler heads in lawn areas on temporary risers with top of heads four (4") inches above finish grade. Place part-circle rotary pop-up sprinkler heads twelve (12") inches from edge of and flush with top of adjacent walks, header boards, curbs, and mowing bands, or paved areas at time of installation. Rotary sprinklers to be installed on a swing joint assembly as detailed.

B. Install all impact sprinkler spray heads and bubbler heads on a swing joint assembly as detailed on the Drawings.

C. Stake on-grade shrub sprinkler head risers with a thirty (30") inch length of three-eighths (3/8") inch diameter smooth rebar and two (2) stainless steel pipe clamps. Set shrub heads twelve (12") inches above grade in groundcover areas or as required by height of plant material and eight (8") inches above grade in shrub areas. Place heads a minimum of six (6") inches from back of curb or edge of pavement. Place adjacent to walls. Stake heads prior to backfilling trenches. Stakes to be parallel to riser. Where copper risers are specified, use a section of flex hose below grade.

3.14 AUTOMATIC CONTROLLER

A. Install per local code and manufacturer's latest printed instructions.

B. Connect remote control valves to controller in clockwise sequence to correspond with station setting beginning with Stations 1, 2, 3, etc.

C. Affix controller name (i.e. "Controller A") on inside of controller cabinet door with letters minimum of one (1") inch high. Affix a non-fading copy of irrigation diagram to cabinet door below controller name. Irrigation diagram to be sealed between two sheets of 20 mil (minimum) plastic. (Irrigation diagram is detailed on plan.) (Irrigation diagram shall be a reduced copy of the as-built drawing and shall show clearly all valves operated by the controller, showing station number, valve size, and type of planting irrigated.)

3.15 CONTROL WIRING

A. Install control wires with sprinkler mains and laterals in common trenches wherever possible. Lay to the side of pipe line. Provide looped slack at valves and snake wires in trench to allow for contraction of wires. Tie wires in bundles at ten (10') foot intervals.

B. Control wire splices at remote control valves to be crimped and sealed with specified splicing materials. Line splices will be allowed only on runs of more than 500 feet. Line splices to be Marconi-type taped and sealed with 3M dbr-6 600V slice kits.

C. Install a minimum of one (1) extra control wire to the control valve located the greatest distance from the controller in both directions and label each end blank.

3.16 CLOSING OF PIPE AND FLUSHING OF LINES

A. Cap or plug all openings as soon as lines have been installed to prevent entrance of materials that would obstruct the pipe. Leave in place until removal is necessary for completion of installation.

B. Thoroughly flush out all water lines before installing heads, valves and other hydrants.

C. Test as specified.

D. Upon completion of testing, complete assembly and adjust sprinkler heads for proper distribution.

E. All sprinkler heads and quick coupling valves shall be set perpendicular to finished grades unless otherwise designated on the drawings, or otherwise specified. Sprinkler heads adjacent to existing walls, curbs and other paved areas, shall be set to grade. Sprinkler heads which are to be installed in lawn areas where the turf has not yet been established

shall be set one (1") inch above the proposed finish grade. Heads installed in this manner will be lowered to grade when the turf is sufficiently established to allow walking on it without appreciable destruction. Such lowering of heads shall be done by this Contractor as part of the original contract with no additional cost to the Owner.

3.17 TESTING

A. Make hydrostatic tests when welded PVC joints have cured as per manufacturer's instructions.

1. Pressurized Mains:

a. Completely install water meter, mains, isolation valves and control valves. Do not install laterals.
b. Open all isolation valves.
c. Fill all lines with water and shut off at meter.
d. Pressurize the main with air to 70 psi. Monitor gauge for pressure loss for four (4) hours.
e. Leave lines and fittings exposed throughout testing period.
f. Leaks resulting from tests shall be repaired and tests repeated until the system passes.
g. Test all isolation valves for leakage.

2. Non-Pressure Laterals:

a. Test piping after laterals and risers are installed and system is fully operational.
b. Leave trenches open to detect possible leaks.

B. Submit written requests for inspections to the Landscape Architect at least forty eight (48) hours prior to anticipated inspection date.

3.18 BACKFILL AND COMPACTING

A. After system is operating and required tests and inspections have been made, backfill excavations and trenches with clean soil, free of debris.

B. Backfill for all trenches, regardless of the type of pipe covered, shall be compacted to minimum ninety five (95%) percent density under pavements, eighty five (85%) percent under planted areas.

C. Compact trenches in areas to be planted by thoroughly flooding the backfill. Jetting process may be used in those areas.

3.19 CLEAN UP: Clean up and remove all debris from the entire work area prior to Final Acceptance to satisfaction of Landscape Architect.

END OF SECTION

SECTION 329113

SOIL PREPARATION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes materials, labor, apparatus, tools, equipment, temporary construction, transportation, and services necessary for and incidental to performing the proper completion of Work, as required to make a complete and thorough preparation of the planting soil, including soil amendment products, imported topsoil, as required, to make up deficiencies in quantity of soil available on site, as shown in the Contract Drawings, and as specified herein this Section.

B. Work under this Section consists of, but is not necessarily limited to, furnishing and installing the following:

1. Agronomic Soil Fertility Testing and Soil Percolation Testing.
2. Topsoil.
3. Pre-Plant Weed Control.
4. Soil Conditioners, Amendments, and Fertilizers.
5. Import soil for specific plant material types and related requirements.
6. Mixing of planting mediums
7. Transporting and storage of soils and planting mediums.
8. Machinery and loading restrictions.

C. Related Documents: The following Documents contain requirements that relate to Work in this Section:

1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
2. Section 312219 "Landscape and Fine Grading".
3. Section 329200 "Lawns and Grasses".
4. Section 329300 "Trees, Shrubs, Vines and Groundcovers".
5. Section 329813 "Landscape Establishment Period".

1.2 DEFINITIONS AND APPLICABLE STANDARDS

A. References:

1. USDA – United States Department of Agriculture.
2. ASTM – American Society for Testing and Materials.

B. Definitions:

1. Topsoil:

a. Topsoil - Shall be friable soil, providing sufficient structure in order to give good till and aeration.
b. Gradation Limits - Soil shall be a sandy loam, loam, clay loam or clay. The definition of soil texture shall be per the USDA classification scheme. Gravel over ¼-inch in diameter shall be less than 10% by weight.

c. Permeability Rate - Hydraulic conductivity rate shall be not less than one-inch (1") per hour, nor more than twenty-inches (20") per hour, then tested in accordance with the USDA Handbook Number 60, Method 34b, or other approved Methods.

d. Fertility - The range of the essential elemental concentration in soil shall be as follows:

Ammonium Bicarbonate/ DTPA Extraction (PPM):	
Element	(mg/kilogram) dry weight basis
Phosphorous	4 - 40
Potassium	60 - 220
Iron	4 - 35
Manganese	0.6 - 6
Zinc	0.6 - 8
Copper	0.1 - 5
Boron	0.2 - 1
Magnesium	50 - 500
Sodium	0 - 100
Sulfur	25 - 500
Molybdenum	.1 – 30

e. Acidity - The soil pH range measured in the saturation extract (Method 21a, USDA Handbook number 60) shall be 6.0 – 7.9.

f. Salinity - The salinity range measured in the saturation extract (Method 3a, USDA Hand Number 60) shall be 0.5 – 2.0 dS/m. If calcium and if sulfate ions both exceed 20 milli-equivalents per liter in the saturation extract, the maximum salinity shall be 4/0 dS/m.

g. Boron - The maximum concentration of soluble boron in the saturation extract (Method 3a, USDA Handbook Number 60) shall be 1 mg/1 (parts per million).

h. Sodium Adsorption Ratio (SAR) - The maximum SAR shall be 4 measured per Method 20b, USDA Handbook Number 60.

i. Soil Organic Matter Content - Sufficient soil organic matter shall be present to impart good physical soil properties but not be excessive to cause toxicity or cause excessive reduction in the volume of soil due to decomposition of organic matter.

j. Calcium Carbonate Content - Free calcium carbonate (limestone) may be present.

k. Heavy Metals - The maximum permissible elemental concentration in the soil shall not exceed the following:

Ammonium Bicarbonate/DTPA Extraction (PPM):	
Element	(mg/kilogram) dry weight basis
Arsenic	
Cadmium	2
Chromium	10
Cobalt	2
Lead	30
Mercury	1
Nickel	5
Selenium	3
Silver	.5
Vanadium	3

l. Elemental Concentration - If the soil pH is between 6 and 7, the maximum permissible elemental concentration shall be reduced 50%. If the soil pH is less than 6.0, the maximum permissible elemental concentration shall be present at 50% or more of the above values.
m. Phytotoxic constituent, herbicides, hydrocarbons, etc. – Germination and growth of plants shall not be restricted more than 10% compared to standard controls. Standard controls shall be both monocots and dicots. Petroleum hydrocarbons shall not be present.
n. Sub Grade - Soil level resulting from the rough grading work under another Section. Cultivation of sub grade areas prior to placement of Topsoil is included in this Section.
o. Stockpiled Topsoil - Soil stockpiled for spreading over prepared sub-grade.
p. Stockpiled Native Topsoil: Topsoil stripped from the site prior to rough grading Work (under another Section), to be spread and amended as Work under this Section.
q. Imported Topsoil: Off-site Topsoil, imported and stockpiled under this Section, to be spread and amended as Work under this Section.

C. Measurements:

1. PPM: Measurement, in parts per million.

1.3 SUBMITTALS

A. General: Refer to Division 01 for project submittal requirements and timelines. If provided in hardcopy submittal booklets submit each item in this Article in required copies with three (3) copies for review by Landscape Architect. Two (2) copies shall be returned (one for Client and one for Contractor) and one copy maintained by Landscape Architect. Provide two (2) sets of Material Samples for review by the Landscape Architect unless requested otherwise. One set will be returned for use as site/field referee sample and the other shall be maintained by the Landscape Architect.

B. Submittal Booklets: Each Submittal Booklet under this Section shall be tabbed into specific sections, containing clearly identified (through yellow highlighter or other specific identification methods) and legible information on the following information indicated in this Article.

C. Electronic Submittals: Electronic Submittal shall be provided in a single bound file, PDF format preferred, unless otherwise noted in Division 01.

D. Submittals under this Article will be rejected and returned without the benefit of review by the Landscape Architect if they are difficult to read due to insufficient scale, poor image quality, or poor drafting quality; or if all of the required information is missing or not presented in the format as requested.

E. No Work under this Section shall proceed until all information indicated herein this Article have been reviewed, accepted, and approved by the Landscape Architect, in writing.

F. Product Data and physical Product Samples: Submit Manufacturer's current catalog cuts, specifications, and physical Product Samples provided in re-sealable labeled plastic bags (min. one (1) gallon size) for the following (as applicable):

1. Planting Soil (Imported/Amended Topsoil).
2. Soil Amendments (for each type used)
3. Bulk Composted Organic Soil Amendment Material.

4. Granular Soil Conditioning Material.
5. Fertilizers (for each type used).
6. Mycorrhizal Additives (granular or tabular).

G. Approved Testing Laboratory and Procedures for Agronomic Soil Fertility Analyses:

1. Agronomic Soil Fertility Analyses shall be conducted by a reputable, certified, agronomic soils laboratory. Laboratory shall be a member of the Council on Soil Testing and Plant Analysis. The same laboratory shall be used throughout the duration of the Contract:

   a. Wallace Laboratories, El Segundo, CA. 310-615-0116.

2. Contractor shall verify and confirm the selected Testing Laboratory and specific location(s) of soil sample(s) with the Landscape Architect prior to commencing soil sampling operations.
3. Submit the physical Samples directly to the selected Laboratory for analysis, per the procedures outlined per Part III herein this Section.

   a. In addition to the physical Soil Samples, Contractor shall also provide the Laboratory with a copy of the Soil Amendment and Fertilizer products indicated herein this Section.

   b. Same samples (duplicates) shall be provided to SWA in 1 gallon samples

4. Along with the testing data results, the Agronomic Soil Fertility Analysis shall include written recommendations by the Laboratory for amending and/or correcting the sampled soil conditions, utilizing the organic-based Soil Amendments and Fertilizers described herein this Section.

   a. The Analyses shall also include Maintenance and Post-Maintenance fertilization programs for planted areas within the Contract.

5. Agronomic Soil Fertility Analyses shall be performed on each of the native site soil samples, the imported topsoil (as required) and lightweight soil mix (as required).

H. Submit bound copies of the laboratory's Agronomic Soil Fertility Analysis and Recommendations to Landscape Architect a minimum of 45 days prior to amending of the soil and ordering soil amendments. The locations of where each of the soil test samples were derived from the Project Site shall be keyed to the site plan and shall be included with the results.

I. Planting operations shall not commence until the results of the Agronomic Soil Fertility Analysis and Recommendations are reviewed accordingly by the Landscape Architect.

1. The quantity or type of amendments may be modified by the Agronomic Soil Fertility Analysis and Recommendations. Recommendations as approved shall take precedence over the amendment and fertilizer application rates specified herein or on the Contract Documents.

1.4 QUALITY ASSURANCE AND CONTROL

A. Certificates of inspection: Provide those required by law for transportation, with invoice. File copies of certificates with Landscape Architect after acceptance of material. Inspection by governmental officials at point of origin does not preclude rejection of materials at project site.

B. Intent: The amendments and quantities included herein are approximate and are for bidding purposes only. Following an on-site soil analysis by the Wallace Labs, El Segundo, California, 310-615-0116, composition of amendments may change. Contract price shall be adjusted accordingly.

C. All testing noted herein shall be paid for by Contractor.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packaged Materials: Deliver packaged materials in original, unopened packages or containers, with manufacturer's labels intact and legible, showing weight, analysis, and name of manufacturer. Store and secure properly to prevent theft or damage.

B. Store packaged materials off ground and under cover, away from damp surfaces and inclement weather.

C. Deliver and install materials so as to not delay Work, and install only after preparations for installation have been completed.

D. Protect materials during storage and construction against soilage or contamination from earth and other materials.

1.6 COORDINATION, SCHEDULING, AND OBSERVATIONS

A. Notify the Contractors performing Work related to installation of Work under this Section in ample time so as to allow sufficient time for them to perform their portion of Work and that progress of Work is not delayed. Verify conditions at the Project Site for Work that affects installation under this Section. Coordinate items of other trades to be furnished and set in place.

B. Utilities: Determine location of above grade and underground utilities and perform Work in a manner which will avoid damage to utilities. Hand excavate, as required. Maintain grade stakes until removal is mutually agreed upon by parties concerned.

C. Excavation: When conditions detrimental to adequate Soil Preparation operations are encountered, such as rubble fill, adverse drainage conditions, or obstructions, cease operations and notify Landscape Architect for further direction.

D. Installation: Perform Soil Preparation operations only when weather and soil conditions are suitable in accordance with locally accepted practices.

E. Construction Site Observations: Periodic site observations shall be made by the Landscape Architect during the installation of Work under this Section for compliance with requirements for type, size, and quality. Landscape Architect retains right to observe Work for defects and to reject unsatisfactory or defective material at any time during progress of Work. Contractor shall remove rejected materials immediately from Project site. The Contractor shall request, in writing, at least one (1) week in advance of the time when mandatory site observation(s) by the Landscape Architect are required.

1.7 PROJECT/SITE CONDITIONS

A. Project Site shall be free of weeds and invasive grasses, (Nut Grass, etc.) prior to Topsoil distribution or soil amendment placement.

B. Excessive rock, dead or declining vegetation, trash, debris, or other items that has accumulated throughout the duration of the Project shall be removed from the Project Site by the Contractor, and as directed by the Landscape Architect.

C. Grading and soil preparation Work shall be performed only during the period when beneficial and optimum horticultural results may be obtained. If the moisture content of the soil should reach such a level that working it would destroy soil structure or cause compaction, spreading and grading operations shall be suspended until, in the opinion of the Landscape Architect, the moisture content is increased or reduced to acceptable levels and the desired results are likely to be obtained.

1. Soil moisture level prior to planting shall be no less than 75% of field capacity. The determination of adequate soil moisture for planting shall be in the sole judgment of the Landscape Architect.
2. If the soil moisture level is found to be insufficient for planting, planting pits shall be filled with water and allowed to drain before commencing planting operations.

D. Planting areas which become compacted in excess of 85% relative compaction due to construction activities shall be tilled and thoroughly cross-ripped to a minimum depth of twelve-inches (12") to alleviate the condition, taking care to avoid all existing subsurface utilities, drainage, etc.

1.8 BIDDING

A. The amendments, quantities and procedures included herein are for bidding purposes only. Following an on-site agricultural soil analysis after the rough grading, the amendments and quantity and procedures may change.

B. Tests shall be paid for by the Contractor.

1.9 FINAL ACCEPTANCE

A. Acceptance: The Landscape Architect will accept the Work upon satisfactory completion of all soil preparation.

B. Notification: Notify Landscape Architect for review of soil preparation prior to proceeding with planting operations.

PART 2 - PRODUCTS

2.1 TOPSOIL

A. Definition: Topsoil shall be defined as an onsite soil material that could be used in the planting mixes for backfill of tree, shrub and groundcover planting pits provided it can be made to conform to the provisions included under the title "Topsoil".

B. General Qualifications: Topsoil shall be fertile, friable, well-drained soil, of uniform quality, free of stones over 1 inch diameter, sticks, oils, chemicals, asphalt materials and residues, toxic substances, concrete and other deleterious materials, as a planting medium for the project. It shall not be infested with nematodes or other undesirable disease-causing organisms such as insects and plant pathogens.

C. Topsoil shall be friable and have sufficient structure in order to give good tilth and aeration to the soil. Soil shall have a field capacity of at least 15 percent on a dry weight basis.

D. Gradation limits

1. Soil shall be a sandy loam, loam, clay loam or clay. The material shall be as specified within these specifications or if not specifically identified it shall be similar to the existing site soil.
2. The definition of soil texture shall be the USDA classification scheme.
3. Gravel over ¼-inch in diameter shall be less than 10% by weight.
4. 100 % of the material shall pass a 1" sieve.

E. Permeability Rate - Hydraulic conductivity rate shall be not less than one inch per hour nor more than 20 inches per hour when tested in accordance with the USDA Handbook Number 60, method 34b or other approved methods.

F. Fertility - The range of the essential elemental concentration in soil shall be as follows:

Ammonium Bicarbonate/DTPA Extraction	Parts per million (mg/kilogram) Dry Weight Basis
phosphorus	2 - 40
potassium	40 - 220
iron	2 - 35
manganese	0.3 - 6
zinc	0.6 - 8
copper	0.1 - 5
boron	0.2 - 1
magnesium	50 - 150
sodium	0 - 100
sulfur	25 - 500
molybdenum	0.1 - 30

G. Chemistry - Suitability Considerations:

1. Acidity - The soil pH range measured in the saturation extract (Method 21a, USDA Handbook Number 60) shall be 6.0 - 7.9.
2. Salinity - The salinity range measured in the saturation extract (Method 3a, USDA Handbook Number 60) shall be 0.5 - 2.0 dS/m. If calcium and if sulfate ions both exceed 20 milliequivalents per liter in the saturation extract, the maximum salinity shall be 4.0 dS/m.
3. Chloride - The maximum concentration of soluble chloride in the saturation extract (Method 3a, USDA Handbook Number 60) shall be 150 mg/l (parts per million).
4. Boron - The maximum concentration of soluble boron in the saturation extract (Method 3a, USDA Handbook Number 60) shall be 1 mg/l (parts per million).
5. Sodium Adsorption Ratio (SAR) - The maximum SAR shall be 3 measured per Method 20b, USDA Handbook Number 60.
6. Aluminum – Available aluminum measured with the Ammonium Bicarbonate/DTPA Extraction shall be less than 5 parts per million.
7. Soil Organic Matter Content - Sufficient soil organic matter shall be present to impart good physical soil properties but not be excessive to cause toxicity or cause excessive reduction in the volume of soil due to decomposition of organic matter.
8. Calcium Carbonate Content - Free calcium carbonate (limestone) shall not be present.

9. Heavy Metals - The maximum permissible elemental concentration in the soil shall not exceed the following concentrations:

Ammonium Bicarbonate/DTPA Extraction	Parts per million (mg/kilogram) Dry Weight Basis
arsenic	1
cadmium	1
chromium	10
cobalt	2
lead	30
mercury	1
nickel	5
selenium	3
silver	0.5
vanadium	3

a. If the soil pH is between 6 and 7, the maximum permissible elemental concentration shall be reduced 50%. If the soil pH is less than 6.0, the maximum permissible elemental concentration shall be reduced 75%. No more than three metals shall be present at 50% or more of the above values.

H. Phytotoxic constituent, herbicides, hydrocarbons etc. - Germination and growth of monocots and dicots shall not be restricted more than 10%. Total petroleum hydrocarbons shall not exceed 50 mg/kg dry soil measured per the modified EPA Method No. 8015. Total aromatic volatile organic hydrocarbons (benzene, toluene, xylene and ethylbenzene) shall not exceed 0.5 mg/kg dry soil measured per EPA Methods No. 8020.

I. Existing Soil to be amended: Inspect existing soil and do all work necessary to bring it to standards specified under "Topsoil" above. Amend as specified herein.

1. The Contractor shall schedule a site visit with the Landscape Architect for the purpose of obtaining a soil analysis. Samples shall be taken from five typical tree/planting locations and delivered by the Contractor to the designated soil testing laboratory. Submit soils analysis and recommendations to the Landscape Architect for acceptance. Soil analysis shall indicate quantities, chemical properties and recommended manufacturer or supplier.
2. Areas of existing soil to be amended shall be all areas to be planted. Modified amending without tilling is required in slope areas. Turf and grass shall receive full soil preparation.

2.2 ORGANIC AMENDMENTS

A. Compost Amendment: Acceptable products are finely ground tree and shrub trimmings and vegetable products that have been decomposed and fully composted at least 120 days.

1. Humus material shall have an acid-soluble ash content of no less than 6% and no more than 20%.
2. The pH of the material shall be between 6 and 7.5.
3. The salt content shall be less than 10 millimho/cm @ 25° C. on a saturated paste extract.

a. Higher amounts of salinity may be present if the soils are to be preleached to reduce the excess or if the plant species will tolerate the salinity. Final determination will be made during soil testing and recommendations.

4. Boron content of the saturated extract shall be less than 1.0 parts per million.

a. Higher amounts of boron may be present if the soils are to be preleached to reduce the excess or if the plant species will tolerate the boron. Final determination will be made during soil testing and recommendations.

5. Silicon content (acid-insoluble ash) shall be less than 50%.
6. Calcium carbonate shall not be present if to be applied on alkaline soils.
7. Types of acceptable products are composts, manures, mushroom composts, straw, alfalfa, peat mosses etc. low in salts, low in heavy metals, free from weed seeds, free of pathogens and other deleterious materials.
8. Composted wood products are conditionally acceptable [stable humus must be present]. Wood based products are not acceptable which are based on red wood or cedar.
9. Sludge-based materials are not acceptable if the soil already has a high level (toxic level) of zinc, copper or other heavy metals based on soil analysis.
10. Carbon:nitrogen ratio is less than 25:1.
11. The compost shall be aerobic without malodorous presence of decomposition products.
12. The maximum particle size shall be 0.5 inch, 80% or more shall pass a No. 4 screen for soil amending. The maximum particle size shall be 0.25 inch for hydroseeding.

B. Maximum total permissible pollutant concentrations in amendment in parts per million on a dry weight basis:

Item	Parts Per Million Maximum		Item	Parts Per Million Maximum
arsenic	20		mercury	10
copper	150		vanadium	500
selenium	50		cobalt	50
cadmium	15		molybdenum	60
lead	200		zinc	300
silver	10		nickel	100
chromium	300			

2.3 IMPORT AMENDMENT AND SOIL FOR PARTICULAR PLANTS:

A. The following materials are to be used for acid loving plant beds:

1. Azalea Mix as mixed and provided containing composted green waste, sand and soil by Soil Building Systems or approved equivalent. pH to be between 4.5 and 6.5. Provide sample to laboratory for testing and recommendations. Provide additional sample to Landscape Architect.

B. The following materials are to be used for cactus planting:

1. Very sandy loam with pH of 6.5 to 6.8. Provide sample to laboratory for testing and recommendations. Provide additional sample to Landscape Architect.

C. The following materials are to be used for event lawn planting:

1. Very sandy loam with pH of 6.5 to 6.8. Provide sample to laboratory for testing and recommendations. Provide additional sample to Landscape Architect.

2.4 CHEMICAL ADDITIVES:

A. The following additives may or may not be used depending on the outcome of the soils report.

1. Ground Limestone: Agricultural limestone containing not less than 85% of total carbonates, ground to such fineness that 50% will pass #100 sieve and 90% will pass #20 sieve.
2. Dolomite Lime: Agricultural grade mineral soil conditioner containing 35% minimum magnesium carbonate and 49% minimum calcium carbonate, 100% passing #65 sieve. "Kaiser Dolomite 65 AG" as manufactured by Kaiser, Inc. Mineral Products Department, or equal.
3. Gypsum: Agricultural grade product containing 90% minimum calcium sulfate dihydrate.
4. Iron Sulfate (Ferric or Ferrous): Supplied by a commercial fertilizer supplier, containing 20% to 30% iron and 35% to 40% sulfur.
5. Sulfate of Potash: Agricultural grade containing 50% to 53% of water-soluble potash.
6. Single Superphosphate: Commercial product containing 20% to 25% available phosphoric acid.
7. Ammonium Sulfate: Commercial product containing approximately 21% ammonia measured as nitrogen.
8. Ammonium Phosphate: Commercial product containing approximately 18% ammonia measured as nitrogen and 48% phosphoric acid.
9. Ammonium Nitrate: Commercial product containing approximately 17% ammonia measured as nitrogen and 17% nitrate nitrogen.
10. Calcium Nitrate: Agricultural grade containing 15.5% nitrogen and 21% calcium.
11. Urea Formaldehyde (Urea-Form): Granular commercial product containing 38% slow release nitrogen with a minimum of 23% WIN (water insoluble nitrogen).
12. I.B.D.U. (Iso Butyldiene Diurea): Commercial product containing 31% slow release nitrogen.
13. Soil Sulfur: Agricultural grade sulfur containing a minimum of 96% sulfur.
14. Iron Sequestrene: Geigy Iron Sequestrene 138 Fe (Iron EDDHA)
15. Gro-Safe: Herbicide absorbent as manufactured by American Norit Company of Jacksonville, FL (800) 641 9245).
16. Mycorrhizal additive/Restorative: JRM Chemical, Cleveland Ohio, 800-962-4010 or Tri-C Natural Solutions, Chino, California 800-927-3311 or approved equal.

2.5 WATER: Clean, fresh and potable, furnished and paid for by Owner.

2.6 SOIL MIXES:

A. Backfill Mix or Preparation Layer (8” depth) for On-Grade Planting or Pocket Plant Pits: Thoroughly mix the following components into one (1 cy) cubic yard of backfill mix:

1. 75% by volume of on-site soil
2. 15% by volume of expanded shale (1/8” to 1/4” diameter)
3. 10% by volume of organic compost
4. 1/3 pound (lb) ammonium sulfate
5. 1/2 pound (lb) of triple super phosphate
6. 1/2 pound (lb) potassium sulfate (0-0-50)
7. 2 pounds (lbs) agricultural gypsum
8. Mycorrhizal Inoculum – (granular at 1 lb per 1000 sq, ft,)

PART 3 - EXECUTION

3.1 SOIL PREPARATION

A. General:

1. Moisture Content: Do not work soil when moisture content is so great that excessive compaction will occur, nor when it is so dry that dust will form in air or that clods will not break readily. Apply water, if necessary, to bring soil to an optimum moisture content.

B. Preparation of Existing Soil:

1. Verification of Existing Grades: Verify that grades are within 1 in. plus or minus of the required finished grades. Report all variations to the Landscape Architect.
2. Clearing of Debris: Clear all planting areas of stones 1 in. diameter and larger, weeds, debris and other extraneous materials prior to amending existing soil or spreading imported topsoil.
3. Cultivation: Rip or cultivate all planting areas to a depth of 12 inches immediately prior to amending existing soil. Rototill to reduce soil clods to a maximum diameter of one (1") inch in the top six (6") inches. Do not rototill within the existing tree areas.

C. If rock, road base or similar material is encountered, remove that material is encountered, remove that material to full depth plus two inches and haul and dispose of offsite at the direction and approval of the owner's representative.

3.2 SOIL CONDITIONING

A. Amending of Existing Soil:

B. Verification: Do not commence amending of existing soil prior to acceptance by Landscape Architect of soil preparation.

C. Application Rate: Apply to all planting areas at the following rates per 1,000 square feet:

1. 3 cubic yards organic amendment as specified
2. 5 pounds ammonium sulfate
3. 6 pounds super phosphate
4. 8 pounds potassium sulfate (0-0-50)
5. 35 pounds agricultural gypsum
6. (Other Chemical additives per soils report, if any)
7. Areas to receive Hydroseeding: Delete fertilizer and gypsum component; provide incorporated organic amendments as specified.

D. Reference Section 32 92 00 "Lawns and Grasses" for soil preparation in lawn and meadows.

E. Incorporation of Amendments: Incorporate homogeneously and thoroughly with top 6 in. of soil layer and bring amended soil to finish grades and elevations shown on Drawings. Do not work soils under muddy conditions.

F. Surface broadcast amendments at 1/3 the specified rate in the existing tree areas prior to hand soil conditioning or raking, do not otherwise incorporate.

3.3 SOIL PERCOLATION TESTING

A. Type/Quantity: During operations of Agronomic Soil Fertility Testing and prior to installing Plant Material, Contractor shall perform Soil Percolation Tests, through the direction of the Landscape Architect, in selected representative areas of the Project Site, to verify acceptable natural drainage, soil structure, and soil composition. Contractor shall verify the locations of the Soil Percolation Tests with the Landscape Architect.

B. Procedure: Each Soil Percolation Test shall be performed as follows:

1. Dig a hole: 2'-0" wide x 2'-0" long x 2'-0" deep.
2. Fill the hole with water to top and cover with plywood and barricade. Allow hole to drain and fill again to top.
3. Make twice daily observations, noting the depth of water each day.
4. Report findings, in writing, to the Landscape Architect. Include the length of time the water takes to drain completely from each hole, date of test, location, and other information, which may be useful in providing further recommendations.

C. Results: Based on the combined results of the Agronomic Soil Fertility Testing and the Soil Percolation Tests, Contractor may be required to install additional tree drainage sumps or other drainage methods at each planting pit for trees larger than 15-gallon container stock. This does not relieve the Contractor's obligation within the Base Bid to provide the required Tree Root Aeration Units indicated in Section 329400 – Landscape Planting Accessories. Contractor shall include, as a line-item price within the Base Bid, the price per each additional tree drainage sump, should they be required (based on the testing). Should additional tree drainage sumps or other methods is required, compensation shall be awarded to the Contractor at the line-item price (each) as provided by the Contractor.

3.4 SOIL MOISTURE CONTENT

A. General: Do not work soil when moisture content is so great that excessive compaction occurs, or when it is so dry that dust will form in air, or that clods will not break readily. Apply water, if necessary, to bring soil to an optimum moisture content for tilling and planting. Soil moisture level prior to planting shall be no less than 75% of field capacity. The determination of adequate soil moisture for planting shall be the judgment of the Landscape Architect. Range: Maintain within two-percent (2%) above or below optimum moisture content at times during Work.

3.5 PROTECTION OF SITE

A. Contractor shall protect existing and new improvements and systems installed prior to planting installation. Maintain protection in place until completion of Work and contracted Landscape Establishment Period.

B. Protect concrete paving, headers, and drainage from staining due to contact with wet nitrogen stabilized mulch/sawdust, or contact with chelated iron. Correct any stained concrete.

3.6 DRAINAGE OF PLANTING AREAS

A. Surface Drainage:

1. Discrepancies: Provide proper surface drainage of planted areas. Submit in writing all discrepancies in the Contract Drawings or Specifications, or prior Work done by others, which Contractor feels precludes establishing proper drainage.
2. Correction: Include description of work required for correction or relief of said condition.

B. Detrimental Drainage, Soils and Obstructions:
1. Notification: Submit in writing all soils or drainage conditions considered detrimental to growth of plant materials. State condition and submit proposal and cost estimate for correcting condition.
2. Correction: Submit for acceptance a written proposal and cost estimate for the correction before proceeding with Work.

3. Obstructions: If rock, underground construction Work, tree roots, or other obstructions are encountered in the performance of Work under this Section, submit cost required to remove the obstructions to a depth of not less than six-inches (6") below the required soil depth.

3.7 CLEAN UP AND PROTECTION

A. For Work under this Section, keep Work area in a clean, orderly, and safe condition. Contractor shall remove trash caused from his Work on a weekly basis throughout the duration of the Work.

B. Upon completion of his Work under this Section, the Contractor shall remove rubbish, waste, debris, excess construction materials, and other items resulting from construction operations offsite as described herein this Section, as directed by the Landscape Architect.

END OF SECTION

SECTION 329200

LAWNS AND GRASSES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes materials, labor, apparatus, tools, equipment, temporary construction, transportation, and services necessary for and incidental to performing the proper completion of Work, as required to make a complete Turf Grass and/or Ornamental Groundcover (via sown seed, stolon, plug, hydromulch or sod) planting installation, as shown on the Contract Drawings, and as specified herein this Section.

B. Work under this Section consists of, but is not necessarily limited to, furnishing and installing the following:

1. Sodded Turf Grasses.
2. Seeded Meadow or Native Turf Grasses (Machine broadcast).
3. Seeded Meadow or Native Turf Grasses (Hydroseeded).

C. Related Documents: The following Documents contain requirements that relate to Work in this Section:

1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
2. Section 312219 "Landscape Fine Grading".
3. Section 328400 "Site Irrigation System".
4. Section 329113 "Soil Preparation".
5. Section 329300 "Trees, Shrubs, Vines and Groundcovers".
6. Section 329813 "Landscape Establishment Period".

1.2 DEFINITIONS AND APPLICABLE STANDARDS

A. References:

1. ASPA – American Sod Producers Association.
2. AOSA – Association of Official Seed Analysts.

B. Definitions:

1. Plant Material(s): Refers to living plant species, inclusive of turf grass (via sown seed, stolons, and/or sod), ornamental grasses or groundcovers (via sown seed or sown plugs) for the Project.
2. Planting Area (PA): As denoted on the Contract Drawings, shall refer to areas to be installed with Plant Material(s), or areas where existing vegetation shall be protected.
3. Hydro-Mulching: Refers to the practice of sowing seeds (via hydro-seeding method) or stolons (via hydro-stolonizing method) together within a slurry mixture of water, fertilizer, cellulose (wood) fiber mulch, binder additive / soil and mulch tackifier, and other additives and materials, which is sprayed uniformly on a prepared soil surface through a pressurized distribution system.

C. Measurements:

1. SQ/FT: Measurement, in square-foot.

1.3 SUBMITTALS

A. General: Refer to Division 01 for project submittal requirements and timelines. If provided in hardcopy submittal booklets submit each item in this Article in required copies with four (4) copies for review by Landscape Architect. Three (3) copies shall be returned (One for Client, one for Owner and one for Contractor) and one copy maintained by Landscape Architect. Provide one (1) sets of Material Samples for review by the Landscape Architect unless requested otherwise.

B. Submittal Booklets: Each Submittal Booklet under this Section shall be tabbed into specific sections, containing clearly identified (through yellow highlighter or other specific identification methods) and legible information on the following information indicated in this Article.

C. Electronic Submittals: Electronic Submittal shall be provided in a single bound file, PDF format preferred, unless otherwise noted in Division 01.

D. Samples and Product Data: Submit samples, certification, and manufacturers' literature for the following items:

1. Seed Varieties: Guaranteed statement of composition, mixture and percentage of purity and germination of each variety
2. Sod Information and Certification
3. Mulch: Manufacturers literature
4. Soil Stabilizer: Manufacturers literature
5. Fertilizer: Manufacturers literature
6. Erosion Control Fabric

E. Test Data: Submit all laboratory test data for all materials.

1. Owner’s Test: The Owner may choose to test the seed or seed mixes. The Contractor shall be notified.

F. Submittal Schedule: All products in this section that are required for submittal shall be included in one (1) Division 2 submittal package.

G. Samples: (Not Required)

1.4 QUALITY ASSURANCE AND CONTROL

A. Certificates of Inspection: Provide as required by law for transportation of each shipment of seed along with invoice. Submit copies of certificates after acceptance of material. Inspection by Federal or State Governments at place of growth does not preclude rejection at project site.

1. Sod: Shall be subject to inspection and approval by Landscape Architect at the site upon delivery for conformity to specifications. Such approval shall not impair the right of inspection and rejection during progress of the work. Landscape Architect reserves right to refuse inspection at this time if, in his judgment, a sufficient quantity of sod is not available for inspection.
2. Seed: The Landscape Architect shall be furnished a signed copy of statement from vendor, certifying that each container of seed delivered is labeled in accordance with the Federal Seed Act and is at least equal to requirements previously specified. Seed

analysis shall be furnished prior to commencement of planting operations. Each lot of seed may be resampled and retested in accordance with latest Rules and Regulations under the Federal Seed Act at the discretion of the Landscape Architect. If these tests reveal the seed to be below the specified pure live seed content, the Contractor shall be required to plant additional seed to compensate for the deficiency at no additional cost to the Owner. The State Seed Laboratory will conduct the seed retests. Allowance will be made for the actual pure live seed content of the specified grasses in determining the actual planting rate.

B. Inspections:

1. Make written request for inspection after seeding or sodding operations have been completed. Such inspection is for the purpose of commencement of the Landscape Establishment Period.
2. Submit written requests for inspections to the Landscape Architect at least seven (7) days prior to anticipated inspection date.

C. Applicable Standards: Apply the current or latest editions of the standards for seed as described in the following:

1. Hortus III - 1976 Edition, Bailey Horatorium, Cornell University.
2. Federal Seed Act.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Seed:

1. Delivery: Furnish standard seed in unopened manufacturer's standard containers bearing original certification labels showing quantity, analysis and name of manufacturer.
2. Storage: Store seed with protection from weather or other conditions that would damage or impair the effectiveness of the product.

B. Mulch: Each package of cellulose fiber shall be marked by the manufacturer to show the air dry weight content.

C. Sod:

1. Harvest and Delivery: Harvest from the source and deliver to project site within 24 hours. Deliver only as much sod as can be installed in one day's work.
2. Review: Sod not transplanted within this time period shall be reviewed prior to installation.

D. Product Storage:

1. Protect products from weather or other conditions that would damage or impair the effectiveness of the items.

1.6 PROJECT/SITE CONDITIONS

A. General Requirements: Installation under this Section shall be performed only during the time of day and during seasons when satisfactory results can be expected, unless authorized by the Landscape Architect.

1. Seeds: Install immediately after finish grading and irrigation installation are accepted.
2. Sod: Install immediately after finish grading and irrigation installation are accepted.

3. Stolons: Install immediately after finish grading and irrigation installation are accepted.
4. Plugs: Install immediately after finish grading and irrigation installation are accepted.

B. Climate Restrictions: Do not install Plant Materials under this Section during rainy or inclement weather.

C. Hydro-mulching Operations:

1. Irrigated Areas: Commence Work within fourteen (14) calendar days after the completion and acceptance of Soil Preparation (per Section 329113 – Soil Preparation.) in planting areas.
2. Un-irrigated Areas: Commence work only as soon as the area is ready, Contractor is responsible to provide temporary irrigation, as required, to un-irrigated areas to insure proper germination and growth establishment of the seeded and / or hydro-mulch to meet a minimum of 95% coverage of the hydro-mulched areas to satisfy Final Acceptance requirements.

1.7 SUBSTITUTIONS

A. Consideration: Materials to be considered equal to the Materials indicated herein this Section shall be reviewed by the Landscape Architect. Materials with equal performance characteristics produced by other Manufacturer's and/or Distributors may be considered, providing deviations in dimensional size, color, composition, operation, and/or other characteristics do not change the design concept, aesthetic appearance, nor intended performance, as solely judged by the Landscape Architect. The burden of proof on product equality is on the Contractor.

B. Specific reference to Manufacturer's names and products specified herein are used as standards of quality. This implies no right to the Contractor to substitute other materials without prior written approval by the Landscape Architect for Work under this Section.

C. Materials substituted and installed by the Contractor, without prior written approval by the Landscape Architect, may be rejected. Contractor shall not be entitled to be compensated by the Owner where the Contractor has installed rejected substitutions without receiving prior written approval.

D. Contract Price: Substituted Materials under this Section shall not increase the Contract price.

1.8 ANALYSES OF SAMPLES AND TESTS

A. Samples: Landscape Architect reserves the right to take and analyze samples of materials for conformity to specifications at any time. Furnish samples upon request.

B. Rejected Materials: Remove rejected materials immediately from the site at Contractor's expense. Pay cost of testing of materials not meeting specifications.

1.9 LANDSCAPE ESTABLISHMENT PERIOD

A. Refer to Section 329813 "Landscape Establishment Period", for requirements under this Article.

1. During the duration of the Landscape Establishment Period, continuously maintain Landscape Planting Accessories by tightening, holding plumb, and/or repairing Staking and/or Guying supports, providing adequate depths and coverage requirements of Landscape Mulching Materials, monitoring drainage within Tree Root Aeration Units, hold Edging Materials true and in proper alignments, and other requirements, as required, to

establish healthy, viable landscape planting materials until Final Acceptance of Work is granted.

1.10 PROTECTION OF ADJACENT AND EXISTING LAWNS TO REMAIN:

A. Do not store materials or equipment, permit burning, or operate or park equipment on existing lawn areas to remain except as actually required for construction in those areas.

B. Provide barricades, fences or other barriers as necessary to protect existing lawns to remain from damage during construction.

C. Notify Landscape Architect in any case where Contractor feels grading or other construction called for by Contract Documents may damage existing lawns to remain.

D. If existing lawn areas to remain are damaged during construction, Contractor shall replace such lawn areas of the same quality as those damaged at no cost to Owner. Determination of extent of damage and value of damaged lawns shall rest solely with Landscape Architect.

1.11 WARRANTY PERIOD

A. Time Period: Warrant that all lawns, sodded areas, hydromulch meadow and grass areas will be in a healthy and flourishing condition of active growth twelve (12) months from date of Final Acceptance.

B. Appearance During Warranty: All grassed areas shall be free of dead or dying patches, and all areas shall show foliage of a normal density, size and color for the season during which it is reviewed

C. Delays: All delays in completion of planting operations which extend the planting into more than one planting season shall extend the Warranty Period correspondingly.

D. Coverage: Warrant growth and coverage of lawn and meadow planting to the effect that:

1. For meadows: a minimum of 95% of the area planted shall be covered with specified planting after one growing season with no bare spots.
2. For Sod: Complete lush cover with no brown sections, edges, seams or cracks showing. Sod shall have established to the extent that satisfactory capillary action between the sod and soil has been established. 100 per cent coverage.
3. For Seed: Ninety eight (98%) percent uniform coverage of grass in excess of one (1") inch height. No bare spots of greater than one half (1/2) square foot and no aggregate bare areas in any 100 square feet greater than 2 square feet.

E. Exceptions: Contractor shall not be held responsible for failures due to neglect by Owner, Client, vandalism, etc., during Warranty Period. Report such conditions in writing.

1.12 FINAL ACCEPTANCE:

A. Work under this Section will be accepted by Landscape Architect upon satisfactory completion of all work, but exclusive of re-application under the Guarantee Period. Final Acceptance of lawn establishment shall be as follows:

1. For Sod: Complete lush cover with no bare or brown sections and no seams or cracks are showing. Sod shall have established to the extent that satisfactory capillary action between the sod and soil has been established and there are no bare areas.

2. For Seed: Complete coverage with no more than 30% soil visibility levels. Coverage must be equal and well distributed over entire area.
3. The Landscape Architect and/or Owner shall interpret the above. Upon Final Acceptance, the Owner will assume the responsibility for maintenance of the work.

1.13 REPLACEMENTS

A. Unacceptable Workmanship: Hydroseed areas exhibiting conditions that are determined as unacceptable workmanship shall be repaired and/or replaced at no additional cost to the Owner.

B. Replacements: Replace, without cost to Owner, and as soon as weather conditions permit, all hydroseed not in a vigorous, thriving condition, as determined by Landscape Architect during and at the end of Warranty Period.

C. Matching: Closely match all replacement seed with adjacent areas of lawn or grass. Apply all requirements of this Specification to all replacements.

PART 2 - PRODUCTS

2.1 SOD

A. One year old sod, variety as shown on the drawings.

1. Sod shall be dense with the grass having been mowed at one (1") inch height before lifting from field. All grown on fumigated soil.
2. Sod shall be in vigorous condition, dark green in color, free of disease and harmful insects.
3. Do not stack for more than twenty four (24) hours between time of cutting and time of delivery.
4. Landscape Architect reserves the right to reject any sod deemed unacceptable for installation.

2.2 LAWN SEED

A. Composition: Fresh, clean, certified, Class 'A', new crop seed.

B. Weed Seed: Do not exceed 0.25%.

2.3 FERTILIZER FOR TANK MIX

A. Shall be as established through soil testing, pelleted, uniform in composition, free-flowing, and suitable for application with approved equipment. The fertilizer shall be delivered to the site in bags or other convenient containers, each fully labeled, conforming to the applicable State fertilizer laws, and bearing the name or trademark and warranty of the producer.

2.4 MULCH

A. General:

1. Composition: Green-colored, fibrous, virgin wood cellulose mulch containing no growth or germination-inhibiting factors.

2. Dispersion in Slurry: Mulch shall be manufactured in such manner that after addition to and agitation in slurry tanks with fertilizer, seed, water and other approved additives, fibers in the material will become uniformly suspended to form a homogeneous slurry.
3. Absorption Capacity: When hydraulically sprayed on the ground, the material will form a blotter-like groundcover impregnated uniformly with seed which will allow the absorption of moisture and allow rainfall to percolate to the underlying soil.

B. Specifications:

1. Weight: Weight specifications of this material from suppliers, and for all applications, shall refer only to air dry weight of the fiber material. Absolute air dry weight is based on the normal standards of the Technical Association of the Pulp and Paper Industry for wood cellulose and is considered equivalent to 10% moisture.
2. Labeling: Each package of the cellulose fiber shall be marked by the manufacturer to show the air dry weight content.

2.5 HYDRAULIC EQUIPMENT FOR HYDROMULCH SEEDING

A. Mixer: Use a commercial type hydro-seeder for the application of slurry. Equipment shall have a built-in agitation system with an operating capacity sufficient to agitate, suspend and homogenously mix slurry.

B. Distribution Lines: Large enough to prevent stoppage and to provide even distribution of the slurry over the ground.

C. Pump Capacity: 150 psi at the nozzle.

D. Slurry Tank: Minimum capacity of 1000 gallons and shall be mounted on a traveling unit which will place the slurry tank and spray nozzles within sufficient proximity to the areas to be seeded so as to provide uniform distribution without waste.

2.6 WATER: Potable water as furnished by Owner. Transport as required.

2.7 FIBER MULCH

A. Fiber mulch, for use with the hydraulic application of grass seed and fertilizer, shall consist of specially prepared mulch. It shall be processed in such a manner that it will not contain germination or growth inhibiting factors. It shall be dyed an appropriate color to allow visual metering of its application. The mulch shall have the property of becoming evenly dispersed and suspended when agitated in water. When sprayed uniformly on the surface of the soil, the fibers shall form a blotter-like groundcover which readily absorbs water and allows infiltration to the underlying soil. Weight specifications from suppliers for all applications shall refer only to air dry weight of the fiber, a standard equivalent to eighteen (18%) percent moisture. The mulch material shall be supplied in packages having a gross weight not in excess of 100 pounds and be marked by the manufacturer to show the dry weight content. Suppliers shall be prepared to certify that laboratory and field testing of their product has been accomplished and that it meets all of the foregoing requirements.

B. Soil Stabilizer:

1. Composition: Totally organic substance, supplied in powder form and at least 90% of which is 92% pure muciloid derived from ground Plantago ovata-insularis husks. Stabilizer shall be water-soluble, non-toxic hydrophilic and shall not inhibit germination.
2. Product: "Ecology Controls M-binder" by Ecology Controls, (213) 877-8600, or "R-Binder" by Clyde Robin Seed Co., (415) 785-0425.

C. Mulch and Soil Stabilizer:

1. Composition: Pre-mixed, organic-based combination of virgin-wool fiber and stabilizing agent with no growth or germination-inhibiting elements.
2. Product: "Hydro Mulch 2000 Fiber" by Conwed Corporation., (612) 221-1190.

2.8 TOPSOIL AND SAND

A. Shall be as specified in Section 329113 "Soil Preparation", for the purpose of topdressing under existing trees.

1. Blend

a. 1/3 Cubic Yard Sandy Loam Topsoil (75%)
b. Compost (25%)
c. Fertilizer according to the soil report recommendations

2.9 LAWN FERTILIZER FOR EXISTING LAWN

A. Shall be as specified in Section 329813 “Landscape Establishment Specification” or as recommend by the project agronomist during the soil testing and recommendations portion of Section 329113 “Soil Preparation”.

2.10 TOPDRESS SOIL MIX

A. Blend

1. 1/3 Cubic Yard Topsoil (33%)
2. 1/2 Cubic Yard Sand (50%)
3. 1/6 Cubic Yard Compost (17%)

2.11 WATER: Shall be free from oil, acid, alkali, salt, and other substances harmful to growth of grass. The water source shall be subject to approval prior to use.

PART 3 - EXECUTION

3.1 EXAMINATION

A. NO WORK UNDER THIS SECTION SHALL COMMENCE UNTIL SUBMITTALS UNDER THIS SECTION HAVE BEEN REVIEWED ACCORDINGLY BY THE LANDSCAPE ARCHITECT.

B. Prior to commencing Work under this Section, Contractor shall examine previously installed Work from other trades and verify that such Work is complete and to the point where Work herein may commence properly. Do not proceed with Work until unsatisfactory conditions have been corrected.

C. Contractor shall notify the Landscape Architect, in writing, on the anticipated commencement date and length of duration of the Work installation herein this section.

D. Verification of Conditions:

1. Grades: Verify that grades are within 1 in. plus or minus of the required finished grades. Verify that erosion control materials have been installed in other sections. Report all variations in writing.

2. Stones, Weeds, Debris: Verify that all areas to receive lawns and grasses are clear of stones larger than 3/4 inch in diameter, weeds, debris and other extraneous materials.

3.2 GENERAL

A. Areas to Receive Hydroseeding: All designated areas as delineated on the Drawings.

B. Perform seeding on a section-by-section basis and after approval of Landscape Architect of graded condition. Complete areas in a continuous manner.

C. Scheduling:

1. Irrigated Areas: Within fourteen (14) calendar days after the completion of finish grading in any area. In the event of anticipated bad weather conditions, apply immediately.

D. Exiting lawn interface:

1. Work new and existing lawn or meadow areas edges together such that after new material has established the appearance will be a generally seamless in appearance.

3.3 SPECIAL MULCHING EQUIPMENT

A. Hydraulic equipment used for the application of fertilizer, seed, and slurry of prepared wood fiber mulch shall have a built-in agitation system with an operating capacity sufficient to agitate, suspend, and homogeneously mix a slurry containing up to forty (40) pounds of fiber plus a combined total of seventy (70) pounds of fertilizer solids for each one hundred (100) gallons of water. The slurry distribution lines shall be large enough to prevent stoppage. The discharge line shall be equipped with a set of hydraulic spray nozzles which provide even distribution of the slurry on the slopes to be seeded. The slurry tank shall have a minimum capacity of eight hundred (800) gallons and shall be mounted on a traveling unit which may be either self-propelled or drawn with a separate unit which will place the slurry tank and spray nozzles within sufficient proximity to the areas to be seeded so as to provide uniform distribution without waste. The Landscape Architect may authorize equipment with smaller tank capacity provided that the equipment has the necessary agitation system and sufficient pump capacity to spray the slurry in a uniform coat.

B. Mixing: Care shall be taken that the slurry preparation takes place on the site of the work. The slurry preparation should begin by adding water to the tank when the engine is at half throttle. When the water level has reached the height of the agitator shaft, good recirculation shall be established and seed shall be added. Fertilizer shall then be added, followed by wood pulp mulch. The wood pulp mulch shall only be added to the mixture after the seed and when the tank is at least one-third filled with water. The engine throttle shall be opened to full speed when the tank is half filled with water. All the wood pulp mulch shall be added by the time the tank is two-thirds to three-fourths full. Spraying shall commence immediately when the tank is full. The operator shall spry the area with a uniform, visible coat by using the green color of the wood pulp as a guide.

C. Application:

1. Contractor shall obtain approval of hydromulch area preparation from the Landscape Architect prior to application.
2. Operators of hydromulching equipment shall be thoroughly experienced in this type of application. Apply specified slurry mix in a motion to form a uniform mat at specified rate.
3. Keep hydromulch within areas designated and keep from contact with other plant material.

4. Slurry mixture which has not been applied within four (4) hours of mixing shall not be used and shall be removed from the site.
5. After application, the Contractor shall not operate any equipment over the covered area.
6. Immediately after application, thoroughly wash off any plant material, planting areas, or paved areas not intended to receive slurry mix. Keep all paved and planting areas clean during maintenance operations.
7. Refer also to the maintenance portion of this Section.

D. Unseeded Areas: If, in the opinion of the Landscape Architect, unplanted skips and areas are noted after hydromulching, the Contractor shall be required to seed the unplanted areas with the grasses that were to have been planted at no additional cost to the Owner.

3.4 SOIL PREPARATION AND CONDITIONING

A. Provide 4” topsoil at all lawn and meadow planting areas with noted bed preparation requirements below.

B. Verification:

1. Stones, Weeds, Debris: Verify that all areas to receive lawns are clear of stones larger than 1-1/2 in. diameter, weeds, debris and other extraneous materials.
2. Grades: Verify that grades are within 1 in. plus or minus of the required finished grades. Report all variations in writing.

C. Soil Moisture:

1. Excessive Moisture: Do not commence work of this section when soil moisture content is so great that excessive compaction will not occur, nor when it is so dry that dust will form in air or that clod will not break readily.
2. Inadequate Moisture: Apply water, as necessary, to bring soil to optimum moisture content for planting.

D. Existing trees: Insure soil preparation within the drip lines of existing trees is by hand and in compliance with Section 329113 “Soil Preparation”.

E. Soil Conditioning for all meadow grass areas:

1. Rip soil to a depth of 6 inches minimum on 12 inch centers
2. Relieve compaction, construction traffic and compacted areas by ripping soil to a depth of 12 inches and 12 inch centers.
   a. In any existing tree areas, reduce tilling to a maximum of 2 inch depth.
3. Apply compost prior to final tilling at 2 yards per 1,000 sq. ft.
4. Rototill ripped soil with compost surfacing to a depth of 6 inches to reduce clods and soil to less than 1 inch diameter.
5. Fine grade
6. Apply Hydro-mulch seeding as specified.

F. Soil Conditioning for Sod and Turf Seed Areas:

1. Comply with requirement above. Apply fertilizer during hydro mulch process.

3.5 HYDROSEED

A. Preparation: Do all slurry preparation at the job site.

1. Water: Add water to the tank when the engine is at half throttle. When the water level has reached the height of the agitator shaft, establish good re-circulation and add seed.
2. Seed: Do not allow seed to remain more than 30 min. in slurry.
3. Fertilizer: Add fertilizer, followed by the mulch. The mulch shall only be added to the mixture after the seed, and when the tank is at least 1/3 filled with water.
4. Mixing: Open the engine throttle to full speed when the tank is half-filled with water. Add all the mulch by the time the tank is 2/3 to 3/4 full. Commence spraying immediately when the tank is full.

B. Application:

1. General: Apply specified slurry mix in a sweeping motion to form a uniform mat at the specified rate. Keep hydroseeding within designated areas and keep from contact with other plant materials.
2. Unused Mix: Do not use slurry mixture that has not been applied within 4 hours of mixing. Promptly remove from the site.
3. Protection: After application, do not operate any equipment over the hydroseeded areas.
4. Reseeding: Reseed all areas and parts of areas that fail to show a uniform stand until all areas are satisfactorily covered.

3.6 SODDING ON PREPARED FINISHED GRADE

A. Bed Preparation: Immediately after the soil preparation is completed and finished grade has been approved, begin sodding operations. If sod bed is dry immediately prior to sod installation, dampen surface with a fine mist of water.

3.7 DRILLED SEEDING ON PREPARED FINISHED GRADE

A. Immediately after finished grade has been approved, begin seeding operations. Lightly disc seed bed surface to a depth of on-quarter (1/4") inch immediately before seeding operations.

B. Apply seed by mechanical "culti-packer" type or approved similar equipment. Cover the seed and form the seed bed in one operation. In areas inaccessible to culti-packer, seed by hand.

C. Take extreme care during seeding and raking to insure that no change occurs in finish grades and that seed is evenly distributed over entire seed bed.

D. Roll seeded bed with 200 pound ballast roller.

E. Water with fine spray.

3.8 CLEAN-UP

A. General: Keep all areas of work clean, neat and orderly at all times. Keep all paved areas clean during planting operations.

B. Overspray: Immediately after application, thoroughly wash off any plant materials, planting areas, or paved areas not intended to receive slurry mix.

C. Debris: Clean up and remove all deleterious materials and debris from the entire work area prior to Final Acceptance.

END OF SECTION

SECTION 329300

TREES, SHRUBS, VINES AND GROUNDCOVERS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes materials, labor, apparatus, tools, equipment, temporary construction, transportation, and services necessary for and incidental to performing the proper completion of Work, as required to make a complete Exterior Landscape Planting installation, as shown in the Contract Drawings, and as specified herein this Section.

B. Work under this section consists of, but is not necessarily limited to, furnishing and installing the following:

1. Excavation of tree pits and trenches
2. Excavation of plant pits and beds
3. Provide and install plant materials and related items
4. Finish grading of planted areas
5. Warranty and replacements

C. Related Documents: The following Documents contain requirements that relate to Work in this Section:

1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section
2. Section 015639 "Temporary Tree and Plant Protection".
3. Section 312219 "Landscape and Fine Grading".
4. Section 328400 "Site Irrigation System".
5. Section 329013 “Plant Material Contract Growing and Maintenance”.
6. Section 329113 "Soil Preparation".
7. Section 329813 "Landscape Establishment Period".
8. Section 334300 "Landscape Drainage".

1.2 DEFINITIONS AND APPLICABLE STANDARDS

A. References:

1. ASTM – American Society for Testing Materials.
2. USDA – United States Department of Agriculture.
3. ANSI – American National Standards Institute.

B. Reference Standards:

1. American National Standard for Nursery Stock (ANSI Z60.1). American National Standards Institute, and American Association of Nurserymen, Latest edition,
2. American Joint Committee on Horticultural Nomenclature, 1942 Edition of Standardized Plant Names.
3. Hortus III, 1976 Edition, Liberty Hyde Bailey Hortorium, Cornell University.
4. The Hillier Gardener's Guide to Trees and Shrubs, 4th Edition, 1978.
5. Manual of Cultivated Conifers, Den Ouden & Boon, 1978.

6. Datascape Guide to Commercial Nomenclature, American Nurserymen Publishing Co., Chicago, IL, 1994.
7. American National Standard for Tree Care Operation, Tree, Shrub, and Other Woody Plant Maintenance (ANSI A300), American National Standards Institute, Latest Edition.

C. Definitions:

1. Plant Material(s) – Refers to living plant species, inclusive of trees, shrubs, groundcovers, vines, ornamental grasses, cacti/succulents, espaliers, annuals, perennials, etc., as indicated in the Contract Drawings.
2. Planting Area (PA) – As denoted on the Contract Drawings, shall refer to areas to be installed with Plant Material(s), or areas where existing vegetation shall be protected.
3. Plant Height – Measurement of main body height, not measurement to branch tip.
4. Plant Spread – Measurement of main body diameter, not measurement from branch tip to branch tip.
5. Amended Planting Backfill Mixture – Refer to Section 329113 – Soil Preparation.
6. Balled and Burlapped Stock – Healthy, vigorous exterior plants with firm, natural balls of earth in which they are grown, with ball size not less than diameter and depth recommended by ANSI Z60.1 for type and size of tree or shrub required; wrapped, tied, rigidly supported, and drum laced as recommended by ANSI Z60.1.
7. Balled and Potted Stock – Healthy, vigorous exterior plants dug with firm, natural balls of earth in which they are grown and placed, unbroken, in a container. Ball size is not less than diameter and depth recommended by ANSI Z60.1 for type and size of exterior plant required.
8. Bare-Root Stock – Healthy, vigorous exterior plants grown with a well-branched, fibrous-root system developed by transplanting or root pruning, with soil or growing medium removed, and with not less than minimum root spread according to ANSI Z60.1 for type and size of exterior plant required.
9. Clump – Where three or more young trees were planted in a group and have grown together as a single tree having three or more main stems or trunks.
10. Container-Grown Stock – Healthy, vigorous, well-rooted exterior plants grown in a container with well-established root system reaching sides of container and maintaining a firm ball when removed from container. Container shall be rigid enough to hold ball shape and protect root mass during shipping and be sized according to ANSI Z60.1 for type and size of exterior plant required.
11. Fabric Bag-Grown Stock – Healthy, vigorous, well-rooted exterior plants established and grown in-ground in a porous fabric bag with well-established root system reaching sides of fabric bag. Fabric bag size is not less than diameter, depth, and volume required by ANSI Z60.1 for type and size of exterior plant.
12. Finish Grade – Elevation of finished surface of planting soil.
13. Manufactured Topsoil – Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.
14. Multi-Stem – Where three (3) or more main stems arise from the ground from a single root crown or at a point right above the root crown.
15. Sub-grade – Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill, before placing planting soil.
16. Subsoil – All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

D. Measurements:

1. sq/ft: Measurement, in square-foot.
2. o.c.: Measurement used for On-Center spacing.
3. e.w.: Direction of Measurements - Each Way

1.3 SUBMITTALS

A. General: Refer to Division 01 for project submittal requirements and timelines. If provided in hardcopy submittal booklets submit each item in this Article in required copies with four (4) copies for review by Landscape Architect. Three (3) copies shall be returned (One for Client, one for Owner and one for Contractor) and one copy maintained by Landscape Architect. Provide one (1) sets of Material Samples for review by the Landscape Architect unless requested otherwise.

B. Submittal Booklets: Each Submittal Booklet under this Section shall be tabbed into specific sections, containing clearly identified (through yellow highlighter or other specific identification methods) and legible information on the following information indicated in this Article.

C. Electronic Submittals: Electronic Submittal shall be provided in a single bound file, PDF format preferred, unless otherwise noted in Division 01.

D. Material Samples and Literature: Submit requested items at least sixty (60) days prior to delivery to site. Attach product name, address of manufacturer and/or supplier and appropriate literature to each sample. Literature or Product Data shall consist of manufacturer's current specifications, with catalog cuts, data sheets and installation instructions.

1. Tree and Shrub Planting Fertilizer: Literature.
2. Wood Chip Mulch: One (1) quart sample and anylisis.
3. Decomposed Granite Gravel Mulch: One (1) pint (sample).

E. Plant Material Samples: Submit documentation within thirty (30) days after award of Contract that all plant materials have been located and are ready to be secured. Arrange specific review procedure of plant materials at time of submission. Submittals and review shall be organized as follows:

1. Preliminary Review: Submit representative photographs for review of all plant materials in the required sizes and in available quantity at least sixty (60) working days prior to shipment to the site.

    a. Submittal shall include two (2) items per plant:

        1) A minimum of two color photograph from opposite sides of each tree species
        2) One color photocopy of the mounted sheet. Include one (1) set for each plant type and size required for the project. The 8 1/2" x 11" sheet is to include the name and address of the supplier, size of the plant in the picture and Botanical and English name of the plant.

    b. Tree and photographs shall include a person or device to determine scale.

2. Tagging: The Landscape Architect may elect to review any of the material at the place of growth. Upon review and acceptance of plant material photograph, specific items will be selected for field review by the Landscape Architect. The Landscape Contractor shall arrange the review and he shall accompany the Landscape Architect for all reviews and tagging plants at place of growth and upon delivery for conformity to specifications.
3. Photograph Acceptance and Nursery Review: Acceptance of material through photographs does not preclude rejection of unsatisfactory material upon delivery. The Landscape Architect reserves the right to refuse review from photographs or at the grower if, in his judgment suitable material or sufficient quantities are not available. Contractor shall insure a sufficient quantity of plants will be available whenever trips are arranged to a nursery for the purposes of tagging material for the project.

4. Unavailable Material: If proof is submitted that any plant specified is not obtainable, a proposal will be considered for use of the nearest equivalent size or variety with corresponding adjustment of Contract price. Substantiate such proof in writing no later than fifteen (15) days after award of contract.
5. Distant Material: Submit photographs with a person adjacent to plants for preliminary review. Such review shall not impair the right of review and rejection during progress of the work.
6. Special Conditions: The above provisions shall not relieve Contractor of the responsibility of obtaining specified materials in advance if special growing conditions or other arrangements must be made in order to supply specified materials.
7. Plant material submittals are to begin within two to three weeks after the contractor has been selected and given an official contract. All plant material is to be located, approved, and secured 30 days prior to installation.

F. Test Reports: One (1) copy to be sent by testing laboratory directly to Landscape Architect.

G. Submittal Schedule: All products in this section which is required for submittal shall be included in one (1) Section 329300 submittal package.

1.4 QUALITY ASSURANCE AND CONTROL

A. Certificates:

1. Submit certificates of inspection required by law for transportation of each shipment of plants along with invoice.
2. File copies of certificates after acceptance of material. Inspection by Federal or State Governments at place of growth does not preclude rejection of plants at project site.

B. Applicable Standards: Apply standards for plant materials as described in the following:

1. "Grades and Standards", latest edition, Texas Association of Nurserymen Specifications, Austin, Texas 78704.
2. "American Standard for Nursery Stock", 1980 Edition, American National Standards Institute, Incorporated, (A.N.S.I. Z60-1-1980).
3. "Standardized Plant Names", 1942 Edition, American Joint Committee on Horticultural Nomenclature.
4. American Standard for Nursery Stock, 1980 Edition, American Association of Nurserymen, Inc.
5. Hortus III - 1976 Edition, Bailey Horatorium, Cornell University.

C. Testing Agency: Wallace Laboratories, 365 Coral Circle, El Segundo, CA 90245. Tel (310)-615-0116, Attn: Mr. Garn Wallace, Ph. D.

1.5 PROJECT/SITE CONDITIONS

A. Protection of Existing Plants to Remain:

1. Operations: Do not store materials or equipment, permit burning, or operate or park equipment under the branches of all existing plants to remain except as actually required for construction and pocket planting in those areas.
2. Barriers: Protect existing barricades, fences or other barriers as necessary at the drip line to protect existing plants to remain from damage during construction.
3. Equipment: Minimal equipment is to be used in the natural areas. Use only light weight rubber tired machines (Bob-Cat or similar) and wheel barrows or plant carts to transport material. Drive machines out of natural areas except as absolutely necessary. Hold a review of proposed paths prior to work.

4. Notification: Notify Landscape Architect when Contractor feels other construction activities may damage existing plants to remain.

B. Replacement of Damaged Plants:

1. Replacement: Replace existing plants to remain which are damaged during construction with accepted plants of the same species and size as those damaged at no cost to Owner.
2. Landscape Architect Role: Determine extent of damage and value of damaged plants.

1.6 WORK SCHEDULE: Proceed with the work as rapidly as the site becomes available, consistent with normal seasonal limitations for planting work.

1.7 SELECTION, ORDERING AND PURCHASE OF CONTRACT GROWN TREE MATERIAL

A. Tagging: Upon review and acceptance of plant material photographs, specific items will be selected for field review by the Landscape Architect. The Landscape Contractor shall arrange the review and he shall accompany the Landscape Architect for all reviews and tagging plants at place of growth and upon delivery for conformity to specifications.

B. Unavailable Material: If proof is submitted that any plant specified is not obtainable, a proposal will be considered for use of the nearest equivalent size or variety with corresponding adjustment of Contract price. Substantiate such proof in writing no later than fifteen (15) days after award of contract.

C. Special Conditions: The above provisions shall not relieve Contractor of the responsibility of obtaining specified materials in advance if special growing conditions or other arrangements must be made in order to supply specified materials.

1.8 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Labeling: Furnish standard products in manufacturer's standard containers bearing original labels legibly showing quantity, analysis, genus/species and name of manufacturer/grower.

B. Storage: Store products with protection from weather or other conditions which would damage or impair the effectiveness of the product. Protect metal containers from sun during summer months with temperatures above 80 degrees F.

C. Handling: Do not lift or handle container plants by tops, stems or trunks at any time. Do not bind or handle plants with wire or rope at any time.

D. Anti-Desiccant: At Contractor's option, spray all evergreen or deciduous plant material in full leaf immediately before transporting with anti-desiccant. Apply an adequate film over trunks, branches, twigs and foliage.

1.9 ANALYSES OF SAMPLES AND TESTS

A. Sampling: Right is reserved to take and analyze samples of materials for conformity to specifications at any time. Furnish samples upon request.

B. Rejected Materials: Remove rejected materials immediately from the site at Contractor's expense. Pay cost of testing of materials not meeting specifications.

1.10 LANDSCAPE ESTABLISHMENT PERIOD

A. Refer to Section 329813 "Landscape Establishment Period", for requirements under this Article.

1. During the duration of the Landscape Establishment Period, continuously maintain Landscape Planting Accessories by tightening, holding plumb, and/or repairing Staking and/or Guying supports, providing adequate depths and coverage requirements of Landscape Mulching Materials, monitoring drainage within Tree Root Aeration Units, hold Edging Materials true and in proper alignments, and other requirements, as required, to establish healthy, viable landscape planting materials until Final Acceptance of Work is granted.

1.11 WARRANTY PERIOD

A. Warranty:

1. Warrant that all trees less than 4 1/2" caliper and smaller, shrubs, groundcover, and vines planted under this Contract will be healthy and in flourishing condition of active growth one (1) year from date of Substantial Completion.
2. Warrant that all trees 5" caliper and larger planted under this Contract will be healthy and in flourishing condition of active growth two (2) years from date of Substantial Completion.

B. Delays: All delays in completion of planting operations which extend the planting into more than one planting season shall extend the Warranty Period correspondingly.

C. Condition of Plants: Plants shall be free of dead or dying branches and branch tips, with all foliage of a normal density, size and color.

D. Replacements: As soon as weather conditions permit, replace, without cost to Owner all dead plants and all plants not in a vigorous, thriving condition, as determined by Landscape Architect during and at the end of Warranty Period.

E. Exclusions: Contractor shall not be held responsible for failures due to neglect by Owner, vandalism, etc., during the Warranty Period. Report such conditions.

1.12 REPLACEMENTS

A. General:

1. Plant materials exhibiting conditions which are determined as being unacceptable due to workmanship by the Contractor shall be repaired and/or replaced at no additional cost to the Owner.
2. Closely match replacements to adjacent specimens of the same species. Apply all requirements of this Specification to all replacements.

B. Replacement Quantities: Contractor shall be held responsible for a maximum of two (2) replacements for each failed tree, shrub and vine, and same area of groundcover planting after final acceptance during the Warranty Period.

PART 2 - PRODUCTS

2.1 PLANT MATERIALS

A. General:

1. Growing Conditions: Plants shall be nursery-grown in accordance with good horticultural practices under climatic conditions similar to those of project for at least two years unless otherwise specifically authorized.
2. Appearance: All plants shall be exceptionally heavy, symmetrical, tightly knit, so trained or favored in development and appearance as to be superior in form, number of branches, compactness and symmetry.
3. Vigor: Plants shall be sound, healthy and vigorous, well branched and densely foliated when in leaf. They shall be free of disease, insect pests, eggs, or larvae. They shall have healthy, well-developed root systems. Plants shall be free from physical damage or adverse conditions that would prevent thriving growth.
4. Container Stock: Verify that all container stock has been grown in the containers in which delivered for at least six (6) months, but not over two (2) years. Samples must prove to be free of kinked, circling or girdling roots and with no evidence of a pot-bound condition. Do not install container plants that have cracked or broken balls of earth when taken from container.

B. Measurements:

1. General: Measure plants when branches are in their normal upright position. Height and spread dimensions specified refer to main body of plant and not branch tip to tip. Take caliper measurement at a point on the trunk six (6") inches above natural ground line for trees up to four (4") inches in caliper and at a point twelve (12") inches above the natural ground line for trees over four (4") inches in caliper.
2. Size Range: If a range of size is given, do not use plant materials less than the minimum size. Not less than sixty (60%) percent of the plants shall be as large as the maximum size specified. The measurements specified are the minimum size acceptable and are the measurements after pruning, where pruning is required. Plants that meet the measurements specified, but do not possess a normal balance between height and spread shall be rejected.
3. Substitutions: Substituted plants shall be true to species and variety and shall conform to measurements specified except that plants larger than specified may be used if accepted. Use of such plants shall not increase Contract price. If larger plants are accepted, increase the ball of earth in proportion to the size of the plant.

C. Pruning: Do not prune plants before delivery. Prune upon acceptance only under review and direction of Landscape Architect.

1. For pruning after installation, refer to Section 329813 "Landscape Establishment Period".

D. Condition: Trees that have multiple leaders, unless specified, or damaged or crooked leaders, will be rejected. Trees having a main leader shall not have been headed back. Trees with abrasions of the bark, sunscalds, disfiguring knots, or fresh cuts of limbs over three-quarter (3/4") inch that have not completely callused will be rejected.

2.2 BACKFILL MIX FOR ON-GRADE PLANT PITS: See Section 329113 "Soil Preparation" for requirements under this section.

2.3 COMMERCIAL FERTILIZERS

A. Tree, Shrub and Vine Planting Fertilizer: "Agriform" 21 gram tablets with 20-10-5 (N-P-K) formula as manufactured by Sierra Chemical Company, Milpitas, California, Telephone (408) 263-8080, or accepted equal.

2.4 STAKING MATERIALS: Refer to Section 329400 "Landscape Planting Accessories" for requirements under this section.

2.5 GUYING MATERIALS: Refer to Section 329400 "Landscape Planting Accessories" for requirements under this section.

2.6 VINE SUPPORTS: Refer to Section 329400 "Landscape Planting Accessories" for requirements under this section.

2.7 WATER

A. Clean, fresh and potable, furnished and paid for by Owner.

B. Transport as required.

2.8 WOOD CHIP MULCH: Refer to Section 329400 "Landscape Planting Accessories" for requirements under this section.

2.9 ANTI-DESICCANT

A. At Contractors option, apply anti-desiccants for retarding excessive loss of plant moisture and inhibiting wilt. Material shall be sprayable, water insoluble vinyl-vinyl dine complex that will produce a moisture retarding barrier not removable by rain.

1. Wilt-pruf Formula NCF as manufactured by Nursery Specialty Products, Greenwich, Connecticut, or accepted equal.

2.10 DRAINAGE AND SUBDRAINAGE MATERIAL: Refer to Section 334300 "Landscape Drainage" for requirements under this section.

PART 3 - EXECUTION

3.1 EXAMINATION

A. NO WORK UNDER THIS SECTION SHALL COMMENCE UNTIL SUBMITTALS UNDER THIS SECTION HAVE BEEN REVIEWED ACCORDINGLY BY THE LANDSCAPE ARCHITECT.

B. Prior to commencing Work under this Section, Contractor shall examine previously installed Work from other trades and verify that such Work is complete and to the point where Work herein may commence properly. Do not proceed with Work until unsatisfactory conditions have been corrected.

C. Contractor shall notify the Landscape Architect, in writing, on the anticipated commencement date and length of duration of the Work installation herein this section.

D. Installation practices of the Plant Materials shall be performed during those periods when weather and soil conditions are suitable and in accordance with locally accepted horticultural practices, as judged by the Landscape Architect.

1. Soil moisture levels prior to planting shall be no less than seventy-five-percent (75%) of field capacity. The determination of adequate soil moisture for planting shall be in the sole judgment of the Landscape Architect, and their decision shall be final.

a. If the soil moisture level is found to be insufficient for planting installation, planting pits shall be filled with water and allowed to drain before commencing planting operations.
b. Any planting area that may become compacted in excess of eighty-five-percent (85%) relative compaction (due to construction operations or other activities during the Contract) shall be tilled and thoroughly cross-ripped to a minimum depth of nine-inches (9") to alleviate the condition, taking care to avoid all existing subsurface utilities, drainage, etc.
c. Do not commence planting installation prior to acceptance of Section 329113 – Soil Preparation.

E. Contractor shall notify the Landscape Architect, in writing, on the anticipated commencement date and length of duration of the landscape installation.

F. Preparation of Planting Installation: Lay out individual Plant Material locations and areas for multiple plantings. Stake locations, outline areas, and gain the Landscape Architect's acceptance prior to commencing physical planting installation. Contractor shall make minor adjustments to the planting layout as required, per the direction of the Landscape Architect.

G. No more Plant Materials shall be distributed in the planting area on any day than can be installed and watered on that day. Plant Materials shall be planted and watered immediately after the removal of their containers, as applicable.

H. Contractor shall protect existing and new improvements and systems installed prior to planting installation. Maintain protection in place until completion of Work and Landscape Establishment Period.

I. Finish Grades for planting areas shall have been established (per Section 312219 – Landscape Grading) prior to Work under this Section. Verify that grades are within one-inch plus or minus (1"+/-) of the required finish grade, and that all proper soil amendments and fertilizers have been furnished and installed accordingly as specified (per Section 329113 – Soil Preparation).

1. Maintain positive surface drainage of all planted areas throughout the duration of the Contract.

J. Pre-Planting: Where Plant Materials are to be pre-planted to permit site improvements to be installed around them, Contractor shall be responsible for the accurate layout and placement of those Plant Materials, as measured to their centerlines. Confirm designated pre-planting operations with Landscape Architect prior to commencing Work. Contractor shall also be responsible for the protection of pre-planted Plant Materials while other Work is taking place around them. Provide regular irrigation, as necessary, prior to installation and functioning of irrigation systems (per Section 328400 – Site Irrigation System).

3.2 DRAINAGE OF PLANTING AREAS

A. Surface Drainage: Maintain positive surface drainage of planted areas as established under Section 312219 "Landscape and Fine Grading".

B. Discrepancies: Submit in writing, all discrepancies in the Drawings or Specifications, obstructions on the site, or prior work done by others, which Contractor feels precludes maintaining proper drainage; include description of all work required for correction or relief of said discrepancies.

C. Detrimental Drainage, Soils and Obstructions:
1. Notification: Supply written notification of all conditions detrimental to growth of plant material. State condition and submit proposal and cost estimate for correcting condition.
2. Testing: Test drainage of plant beds and pits by filling with water twice in succession. Give written notification of conditions permitting the retention of water in planting beds for more than twenty-four (24) hours.
3. Correction: Submit for acceptance a written proposal and cost estimate for the correction before proceeding with work.
4. Obstructions: If rock, underground construction work, tree roots or other obstructions are encountered in the excavation of plant pits, alternate locations may be used as directed. Where locations cannot be changed, submit cost required to remove the obstructions to a depth of not less than six (6") inches below the required pit depth. Proceed with work after acceptance.

3.3 LAYOUT PLANTING AREAS

A. Layout and Staking: Lay out plants at locations shown on Drawings. Use color-coded wire flags for each species of plant material. Stake each tree, vine and major shrub. Outline shrub and groundcover beds with pain. Locations of plants will be checked in the field and will be adjusted to exact position before planting begins. Right is reserved to refuse review at any time if, in the landscape architect's opinion, a sufficient quantity of plants are not available.

B. Refer to contract documents – planting details for tree layout staking procedure.

3.4 PLANT PIT EXCAVATION

A. Plant Pits outside natural areas:

1. Excavate the planting pits for trees and shrubs which shall be three times the diameter and equal to the depth of the root ball. Where adjacent to hardscape, width in the direction of hardscape shall be to hardscape edge unless indicated otherwise in the drawings.

B. Plant Pits inside natural areas:

1. Excavate the planting pits for trees shall be 12 inches larger and for groundcover and shrubs which shall be 3 inches larger and equal to the depth of the plant material. Avoid root system and adjust location as needed.

3.5 PLANTING OPERATIONS

A. General:

1. Protect plants at all times from sun or drying winds.
2. Keep plants that cannot be planted immediately upon delivery in the shade, well-protected and well-watered.

B. Handling of Plant Materials:
1. Remove canned stock carefully after cans have been cut on two sides with accepted cutter. Do not use spade to cut cans.

2. Lift and handle plants only from the bottom of the ball. If rootball is cracked or broken during handling, plant shall be rejected.

C. Installation:

1. Pit Preparation: Add the appropriate amount of backfill mix to the bottom of the plant pit and blend into the existing soil. Tamp and compact mix.
2. Positioning: After removing plant from container, scarify side of rootball to prevent root-bound condition and position plant in planting pit.
3. Backfilling: Use site stockpiled soil to backfill on-grade plant pits. Set each plant plumb and brace rigidly in position until planting soil has been tamped solidly around the ball and roots. When plant pits have been backfilled approximately 2/3 full, water thoroughly and saturate rootball, before installing remainder of the backfill mix to top of pit, eliminating air pockets.
4. Remove top 1/3 minimum of all wiring, rope and burlap as a part of planting operation.
5. Continue backfill and create maximum 3 inch high temporary water basin.
6. Staking and/or Guying: Stake or guy as outlined below.

D. Adjustment: Adjust plants so that after full settlement has occurred, the natural grade at the base of the plants is flush to a maximum of one (1") inches above the adjacent planting finish grade after natural settlement.

E. Temporary Watering Basin: Form saucer with three (3") inch high berm centered around tree and 2" higher around shrub pits. Locate basins at twelve (12") inches wider than ball diameter. Basins will not be permanent.

F. Watering: Water all plants immediately after planting.

G. Labels: Remove all nursery-type plant labels from plants.

H. Temporary Watering Basin: Remove watering basins prior to finish grading and after irrigation is in operation within shrub, groundcover and lawn areas.

3.6 STAKING AND GUYING

A. General:

1. Trees shall be able to stand upright without support, and shall return to the vertical after their tops have been deflected horizontally and released. Stake or guy trees which do not meet this qualification. All plant materials shall remain plumb and straight for all given conditions from installation through the guarantee period.
2. Use either staking or guying method at Contractor's own option, subject to acceptance.
3. Trees supplied with well-tapered, strong trunks that will stand alone may be staked with two (2) stakes and tied per this section.
4. Tree support, if required, shall be done as outlined on the following tables.

B. Staking: Stake all trees under three (3") inches in caliper in accordance with the details.
1. Locate stakes in a line with trunk of tree, perpendicular to prevailing wind and as close to the main trunk as is practical, avoiding root injury. Drive stakes at least thirty six (36") inches into firm ground.
2. Remove tree from nursery-supplied stake and tie to new stakes using two accepted tree ties. Find proper height for point of tree ties and attach as follows:

a. Hold trunk in one hand, pull top to one side and release. Height at which trunk will snap back to upright is Base Height. Attach tree ties to trunk six (6") inches above Base Height.

b. Tie to stake as detailed.

C. Guying:

1. Guy trees at points of branching with guys spaced equally around and outside perimeter of ball. Cover guys with rubber hose at points of contact with bark. Position guys at crotches and fasten to a deadman.
2. Guys: Provide one (1) turnbuckle for each guy. Use two (2) cable clamps at each cable connection. Place white plastic guy covers on all guys.
3. Manufactured Product: Install per manufacturer's instructions unless modified by Landscape Architect.

Tree caliper @ 12" above grade	Guy	Size	Turnbuckle	Deadmen
3 1/2" to 4 1/2"	1/8" diameter	1 x 19 aircraft cable	1/4"	4x4 x 18" long, 24" deep
5" to 6"	3/16" diameter	1 x 19 aircraft cable	5/16"	4x4 x 24" long, 24" deep
6 1/2" to 8"	3/16" diameter	1 x 19 aircraft cable	5/16"	6x6 x 30" long, 30" deep
8" to 10"	1/4" diameter	1 x 19 aircraft cable	1/2"	8x8 x 42" long, 36" deep

3.7 TRAINING OF VINES AND ESPALIERS

A. Anchors: Place as many anchors as required to securely support the plant and its branching structure as directed.

B. Ties: Tie branches to anchors with vinyl ribbon ties.

C. Small Vines: Secure to wall or fence with polyethylene tape at ten (10") inch intervals.

3.8 PRUNING: See “Landscape Establishment Period” - Section 329813.

3.9 MULCHING

A. Install a two (2") inch deep layer of mulch over all shrub areas including tree and shrub watering basins.

B. Install gravel mulch where shown. Refer to section 321500 “Aggregate Surfacing”.

3.10 GROUNDCOVER PLANTING

A. Tilling: Surface soil in areas to be planted with groundcover shall be tilled to a depth of six (6") inches. Planting soil amendments should be uniformly broadcast and thoroughly incorporated to a depth of six (6") inches by means of rototiller or equal. Do not till in existing tree areas.

B. Planting: Plant groundcover plants at optimum depth for proper growth. Avoid air pockets. Equally space triangularly, at distances called for in the Drawings.

C. Watering: Water bed thoroughly after fertilizer application. Wash all fertilizer from leaves of plant materials.

3.11 CLEAN-UP

A. Keep all areas of work clean, neat and orderly at all times.

B. Clean up and remove all deleterious materials and debris from the entire work area prior to Final Acceptance.

3.12 FINAL REVIEW

A. Final Review under this Section shall be performed upon completion of the Landscape Establishment Period. Refer to Section 329813 "Landscape Establishment Period" for requirements under this section.

END OF SECTION

SECTION 329400

LANDSCAPE PLANTING ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes materials, labor, apparatus, tools, equipment, temporary construction, transportation, and services necessary for and incidental to performing the proper completion of Work, as required to make a complete exterior Landscape Planting Accessories installation, as shown in the Contract Drawings, and as specified herein this Section.

B. Work under this Section consists of, but is not necessarily limited to, furnishing and installing the following:

1. Mulches (wood products).
2. Root Control Barriers.
3. Stakes and Guys.
4. Vine Trellis Support System.
5. Erosion Control Materials.
6. Miscellaneous Materials (Herbicides, Vitamin Stimulant/Root Hormone, etc.).

C. Related Documents: The following Documents contain requirements that relate to Work in this Section:

1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
2. Section 312219 "Landscape and Fine Grading".
3. Section 321500 "Aggregate Surfacing".
4. Section 328400 "Site Irrigation System".
5. Section 329200 "Lawns and Grasses".
6. Section 329300 "Trees, Shrubs, Vines, and Groundcovers".
7. Section 329813 "Landscape Establishment Period".

1.2 DEFINITIONS AND APPLICABLE STANDARDS

A. References:

1. ASTM - American Society for Testing and Materials.
2. ANSI – American National Standards Institute.

B. Measurements:

1. PSI: Measurement, in pounds per square inch.
2. CU/FT: Measurement, in cubic-foot.
3. PPM: Measurement, in parts per million.

1.3 SUBMITTALS

A. General: Refer to Division 01 for project submittal requirements and timelines. If provided in hardcopy submittal booklets submit each item in this Article in required copies with four (4) copies for review by Landscape Architect. Three (3) copies shall be returned (One for Client, one for Owner and one for Contractor) and one copy maintained by Landscape Architect. Provide one (1) sets of Material Samples for review by the Landscape Architect unless requested otherwise.

B. Submittal Booklets: Each Submittal Booklet under this Section shall be tabbed into specific sections, containing clearly identified (through yellow highlighter or other specific identification methods) and legible information on the following information indicated in this Article.

C. Electronic Submittals: Electronic Submittal shall be provided in a single bound file, PDF format preferred, unless otherwise noted in Division 01.

D. Product/Material Data. Submit available product/material literature (including color charts) supplied by manufacturer's, indicating that their products comply with specified requirements. Provide manufacturing source (name, address, and telephone number), and distributor source (name, address, and telephone number) for each type of product/material.

E. Material Samples: For each type of material specified herein, provide Material Samples for review by the Landscape Architect. Include the full range of exposed color and texture expected in the completed Work. Provide Material Samples bound and individually wrapped in re-sealable labeled plastic bags (as applicable):

1. 0.50 cubic foot of Landscape Mulch Material (Shredded Wood Mulch).
2. One (1) two-foot (2'-0") long sample of Root Control Barrier.
3. One (1) set of Tree Tying/Staking Materials for each type used, as applicable.
4. One (1) set of Tree Guying Materials for each type used, as applicable.
5. One (1) two-foot (2'-0") length of Vine Support Tape, and one (1) Vine Support Anchor, as applicable.
6. One (1) two-foot (2'-0") square sample of Erosion Control Material for each type used, as applicable.
7. One (1) two-foot (2'-0") sample of Landscape Edging Materials and Accessories (stake, etc), to verify gauge, size, and color selected, as applicable.

F. Scaled Shop Drawings: Not Required.

G. Field-Constructed Mock-ups: Not Required.

H. Qualification Data: Submit names for firms and persons specified in the "Quality Assurance and Control" Article to demonstrate their capabilities and experience on similar Landscape Planting Accessories installations.

I. Submittals under this Article will be rejected and returned without the benefit of review by the Landscape Architect if they are difficult to read due to insufficient scale, poor image quality, or poor drafting quality; or if all of the required information is missing or not presented in the format as requested. Partial Submittals will not be accepted.

J. No Work shall proceed under this Section until Submittal requirements indicated herein have been reviewed accordingly by the Landscape Architect.

1.4 QUALITY ASSURANCE AND CONTROL

A. Installer Qualifications:
   1. Engage an experienced Installer who has completed Landscape Planting Accessories work similar in material, design, and extent to that indicated for this Project and with a record of successful installation.
   2. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on the Project site during times that installations under this Section are in progress.

B. Observation: Landscape Architect may observe installation of Landscape Planting Accessories at Project Site for compliance with requirements for type, size, and quality. Landscape Architect retains right to observe Landscape Planting Accessories for defects and to reject unsatisfactory or defective material at any time during progress of Work. Contractor shall remove rejected Accessories immediately from Project site.

C. Manufacturer's Directions: Follow Manufacturer's directions and drawings in cases where the Manufacturers of articles used in this Section furnish directions covering points not shown in the Contract Drawings and Contract Specifications.

D. Permits, Fees, Bonds, and Inspections: Contractor shall arrange and pay for permits, fees, bonds, testing services, and inspections necessary to perform and complete Work under this Section.

E. Single-Source Responsibility: Obtain each color, type, and variety of products/materials from a single source with resources to provide products/materials of consistent quality in appearance and physical properties without delaying Work.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Provide new, unused materials indicated under this Section. Store and secure properly to prevent theft or damage. Deliver and store perishable material in original, unopened packaging. It is the responsibility of the Contractor to install "factory condition" Units.

B. Damaged Materials: Be responsible for all damage or disfiguration of Work until Final Acceptance. Remove off site and replace at no additional cost to Owner all damaged or rejected materials.

C. Deliver materials so as to not delay Work, and install only after preparations for installation have been completed.

1.6 COORDINATION, SCHEDULING, AND OBSERVATIONS

A. Utilities: Determine location of above grade and underground utilities and perform Work in a manner which will avoid damage to utilities. Hand excavate, as required. Maintain grade stakes until removal is mutually agreed upon by parties concerned.

B. Excavation: When conditions detrimental to installing Landscape Planting Accessories are encountered, such as rubble fill, adverse drainage conditions, or obstructions, cease installation operations and notify Landscape Architect for further direction.

C. Field Measurements: Contractor shall take field measurements as required. Report major discrepancies between the Contract Drawings and field dimensions to the Landscape Architect prior to commencing Work.

D. Installation: Perform installation of Landscape Planting Accessories only when weather and soil conditions are suitable in accordance with locally accepted practices.

E. Construction Site Observations: Periodic site observations shall be made by the Landscape Architect during the installation of Work under this Section for compliance with requirements for type, size, and quality. Landscape Architect retains right to observe Work for defects and to reject unsatisfactory or defective material at any time during progress of Work. Contractor shall remove rejected materials immediately from Project site. The Contractor shall request, in writing, at least one (1) week in advance of the time when mandatory site observation(s) by the Landscape Architect are required.

1.7 SUBSTITUTIONS

A. Consideration: Materials to be considered equal to the Materials indicated herein this Section shall be reviewed by the Landscape Architect. Materials with equal performance characteristics produced by other Manufacturer's and/or Distributors may be considered, providing deviations in dimensional size, color, composition, operation, and/or other characteristics do not change the design concept, aesthetic appearance, nor intended performance, as solely judged by the Landscape Architect. The burden of proof on product equality is on the Contractor.

B. Specific reference to Manufacturer's names and products specified herein are used as standards of quality. This implies no right to the Contractor to substitute other materials without prior written approval by the Landscape Architect for Work under this Section.

C. Materials substituted and installed by the Contractor, without prior written approval by the Landscape Architect, may be rejected. Contractor shall not be entitled to be compensated by the Owner where the Contractor has installed rejected substitutions without receiving prior written approval.

D. Contract Price: Substituted Materials under this Section shall not increase the Contract price.

1.8 LANDSCAPE ESTABLISHMENT PERIOD

A. Refer to Section 329813 "Landscape Establishment Period", for requirements under this Article.

1. During the duration of the Landscape Establishment Period, continuously maintain Landscape Planting Accessories by tightening, holding plumb, and/or repairing Staking and/or Guying supports, providing adequate depths and coverage requirements of Landscape Mulching Materials, monitoring drainage within Tree Root Aeration Units, hold Edging Materials true and in proper alignments, and other requirements, as required, to establish healthy, viable landscape planting materials until Final Acceptance of Work is granted.

PART 2 - PRODUCTS

2.1 LANDSCAPE MULCH MATERIALS

A. Shredded Wood Mulch: Shredded Wood Mulch, free from deleterious materials, debris, and weed seed. Suitable as a top dressing of trees, shrubs and groundcovers, consisting of following:

1. Type: Shredded cedar, redwood, fir, or hardwood commercial wood bark products, composted with humus and leaf materials. Shredded Wood Mulch shall be graded and to

average dimensions of one-inch (1") to three-inches (3") in length, and flat in cross-section.

a. Minimum organic matter content at 80%.
b. pH between 5.0 and 8.0.
c. Salt content shall be less than 4 millimho/cm @ 25 ˚ C. on a saturated paste extract.
d. Boron content of the saturated extract shall be less than 1.0 parts per million.
e. Calcium carbonate shall not be present.
f. Carbon:Nitrogen ratio is less than 100:1.
g. Compost shall be aerobic without malodorous presence of decomposition products.
h. Maximum particle size shall be 2 inches. A maximum of 5% shall pass a No. 2 screen.

Maximum Total Permissible Pollutant Concentrations (in parts per million (PPM)) on a dry weight basis:	
Arsenic	20 ppm
Molybdenum	30 ppm
Cadmium	15 ppm
Nickel	50 ppm
Chromium	150 ppm
Selenium	25 ppm
Cobalt	50 ppm
Silver	10 ppm
Copper	150 ppm
Vanadium	50 ppm
Lead	150 ppm
Zinc	150 ppm
Mercury	10 ppm

2. Coverage depth:

a. Refer to Part III indicated herein this Section.

2.2 ROOT CONTROL BARRIERS

A. Plastic Root Control Barrier:

1. General: Plastic Root Control Barrier shall be a long-term root control system for trees, fully permeable to oxygen and water to sustain and direct plant growth. Plastic Root Control Barrier shall be manufactured of an extruded, high-impact black homo-polymer (polyethylene or polyolefin) plastic, with minimum 50% post-consumer recycled material, and UV inhibitors. Plastic Root Control Barrier shall be composed of a system consisting of a series of integrally-molded, self-interlocking Barrier Panels. Polystyrene- based plastic is unacceptable.

a. Size: Each panel shall be a minimum of twenty-four-inches (24") in width and thirty-six-inches (36") in depth, extruded to a mean thickness of .08 inches, with ½" to ¾" raised vertical ribs running perpendicular to the panel and spaced six-inches (6") on-center. Provide quantity as required of integrated interlocking joint panels, in lengths as required.

b. Products & Manufacturer's: Subject to compliance with requirements, provide products by one (1) of the following:

1) UB-36-2 Deep Root, Deep Root Partners, San Francisco, CA, 800-458-7668.
2) Root Solutions, Vespro, Inc., San Rafael, CA, 800-554-0914.
3) Or equal, as approved by the Landscape Architect.

2.3 STAKES AND GUYS

A. Tree Guying Hardware

1. Tree Support Staking System (at grade application).

a. Pre-assembled, pre-packaged, tree anchoring system, specifically manufactured to anchor trees in a primary above-grade application. System components (sized accordingly to tree caliper) include anchors, wire rope, turn buckles, tree collars, and wire rope clamps.
b. Products & Manufacturer's: Subject to compliance with requirements, provide products by one (1) of the following:

1) Root Anchor Underground tree Staking by TreeStake Soultions, LLC, www.treestakesolutions.com for distributors.
2) Or approved equal by Landscape Architect.

c. Product Application:

1) For trees up to 2" caliper, Root Anchor 45/65 BG or smaller by Tree Stake Solutions or approved equal.
2) For trees 2.5” – 4” caliper, Root Anchor 100/150 BG or smaller by Tree Stake Solutions or approved equal.
3) For trees 4.5” – 6” caliper, Root Anchor 200/300 BG or smaller by Tree Stake Solutions or approved equal.

2. Tree Support Root Guying System (complete below grade application).

a. Pre-assembled, pre-packaged, tree anchoring system, specifically designed and manufactured to hold the tree's root ball in place, with only the tree protruding from the ground. System components (sized accordingly to tree caliper) include anchors, wire rope, turn buckles, tree collars, and wire rope clamps.
b. Products & Manufacturer's: Subject to compliance with requirements, provide products by one (1) of the following:

1) Duckbill Tree Anchor System, Foresight Products, LLC, 6430 E. 49th Drive, Commerce City, CO 80022, 800-325-5360.
2) Or equal (no known equal).

c. Product Application:

1) For trees up to 3" caliper, Duckbill Tree Anchor System #68RBK.
2) For trees up to 6" caliper, Duckbill Tree Anchor System #88RBK.

B. Supports for Vines:

1. Vine Supports: Galvanized metal or plastic epoxy-fastening type, as accepted.
2. Vine Tie Tape: Polyethylene tape, ½" wide.

2.4 EROSION CONTROL MATERIALS

A. Open Weave Jute Fiber Mesh: Biodegradable, woven, 100% natural jute fiber yarn, +/- 0.25" thick, un-dyed and unbleached, 0.92 lbs. per sq. yd. minimum, with 50% to 65% open area. Provide "U"-shaped, 11-gauge steel wire staples, six-inches (6") to eight-inches (8") long, 2" crown, to anchor Jute Fiber Mesh to soil surface.

1. Products & Manufacturer's: Subject to compliance with requirements, provide products by one (1) of the following:

a. Anti-Wash/Geojute, Belton Industries, Inc.
b. Or equal, as approved by the Landscape Architect.

B. Rolled Erosion Control Blanket: 95-100% organic biodegradable materials, consisting of machine-manufactured 100% certified weed free agricultural straw fibers, 100% natural coconut-fibers (coir), or a combination thereof, evenly distributed over the entire area of the Blanket. Fibers shall be sewn into a medium weight natural fiber, degradable mesh net (top and/or bottom) on on-one-half-inch (1-1/2") centers, with cotton polyester or polypropylene thread. Blanket rolls shall be a minimum of 6'-6" wide, and a minimum of .05 lb./sq. yd. Provide "U"-shaped, 11-gauge steel wire staples, six-inches (6") to eight-inches (8") long, two-inch (2") crown, to anchor Erosion Control Blankets to soil surface.

1. Products & Manufacturer's: Subject to compliance with requirements, provide product(s) as required by one (1) Manufacturer, subject to specific slope gradient conditions indicated per the Contract Drawings, as follows:

Slope Gradient Application	Product Type and Composition	* Acceptable Manufacturers and Manufacturer's Product Reference Numbers			Anticipated Functional Longevity of Product
		Greenfix | America, Brawley, CA 760-351-7791	North American Green, Evansville, IN 800-772-2040	Western Excelsior, Mancos, CO 800-833-8573	
5:1 to 4:1 slopes.	100% Straw; Single Organic Net (Top Only).	#WS05B	#S75BN	#NAT-SR-1	12 Months
4:1 to 3:1 slopes.	100% Straw; Double Organic Net (Top & Bottom).	#WS072B	#S150BN	#NAT-SS-2	12 Months
3:1 to 2:1 slopes.	70% Straw + 30% Coconut Fibers (Coir); Double Net (Top & Bottom).	#CFS072B	#SC150BN	#NAT-CS-3	18 Months
2:1 to 1:1 slopes, and greater.	100% Coconut Fibers (Coir); Double Net (Top & Bottom).	#CF072B	#C125BN	#NAT-CC-4	24 Months

2. * or equal, as approved by the Landscape Architect.

2.5 MISCELLANEOUS MATERIALS

A. Water: Per ASTM C94, from potable domestic source, and free from deleterious materials such as oils, acids, and organic matter. Transport as required.

B. Stress Reducing Agent:

1. Products & Manufacturer's: Subject to compliance with requirements, provide products by one (1) of the following:

a. Roots Concentrate, Roots, Inc., Independence, MO.
b. Or equal (no known equal).

2. Application Rate: Provide at prescribed rate and application per Manufacturer's written recommendations, per one-hundred (100) gallons of water.

C. Wetting Agent and Soil Penetrant:

1. Products & Manufacturer's: Subject to compliance with requirements, provide products by one (1) of the following:

a. Roots NoBurn®, Roots, Inc., Independence, MO.
b. Naiad-SS,
c. Or equal, as approved by the Landscape Architect.

2. Application Rate: Provide at prescribed rate and application per Manufacturer's written recommendations, per one-hundred (100) gallons of water.

D. Herbicides: EPA registered and approved, from the following:

1. Non-Selective Post-Emergent Herbicide: Spray-applied solution containing a minimum of 41% of the active ingredient "glyphosate" (full strength), with a surfactant, mixed with water accordingly per the Manufacturer's directions.

a. Products & Manufacturer's: Subject to compliance with requirements, provide products by one (1) of the following:

1) Roundup® PRO, (41% glyphosate), Monsanto Company, St. Louis, MO.
2) Roundup® PRO Concentrate (50% glyphosate), Monsanto Company, St. Louis, MO.
3) Honcho® Plus, (41% glyphosate), Monsanto Company, St. Louis, MO.
4) High Yield® Kill-Zall Weed & Grass Killer, (41% glyphosate),Voluntary Purchasing Groups, Boneham, TX.
5) Or equal, as approved by the Landscape Architect.

b. Application Rate: Provide at prescribed rate and application per Manufacturer's written recommendations, per one-hundred (100) gallons of water.

2. Selective Pre-Emergent Herbicide (Packaged dry material application): Pre-emergent control of annual grasses and broadleaf weeds in turf grass areas, and woody ornamental trees, shrubs, vines, and groundcover areas. Product to contain the active ingredient "trifluralin".

a. Products & Manufacturer's: Subject to compliance with requirements, provide products by one (1) of the following:

1) Ronstar® 2G, (granular), Aventis Environmental Science USA.
2) Snapshot® 2.5 GT (granular), (2% trifluralin), Dow AgroSciences LLC.
3) Treflan® HFP (43% trifluralin), Dow AgroSciences LLC.
4) Treflan® TR-10, (10% Granular trifluralin), Dow AgroSciences LLC.
5) Surflan®, Dow AgroSciences, LLC.
6) Or equal, as approved by the Landscape Architect.

b. Application Rate: Provide at prescribed rate and application per Manufacturer's written recommendations, per one-hundred (100) gallons of water.

3. Selective Post Emergent Herbicide: Pre-mixed, flow-able formulation designed for product stability, uniformity in the spray solution and ease of handling. Post-emergent control of annual grasses, nutsedge, and broadleaf weeds in turf, generally with one (1) application.

a. Products & Manufacturer's: Subject to compliance with requirements, provide products by one (1) of the following:

1) Trimec® Plus.
2) Ornamec® 170 Grass Herbicide.
3) Or equal, as approved by the Landscape Architect.

b. Application Rate: Provide at prescribed rate and application per Manufacturer's written recommendations, per one-hundred (100) gallons of water.

E. Plant Vitamin/Hormone Stimulant:

1. Provide in a diluted liquid solution with water, at the time of watering-in recently planted plant species.

a. Products & Manufacturer's: Subject to compliance with requirements, provide products by one (1) of the following:

1) SUPERthrive, Vitamin Institute.
2) Roots2, Roots, Inc., Independence, MO.
3) Root-Maxx Plus, Bio-Plex, Mt. Joy, PA.
4) Or equal, as approved by the Landscape Architect.

b. Application Rate: Provide at prescribed rate and application per Manufacturer's written recommendations, per one-hundred (100) gallons of water.

PART 3 - EXECUTION

3.1 EXAMINATION

A. NO WORK UNDER THIS SECTION SHALL COMMENCE UNTIL SUBMITTALS UNDER THIS SECTION HAVE BEEN REVIEWED ACCORDINGLY BY THE LANDSCAPE ARCHITECT.

B. Prior to commencing Work under this Section, Contractor shall examine previously installed Work from other trades and verify that such Work is complete and to the point where Work herein may commence properly. Do not proceed with Work until unsatisfactory conditions have been corrected.

C. Contractor shall notify the Landscape Architect, in writing, on the anticipated commencement date and length of duration of the Work installation herein this section.

D. Installation practices of the Landscape Planting Accessories shall be performed during those periods when weather and soil conditions are suitable and in accordance with locally accepted horticultural practice, as approved by the Landscape Architect. Contractor shall notify the Landscape Architect, in writing, on the anticipated commencement date and length of duration of the landscape installation.

3.2 PROTECTION OF SITE

A. Contractor shall protect existing and new improvements and systems installed prior to installation of Landscape Planting Accessories. Maintain protection in place until completion of Work and Landscape Establishment Period.

3.3 INSTALLATION OF ROOT CONTROL BARRIERS

A. Plastic Root Control Barrier Panels:

1. Verify the location of underground utilities prior to placement of Root Control Barrier Panels.
2. Excavate sub grade to the required depth of the Panel, and install Panels as an interconnected, linear system, with the ribs of the Panels vertically aligned and facing towards the Plant Material's root mass.

    a. Install Root Control Barrier Panels along the entire perimeter edge for trees located in raised planters (as required).
    b. Install Root Control Barrier Panels along the entire perimeter edge of the planting area for trees located in parking lots (as required).
    c. Install Root Control Barrier Panels for trees where the tree trunk is located within a minimum of five-feet (5') of paved surfaces (sidewalks, curbs, plazas, etc).

        1) Root Control Barrier Panels shall extend a minimum of ten-feet (10') from either side of the tree trunk, and follow along the profile of the paved surface being protected. Install Panels at a maximum of four-inches (4") to six-inches (6") from the edge of the paved surface.

    d. Install Root Control Barrier Panels in specific locations as indicated on the Contract Drawings.

3. Install Root Control Barrier Panels plumb, or if conditions allow, with the top of the Panel slightly inclined towards the root mass. DO NOT install with the top inclined away from the root mass.

    a. DO NOT install Root Control Barrier Panels in a circular pattern that encloses the root mass, thus restricting future growth of the Plant Material's root system.

4. Set top of the Root Control Barrier Panels at the finish graded surface, just below the mulch layer. Install per the requirements of the Manufacturer.

3.4 STAKING AND GUYING

A. General: Tree Staking and Tree Guying shall be per the direction of the Landscape Architect. Staking and/or guying of trees shall be completed immediately following tree planting operations.

1. Contactor shall provide new Tree Stake or Tree Guy assemblies; reconditioned or previously-used Tree Stake or Tree Guy assemblies shall not be permitted. Provide one (1) set of Tree Staking materials or Tree Guying materials per tree, as required. Trees shall remain plumb and straight from installation through the Contractor Warranty period. Staking and Guying assemblies shall remain the property of the Owner.

B. Staking/Guying Methodology: Unless otherwise directed on the Contract Drawings or as directed by the Landscape Architect based on field conditions, provide the following Staking/Guying Assemblies, as measured by the size of the tree being supported:

1. 5-gallon size Container Stock to 36"-Box Tree, or for trees up to 3" caliper: Provide Staking Method. Number of stakes per tree shall be as directed herein this Section.
2. For trees larger than 36"-Box size or over 3" caliper: Provide Staking or Guying Method, or as directed by the Landscape Architect.
3. Multi-trunk Trees: Provide Tree Guying Method, or as directed by the Landscape Architect.
4. Specimen-size Trees: Provide Tree Guying Method, or as directed by the Landscape Architect.

3.5 INSTALLATION OF EROSION CONTROL MATERIALS

A. Clear away trash, large stones, and other debris. Prepare sub grade; fine grade area to receive Erosion Control Material, eliminating footprints, tracks, and ruts.

B. Sequences: For hydroseed applications, install the seed slurry prior to installing the Erosion Control Material. In applications where rooted stock is planted on the slope, care shall be exercised to prevent disruption or damage to the underlying material.

C. Unroll Material as close as possible to its intended final position to minimize the need to drag the Material which would dislocate underlying materials or disturb the prepared sub grade or planting. Install Material flush and completely in contact with the ground. Confirm that there is no tension on the Material to minimize soil contact.

D. Overlap Material at a minimum of four-inches (4") on the sides and eighteen-inches (18") on the ends. Staples shall be inserted at intervals no greater than three-feet (3') on-center along overlaps and down the center of each roll length.

E. Joining rolls of the Material shall be installed at the down-channel end of the installed roll, which should overlap the up-channel end of the roll being installed. Overlap should be a minimum of eighteen-inches (18"). Equally set staples on twelve-inch (12") on-center spacing.

F. Anchor slot at top of slope shall be installed by burying up-channel end in a six-inch (6") minimum deep trench. Equally set staples on twelve-inch (12") on-center spacing.

G. On slopes less than six-feet (6') in height, Material may be installed with roll perpendicular to the contours.

H. The terminal fold shall be installed by bringing the Material down to the level area before terminating. Turn the end under a minimum of six-inches (6"). Equally set staples across the fold at twelve-inch (12") on-center spacing.

3.6 MULCHING

A. Shredded Wood Mulch:

1. General: Verify locations to receive Shredded Wood Mulch.
2. Mulch backfilled surfaces of pits, trenches, all planted areas, unless noted otherwise.
3. Apply the following average thickness of Shredded Wood Mulch, and finish level with adjacent finished surfaces. Do not place Shredded Wood Mulch directly against trunks or stems of Plant Materials. Remove Shredded Wood Mulch that is placed against the growing bases or within the basal nodes of plants.
4. Thickness/Depth: Two-inches (2"), minimum.
5. While settlement and/or decomposition of the Shredded Wood may occur during the duration of the Contract, the Shredded Wood Mulch thickness as indicated shall be consistent throughout the duration of the Contract. The Contractor shall provide additional Shredded Wood Mulch, as needed, and as directed by the Landscape Architect, to maintain the specified constant thickness of the Shredded Wood Mulch, until Acceptance of Work is granted.

B. Aggregate Surfacing:

1. General: Verify locations to receive Aggregate Mulch
2. Refer to Section 321500 "Aggregate Surfacing" for installation requirements.

3.7 INSTALLATION OF MISCELLANEOUS MATERIALS

A. Anti-Desiccant: Apply using power spray to provide an adequate film over trunks, branches, stems, twigs, and foliage.

1. When deciduous trees or shrubs are moved in full-leaf, spray with anti-desiccant at nursery before moving and again two (2) weeks after planting.

B. Stress Reducing Agent: Apply, as required and directed by the Landscape Architect, per Manufacturer's latest printed instructions.

C. Wetting Agent & Soil Penetrant: Apply, as required and directed by the Landscape Architect, per Manufacturer's latest printed instructions.

D. Herbicides: Apply, as required and directed by the Landscape Architect, per Manufacturer's latest printed instructions.

E. Plant Vitamin/Root Stimulant: Apply, per the Manufacturer's latest printed instructions. Refer to application requirements per Section 32 9300 "Trees, Shrubs, Vines and Groundcovers".

3.8 CLEAN UP AND PROTECTION

A. For Work under this Section, keep Work area in a clean, orderly, and safe condition. Contractor shall remove trash caused from his Work on a weekly basis throughout the duration of the Work.

B. Protect landscaping from damage due to landscape operations, operations by other Contractors and trades, and trespassers. Maintain protection during installation and landscape

establishment periods. Treat, repair, or replace damaged Landscape Planting Accessories as directed.

C. Upon completion of his Work under this Section, the Contractor shall remove rubbish, waste, debris, excess construction materials, and other items resulting from construction operations offsite as described herein this Section and directed by the Landscape Architect.

3.9 FINAL REVIEW

A. Final Review under this Section shall be performed upon completion of the Landscape Establishment Period. Refer to Section 32 9813 "90 Day Landscape Establishment Period" for requirements under this section.

END OF SECTION

SECTION 329813

LANDSCAPE ESTABLISHMENT PERIOD

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes materials, labor, apparatus, tools, equipment, temporary construction, transportation, and services necessary for and incidental to performing the proper completion of Work, as required to make a complete Landscape Establishment Period, as specified during progress of the Work, after installation, for a designated period, as shown in the Contract Drawings (if any), and as specified herein this Section.

B. Work under this Section consists of, but is not necessarily limited to, furnishing and installing the following:

1. Establishment of Landscape Installation, for a given duration as specified herein this Section.
2. Monitoring, maintenance, adjustment and repair of irrigation.
3. Hand and supplemental watering of plantings
4. Mowing, edging and trimming of lawn areas.
5. Pruning and trimming of trees and shrubs.
6. Weed control and weeding of all planted areas.
7. Application of fertilizers, insecticides, and herbicides.
8. Surface raking or leveling maintenance of aggregate surfacing.
9. General site cleanup; removal of trash and products of maintenance.

C. Related Documents: The following Documents contain requirements that relate to Work in this Section:

1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
2. Section 312219 "Landscape and Fine Grading".
3. Section 321500 "Aggregate Surfacing".
4. Section 328400 "Site Irrigation System".
5. Section 329113 "Soil Preparation".
6. Section 329200 "Lawns and Grasses".
7. Section 329300 "Trees, Shrubs, Vines and Groundcovers".
8. Section 329400 "Landscape Planting Accessories".

1.2 DEFINITIONS AND APPLICABLE STANDARDS

A. References:

1. USDA – United States Department of Agriculture.
2. ASTM – American Society for Testing and Materials.
3. ANSI – American National Standards Institute.
4. ISA – International Society of Arboriculture.

B. Standards:

1. American National Standard for Tree Care Operation, Tree, Shrub, and Other Woody Plant Maintenance (ANSI A300), American National Standards Institute, Latest Edition.
2. American National Standard for Tree Care Operations (ANSI Z133), American National Standards Institute, Latest Edition.
3. Tree Pruning Guidelines, International Society of Arboriculture, 1995 Edition.
4. Pruning Standards for Shade Trees, National Arborists Association, Latest Edition.

1.3 SUBMITTALS

A. General: Refer to Division 01 for project submittal requirements and timelines. If provided in hardcopy submittal booklets submit each item in this Article in required copies with four (4) copies for review by Landscape Architect. Three (3) copies shall be returned (One for Client, one for Owner and one for Contractor) and one copy maintained by Landscape Architect. Provide one (1) sets of Material Samples for review by the Landscape Architect unless requested otherwise.

B. Submittal Booklets: Each Submittal Booklet under this Section shall be tabbed into specific sections, containing clearly identified (through yellow highlighter or other specific identification methods) and legible information on the following information indicated in this Article.

C. Electronic Submittals: Electronic Submittal shall be provided in a single bound file, PDF format preferred, unless otherwise noted in Division 01.

D. Quality Control Submittals:

1. Schedule of maintenance operations and monthly status report including list of equipment, materials proposed for the job (and watering schedule).
2. Licenses, permits and insurance required by the City of Dallas, the State or Federal government pertaining to maintenance work.
3. Monthly record of all herbicides, insecticides and disease control chemicals used for the project.
4. Final landscape establishment report documenting specific changes or modifications to the plants or irrigation and incidents of pest or insect infestation controls that had been required to properly maintain and insure the continued vigor of the planting.
5. Documentation of existing planting and irrigation system.
6. Written application recommendation by a licensed agricultural pest control advisor for all weed, pest and disease controls restricted by the Director of Agriculture proposed for this work.

E. Project Close-out Submittal: Include in a single, 3-ring binder a landscape maintenance manual containing an indexed collection of all schedules, records and permits listed above, as well as a documentation of accepted condition of planting and irrigation at Final Acceptance.

1.4 QUALITY ASSURANCE AND CONTROL

A. Qualifications:

1. Experience: The landscape contractor or maintenance subcontractor shall have a full-time employee assigned to the job as foreman for the duration of the contract. He/she shall have a minimum of four (4) years experience in landscape maintenance supervision, with experience or training in turf management, entomology, pest control, soils, fertilizers and plant identification.

2. Labor Force: The landscape maintenance labor force shall be thoroughly familiar with, and trained in, the work to be accomplished and shall perform the task in a competent, efficient manner acceptable to the Owner and Client.

B. Requirements:

1. Supervision: The foreman shall directly supervise the work force at all times. Notify Owner and Client of all changes in supervision.
2. Identification: Provide proper identification at all times for landscape maintenance firm's vehicles and labor force. Be uniformly dressed in a manner satisfactory to the Owner and Client.

1.5 PROJECT/SITE CONDITIONS

A. Site Visit: At beginning of maintenance period, visit and walk the site with the Owner's representative to clarify scope of work and understand existing project/site conditions.

B. Documentation of Conditions: Document general condition of existing trees, shrubs, vines, groundcovers and lawn recording all plant materials which are healthy, thriving, damaged, dead or dying.

C. Irrigation System: Document general condition of existing irrigation system, making sure that faulty electrical controllers, broken or inoperable sprinkler heads (or emitters) are reported.

1.6 SEQUENCING AND SCHEDULING

A. Perform all maintenance during hours mutually agreed upon between Owner, Client and Contractor.

B. Work force shall be present at the project site at least once a week and as often as necessary to perform specified maintenance in accordance with the approved maintenance schedule.

1.7 CONTRACTOR RESPONSIBILITIES

A. The Contractor shall begin maintenance after any portion of the sprinkler irrigation, each plant and lawn portion is installed.

B. Sprinkler Irrigation System: The Contractor's maintenance of the sprinkler irrigation system shall consist of monitoring and adjustment of valves, repair of leaks in both mains and lateral lines and all other work required to establish a complete working irrigation system.

C. Trees, Shrubs, Groundcovers and Vines: The Contractor's maintenance of new planting shall consist of watering, cultivating, weeding, mulching, re-staking, tightening and repairing of guys, resetting plants to proper grades or upright position, restoration of the planting saucer, and furnishing and applying such sprays and invigorants as are necessary to keep the plantings free of insects and disease and in thriving condition.

D. Lawns and Meadows;

1. The Contractor's maintenance of grass areas shall consist of mowing and edging of lawn and turf areas.
2. Work in all grass areas including meadow grasses shall include watering, weeding, repair of all erosion and reseeding and resodding as necessary to establish a uniform stand of the specified grasses.
3. Edges of meadows shall be trimmed to keep grasses from blocking walk way edges.

1.8 PROTECTION: Protect planting areas and lawns at all times against damage of all kinds for duration of maintenance period. Maintenance includes temporary protection fences, barriers and signs as required for protection. If any plants become damaged or injured, because sufficient protection was not provided, treat or replace as directed by Owner at no additional cost to Owner.

1.9 DURATION: Work under this Section shall commence upon the date specified or noted as in the Substantial Completion Certificate or the Site Substantial Completion Certificate (if a separate certification) and shall occur for a minimum of ninety (90) calendar days or until Final Acceptance by Landscape Architect, whichever is longer.

1.10 FINAL ACCEPTANCE: Work under this Section will be accepted by Landscape Architect upon satisfactory completion of all work, including maintenance, but exclusive of the required guaranteed sprinkler irrigation obligations, replacement of plant materials and lawns under the Warranty Period. Upon Final Acceptance, the Owner or Client will assume responsibility for maintenance of the work.

1.11 MAINTENANCE INSTRUCTIONS: At the completion of work, furnish three (3) copies of documented maintenance events and adjustments or changes required by specific plant or site conditions to Owner to enable the contractor and owner to incorporate those items in the maintenance program for the project.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Materials required for installed items shall match those already in use.

B. Samples of all materials not specified under other Sections of these Specifications shall be submitted for review by Landscape Architect prior to use.

2.2 REQUIRED EQUIPMENT

A. Contractor shall furnish the all necessary maintenance equipment.

2.3 WATER: Clean, potable and fresh, as available from Owner.

2.4 FERTILIZERS

A. Tightly-compressed, slow-release and long-lasting complete fertilizer tablets bearing manufacturer's label of guaranteed analysis of chemicals present.

1. Balanced, once-a-season application, controlled-release fertilizers with a blend of coated prills which supply controlled-release nitrogen, phosphorus and potassium, and uncoated, rapidly soluble prills containing nitrogen and phosphorus.

2.5 HERBICIDES, INSECTICIDES, AND FUNGICIDES

A. Best quality materials with original manufacturers' containers, properly labeled with guaranteed analysis.

1. Use non-staining materials.

2.6 ANNUALS/PERENNIALS

A. Nursery-grown in 4 inch pots, full, healthy plants just ready to bloom.

2.7 LAWN SOD AND TURF OR MEADOW GRASS SEED AND SEED MIXES

A. For sod and seed replacement: Match existing materials.

2.8 REPLACEMENT TREE GUYS, STAKES, TIES AND WIRES

A. Match originally accepted or existing materials on the site.

2.9 EQUIPMENT

A. General: Use only the proper tool for each job. Maintain all tools in sharp, properly-functioning condition. Clean and sterilize pruning tools prior to usage.

2.10 INSECT/DISEASE PREVENTION

A. Take all measures to prevent introduction of insect or disease-laden materials onto the site.

PART 3 - EXECUTION

3.1 EXAMINATION

A. NO WORK UNDER THIS SECTION SHALL COMMENCE UNTIL SUBMITTALS UNDER THIS SECTION HAVE BEEN REVIEWED ACCORDINGLY BY THE LANDSCAPE ARCHITECT.

B. Prior to commencing Work under this Section, Contractor shall examine previously installed Work from other trades and verify that such Work is complete and to the point where Work herein may commence properly. Do not proceed with Work until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Protection:

1. Protect all new planting areas from damage of all kinds from beginning of work until sufficiently established or until Final Acceptance.
2. Provide temporary protection fences, barriers and signs as required for protection.

B. Replacements:

1. Immediately treat or replace all plants which become damaged or injured as a result of Contractor's operations or negligence, as directed by Landscape Architect, at no cost to Owner.
2. Replacement plants shall match size, condition and variety of plants replaced.

3.3 WATERING: It shall be the responsibility of the Contractor to assure that the correct watering of plant materials is achieved by supplemental watering as required. Where there is no automatic irrigation and when ever rainfall is not providing adequate water the contractor is responsible for supplemental watering until the end of the establishment period.

A. Provide regular and supplemental deep watering to all landscape until the plant material has become established and new growth is apparent. Deep watering shall be accomplished with hoses and sprinklers as permitted.

B. Frequent watering to the lawn areas to insure against drying. This may be accomplished as above, by the existing automatic sprinkler system, hand watering or portable sprinklers. Contractor shall monitor settings of automatic sprinkler controls and recommend necessary adjustments according to climatic changes.

C. Contractor shall not be responsible for watering all new planting areas beyond the end of the landscape establishment period.

D. Contractor shall be responsible for damages to irrigation system and for repair costs caused by operation of equipment or by mowing and other maintenance operations.

3.4 WEED CONTROL

A. General:

1. All planting, turf, grass and meadow grass areas shall be maintained in a weed free condition throughout the landscape establishment period.
   a. Apply pre-emergent weed control to shrub, groundcover and annual or perennial plantings at the rates specified by the manufacturer. If plant types are not within manufacturers label guidelines for safe pre-emergent application, weed by hand.
   b. Apply selective and non-selective herbicides per manufacturers label to eliminate weeds in lawn areas.

2. Reference other sections of this specification for additional weed control requirements.

3.5 MAINTENANCE OF TURF AREAS

A. Watering:

1. Water lawns at such frequency as weather conditions require, to replenish soil moisture to 6 in. below root zone. Maintain optimum water availability in the root zone without erosion or over saturation of the soil.
2. Generally, provide initial daily watering to maintain soil moisture in an optimum condition and to promote rapid germination and establishment. After root and top growth has established (approximately 2 weeks, reduce water rate to a total of 1-1/2 in. of water weekly during hot summer weather, in three (3) applications per week after turf or meadow is established.
3. Water at night if irrigation system is electrically controlled. Otherwise, watering shall be done during early mornings.

B. Weed Control:

1. Control broadleaf weeds with selective herbicides.
2. In areas where crabgrass, nut sedge or other invasive weed specie has infested the lawn, apply a selective herbicide as soon as possible, and prior to flowering as recommended by the manufacturer.
3. Apply pre-emergent herbicides such as Dacthal, Balan, or Betasan prior to invasive grassy weed germination in sodded areas.
4. Do not irrigate for 48 hours after application of herbicidal sprays or otherwise as recommended by the manufacturer.

C. Mowing and Edging:

1. Mowing lawn/grass areas shall be accomplished with sharp, properly adjusted mowers of the correct size for the various areas.
2. Mowing frequency shall be at least one time a week and more often as necessary to keep turf at a height between one and two inches as determined by the specie of turf grass installed.
3. Lawn shall be edged evenly at all walks, headers and other hard edges not less than once a week.
4. Mow meadow areas once during early spring to a height of 6 inches, otherwise mow not more than once per season and then only at the specific request of the owner. Generally mowing shall be no lower than 6 inches.

D. Until the establishment of the turf, the Contractor will be responsible for replacing soils that have eroded onto the paved areas and cleaning of same. Residual soils on paving will be removed and if not mingled with objectionable materials, may be re-used in eroded areas.

E. Immediately upon observing any lawn grass spreading into shrub or groundcover areas, the Contractor shall initiate a program of mechanical removal and maintain this program throughout the Landscape Establishment period.

F. Any lawn grass appearing in paved areas shall receive an application of non-selective herbicide according to manufacturer's direction. The herbicide shall be approved and will not be detrimental structurally to paved areas.

G. Special effort shall be given to the control of fire ants infesting the site. After control is accomplished, the ant mounds shall be lowered and tamped to the existing grade.

H. Apply slow release fertilizer (24-6-12) forty five days after installation at 5 pounds per 1000 square feet.

I. Removal of debris from the site unrelated to horticultural maintenance (paper, bottles, cans, signs, etc.) shall be the responsibility of the landscape establishment Contractor and limited to areas designated. Frequency shall be one time per week during the landscape establishment period.

J. Replacements:

1. Replace dead and missing plants according to the warranty requirements.
2. Damages due to Contractor's negligence shall be paid for without charge to Owner or Client.

3.6 MAINTENANCE OF TREES AND SHRUBS

A. Contractor shall adjust and tighten as required all tree staking and guying. Removal as directed by Owner's Representative.

B. Resetting: Reset plants to proper grades and upright position by excavating the edge of the plant pit and repositioning the plant to grade. Install backfill and properly compact.

1. Do not use stake guys to straighten trees. Replant to plumb.

C. Contractor shall deep water all new trees until there are definite signs the trees have established themselves and are pushing out new growth.

D. Temporary Tree Watering basins shall be removed by Contractor at 60 days from time of planting.

E. Contractor shall be continuously alert for signs of insect and pest presence or damage or the presence or damage from plant fungi or disease.

1. Disease and pest control shall be the responsibility of the installing contractor until the end of the Landscape Establishment Period. The contractor shall take corrective action within 24 hours of finding the problem or of being notified that there is a pest or disease problem.
2. Upon locating such disease or pest damage, the Contractor shall report it to the Owner's representative and advise of the course of action the contractor will take to eliminate the problem

F. Weed Control:

1. All areas between plants, including watering basins, shall be weed free at all times.
2. Use only recommended and legally approved herbicides to control weed growth.
3. Avoid frequent soil cultivation that destroys shallow roots and breaks the seal of pre-emergent herbicides.

G. Pruning:

1. Prune trees to select and develop permanent scaffold branches that are smaller in diameter than the trunk or branch to which they are attached, and which have vertical spacing of 18 in. to 48 in. and radial orientation so as not to overlay one another.
2. Prune trees to eliminate diseased or damaged growth, and narrow V-shaped branch forks that lack strength. Reduce toppling and wind damage by thinning out crowns.
3. Prune trees to maintain growth within space limitations, maintaining a natural appearance and balancing crown with roots.
4. No stripping of lower branches ("raising up") of young trees will be permitted.
5. Retain lower branches in a "tipped back" or pinched condition to promote caliper trunk growth (tapered trunk). Do not cut back to fewer than six buds or leaves on such branches. Only cut lower branches flush with the trunk after the tree is able to stand erect without staking or other support.
6. Thin out and shape evergreen trees when necessary to prevent wind and storm damage. Do primary pruning of deciduous trees during the dormant season. Do not permit any pruning of trees prone to excessive "bleeding" during growth season.
7. Prune damaged trees or those that constitute health or safety hazards at any time of year as required.
8. Make all cuts clean and close to the trunk, without cutting into the branch collar. "Stubbing" will not be permitted. Cut smaller branches flush with trunk or lateral branch. Make larger cuts (1 in. in diameter or larger) parallel to shoulder rings, with the top edge of the cut at the trunk or lateral branch.
9. Branches too heavy to handle shall be precut in three stages to prevent splitting or peeling of bark. Make the first two cuts 18 in. or more from the trunk to remove the branch. Make the third cut at the trunk to remove the resulting stub.
10. Do not prune or clip shrubs into balled or boxed forms unless specifically called for by design.

H. Staking and Guying of Trees:

1. Inspect stakes and guys at least once a month to check for rubbing that causes bark wounds.

2. Repair and replace staking and guying as shown and as specified.

I. Replacements:

1. Replace dead and missing plants according to the warranty requirements.
2. Damages due to Contractor's negligence shall be paid for without charge to Owner or Client.

3.7 MAINTENANCE OF EXISTING PLANTINGS TO REMAIN

1. General: Conform to all applicable paragraphs regarding pruning, watering, spraying and fertilizing of new plant materials as specified in this section.
2. Symptoms: Be alert to symptoms of construction damage to existing plantings as evidenced by wilting, unseasonal or early flowering or loss of leaves, and insect or disease infestation due to declining vigor.
3. Notification: Submit in writing of evidences of declining vigor immediately upon discerning the problem. Take appropriate interim measures to mitigate the severity of the problem as specified in this section.
4. Proposal: Submit written proposal and cost estimate for the correction of all conditions before proceeding with permanent correction work.

3.8 MAINTENANCE OF ANNUALS AND PERENNIALS

A. Watering:

1. Hand-water all pre-cast pots and planters without an automatic irrigation system.
2. Species, sizes of plants, container sizes and orientation shall dictate frequency of watering. Submit to Owner a watering schedule for different seasonal requirements.

B. Weed Control: All planters with annuals and perennials shall be weed-free at all times.

C. Pruning:

1. Limit pruning to removal of damaged or dead twigs and foliage.
2. Remove spent flowers on a weekly basis.

D. Replacements of Annuals:

1. Replace annuals when materials exhibit a "spent" condition.
2. Thoroughly cultivate soil after removal of "spent" or "dead" plants prior to planting new materials.

E. Fertilization: Incorporate slow release fertilizers per manufacturer's current specifications, and rake smooth.

F. Replacements:

1. Replace dead and missing plants according to the warranty requirements.
2. Damages due to Contractor's negligence shall be paid for without charge to Owner or Client.

G. Allow for 1 replacement of all annuals during or immediately after the establishment period at no added cost to the owner.

3.9 MAINTENANCE OF GROUNDCOVERS

A. Watering:

1. Check for moisture penetration throughout the root zone at least twice a month.
2. Water as frequently as necessary to maintain healthy growth of groundcovers.

B. Weed Control:

1. All groundcovers shall be maintained in a weed free condition.
2. Control weeds, preferably with pre-emergent herbicides and with selective systemic herbicides.
3. Minimize hoeing of weeds in order to avoid plant damage.

C. Fertilization:

1. Recently installed plant materials: Verify with Owner actual completion date of planting installation and rate of prior application of fertilizers.
2. Install slow release 21-6-12 fertilizer except where high phosphorous has been found through soil testing use 21-0-0 ammonium sulfate. Apply at 5 pounds per 1000 square feet.

D. Mowing and Edging:
1. Edge groundcovers to keep in bounds. Trim top growth as necessary to achieve an overall even appearance.

E. Replacements:

1. Replace dead and missing plants according to the warranty requirements.
2. Damages due to Contractor's negligence shall be paid for without charge to Owner or Client.

3.10 INSECTS, PESTS, AND DISEASE CONTROL

A. Inspection: Inspect all plant materials for signs of stress, damage and potential trouble from the following:

1. Presence of insects, moles, gophers, ground squirrels, snails and slugs in planting areas.
2. Discolored or blotching leaves or needles.
3. Unusually light green or yellowish green color inconsistent with normal green color of leaves.

B. Personnel: Only licensed, qualified, trained personnel shall perform required operations for insect, pest and disease control

C. Application: Spray with extreme care to avoid all hazards to any person or pet in the area or adjacent areas.

D. Should animal control be required, perform such work in accordance with State, Local and Federal Guidelines as applicable.

3.11 MAINTENANCE OF IRRIGATION SYSTEM

A. General:

1. Repair without additional charge to Owner all damages to system caused by Contractor's operations. Perform all repairs within one (1) watering period.
2. Report promptly to Owner all accidental damage not resulting from Contractor's negligence or operations.
3. Do not run the irrigation system during rainy season. Set and program automatic controllers for seasonal water requirements.
4. Twice a month, use a probe or other acceptable tool to check the rootball moisture of representative plants as well as the surrounding soil.

B. Cleaning and Monitoring the System:

1. Continually monitor the irrigation systems to verify that they are functioning properly as designed. Make program adjustments required by changing field conditions.
2. Clean pump filter and strainer at least once a year and as often as necessary to keep the irrigation systems free of sand and other debris.
3. Prevent spraying on windows, building walls, (game courts) by balancing the throttle control on the remote control valves and the adjustment screws on the sprinkler heads. Do not allow water to atomize and drift.

C. Winterization: The irrigation system is designed to be completely drained to protect pipe from bursting prior to freezing temperatures. To adequately drain the system, the following procedure must be followed:

1. Air blow-out

a. Set automatic control stations to 2-1/2 minutes timing.
b. Attach hose from portable air compressor to 1 in. air inlet installed on main line at backflow preventer.
c. Operate compressor at 100 cu. ft. per second at 60-80 PSI.

2. Manual drain valves: Open manual drain valves located at low points on the main line to drain main completely after air blow-out has been completed.
3. Backflow Preventer: Rotate backflow unit at unions and open pet cocks and drain. Reverse operation and tighten unions to resume irrigation.

3.12 MAINTENANCE OF AGGERGATE SURFACING

A. Decomposed Granite:

1. Maintain decomposed granite in a level and uniform surface removing any rutting caused by water movement or pedestrian/vehicular movements.

2. Redistribute surface so that larger particles are equally distributed over surface and not bunched to edges or corners.

3. Remove any materials (soils, rocks, vegetation etc.) not part of approved and applied decomposed granite surface.

4. Reapply binder agent if areas become too soft or movement occurs greater than 1/2" depth from surface elevation. Refer to Section 32 15 00 "Aggregate Surfacing" for product and application.

B. Gravel Aggregates:

1. Maintain small gravels in a level and uniform surface removing any rutting caused by vehicular and or pedestrian circulation and movements.

2. Remove any materials (soils, rocks, vegetation etc.) not part of approved and applied decomposed granite surface.

C. Cobble, River Rock or Large Aggregates:

1. Maintain small gravels in a level and uniform surface removing any rutting caused by vehicular and or pedestrian circulations and movements.

2. Remove any materials (soils, rocks, vegetation etc.) not part of approved and applied decomposed granite surface

3.13 START OF LANDSCAPE ESTABLISHMENT AND SUBSTANTIAL COMPLETION

A. Preliminary Review: As soon as planting is substantially completed according to the construction documents, hold a preliminary review to determine the condition of the work.

B. Date of Review: Notify Landscape Architect at least five (5) workings days prior to anticipated date of review.

C. Beginning of the Maintenance Period: The Landscape Architect will visit the site and determine the status of substantial completion of the work.

1. The date for substantial completion will be determined by the owner's representative and the landscape architect. The landscape architect will issue a written report which will state the date Preliminary Acceptance and Substantial Completion to the Contractor.
2. The report may include items required for correction.

D. Warranty Dates and Date for the End of the Landscape Establishment Period will be noted in the substantial completion report when substantial completion is granted.

3.14 TERMINATION OF THE MAINTENANCE PERIOD

A. Final Acceptance Procedure:

1. Work will be accepted by the Landscape Architect upon satisfactory completion of all work, including the landscape establishment period, but exclusive of replacement of materials under the Warranty Period.
2. Submit a written request to Landscape Architect for review for Final Acceptance at least five (5) working days prior to anticipated Final Review date, which is at the end of the Maintenance Period.

B. Corrective Work:

1. Work requiring corrective action or replacement shall be performed within ten (10) calendar days after the Final Review.
2. Perform corrective work and materials replacement in accordance with the Drawings and Specifications, and shall be made by the Contractor at no cost to the Owner or Client.
3. After corrective work is completed, the Contractor shall again request a Final Review for Final Acceptance as outlined above.

4. Continue maintenance of all landscaped areas until such time as all corrective measures have been completed and accepted.

C. Conditions for Acceptance of Work at End of Maintenance Period:

1. Each plant shall be alive and thriving, showing signs of growth and no signs of stress, disease, or any other weaknesses.
2. Replace all plants not meeting these conditions. An additional Warranty Period equal in length to the original shall be commenced for all such plants and planted areas.

D. Final Acceptance Date: The date on which the Landscape Architect issues a Letter of Final Acceptance. Upon Final Acceptance, the Owner will assume responsibility for maintenance of the work.

3.15 CLEANING

A. Dispose of all pruned materials, vacuum all lawn clippings and leaves, sweep all walkways and rake smooth all mulched areas.

B. Remove from the site all containers and evidence of maintenance activities.

3.16 CLOSE OUT

A. Landscape Maintenance Record: Submit binder to Owner with all documentation and records required and utilized during the maintenance period.

B. Keys and Identification: Return all keys and identification materials supplied by Owner for the purpose of site access.

END OF SECTION

SECTION 334300

LANDSCAPE DRAINAGE

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes materials, labor, apparatus, tools, equipment, temporary construction, transportation, and services necessary for and incidental to performing the proper completion of Work for Landscape Drainage systems and connections, as shown in the Contract Drawings, and as specified herein this Section.

B. Work under this Section consists of, but is not necessarily limited to, furnishing and installing the following:

1. Trenching and backfilling.
2. Providing and installing all pipe, including joints and fittings, cutting pipe to conform to structures and modifications to existing system.
3. Constructing or installing surface basins, area drains and other structures.
4. Area drains in paving and planting
5. Underdrains and subsurface drainage.
6. Subdrainage pipes and fittings
7. Filter fabrics and drainage stone
8. Drainage Gravel

C. Related Documents: The following Documents contain requirements that relate to Work in this Section:

1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
2. Contract Plan Documents – Civil Section
3. Section 312213 “Rough Grading”.
4. Section 312219 "Landscape and Fine Grading".
5. Section 329113 "Soil Preparation".

1.2 DEFINITIONS

A. HDPE: High-density polyethylene

B. PE: Polyethylene plastic.

C. PVC: Polyvinyl chloride plastic.

1.3 SUBMITTALS

A. General: Refer to Division 01 for project submittal requirements and timelines. If provided in hardcopy submittal booklets submit each item in this Article in required copies with four (4) copies for review by Landscape Architect. Three (3) copies shall be returned (One for Client, one for Owner and one for Contractor) and one copy maintained by Landscape Architect. Provide one (1) sets of Material Samples for review by the Landscape Architect unless requested otherwise.

B. Submittal Booklets: Each Submittal Booklet under this Section shall be tabbed into specific sections, containing clearly identified (through yellow highlighter or other specific identification methods) and legible information on the following information indicated in this Article.

C. Electronic Submittals: Electronic Submittal shall be provided in a single bound file, PDF format preferred, unless otherwise noted in Division 01.

D. Product Data: Submit labeled samples, manufacturer's latest catalog cuts and specifications for each specified product. Include submittals for every different item specified in each category. Submit as follows:

1. Solid and Perforated pipe: Provide manufacturers literature and data.
2. Pipe fabric covering: Provide 6" square sample. Provide manufacturers literature and data.
3. Geotextile fabrics. Provide 6" square sample. Provide manufacturers literature and data.
4. Gravel: Provide 1-quart sample with sieve analysis and data for each type specified.
5. Area Drains: Provide manufacturers literature and data for each type specified.
6. Slot or Trench Drains: Provide manufacturers literature and data for each type specified.
7. Sub-Surface Drains: Provide manufacturers literature and data for each type specified.

E. Compatibility Tests: Verification of permittivity and compatibility of soils with geotextile required for compatibility of filter fabric or drainage mat with soil, refer to Section 329113 "Soil Preparation" for required soil types.

F. Test data: Submit all laboratory test data of all materials.

1.4 PROJECT/SITE CONDITIONS

A. Protection of Existing Plants to Remain: Refer to Section 015639 "Temporary Tree and Plant Protection" for requirements under this section.

B. Protection of Utilities:

1. Provide temporary support and protection of underground and surface utility structures, drains, services and other improvements noted to remain.
2. Where grade or alignment of pipe is obstructed by existing utility structures such as conduits, ducts or pipes, permanently support, relocate, remove or reconstruct the obstruction, unless otherwise approved by Landscape Architect.
3. Restore all damaged improvements to original condition at no additional cost to Owner.

1.5 DELIVERY, STORAGE AND HANDLING

A. Delivery: All containerized products shall be delivered to the site in manufacturer's original, unopened, legibly labeled containers. All pipe to be delivered bound securely to prevent damage. Supply items as required to protect and support the products.

B. Storage: Protect materials from damage, water and rust. Store pipes on beds that are full length of pipe. Protect plastic materials from direct sunlight.

C. Pipe: Cap openings against entry by dust, debris and other foreign matter.

D. Damaged Materials: Remove all damaged materials and replace at no expense to Owner.

1.6 COORDINATION, SEQUENCING AND SCHEDULING

A. Drainage panel materials and installation shall be compatible with waterproofing walls below grade.

B. Concealed Work: Verify locations of existing stubouts to receive landscape area drains. Verify and locate existing pipes and structures to be coordinated with landscape drainage work.

C. Field Measurements for Lines and Levels: Confirm lines and levels for each drainage system and coordinate with other systems to prevent conflicts and maintain proper clearances.

D. Notification: Submit to Landscape Architect written notification of all discrepancies in the Drawings or existing conditions which preclude successful installation of landscape drainage work as specified.

E. Plant Pit Drainage: Coordinate installation of inspection tubes and subsurface drainage with installer of plant materials. Reference Section 329300 "Trees, Shrubs, Vines and Groundcovers" for requirements under this section.

1.7 FINAL ACCEPTANCE

A. Review Date: Make a written request for review for Final Acceptance at least five days in advance.

B. Completion: Work will be accepted upon satisfactory completion of all landscape drainage work.

C. Responsibility: Upon Final Acceptance, Owner will assume responsibility for maintenance of the work.

PART 2 - PRODUCTS

2.1 PRODUCTS PIPE AND FITTINGS

A. Polyvinyl chloride pipe and fittings PVC 1120, conforming to ASTM D1785-76, sizes as shown on the Drawings.

1. Type: ASTM D3034, SDR-35, solid and perforated, belled end, solvent weld.
2. Type: ASTM D1785, PVC 1120-1220, Schedule 40, pipes and fittings.

    a. Perforations: 3/8 in. diameter, 4 in. apart center to center longitudinally, in two rows 120 degrees apart.

3. Manufacturer: Lasco, (714) 993-1220.
4. Fittings Manufacturer: Dura, Lasco, Sloan or approved equal

B. Polyethylene:

1. Perforated and Non-Perforated Polyethylene Tubing:
2. Type: ASTM F405 corrugated tubing and fittings, for less than 10 in. diameter, and ASTM F667 for 10 in., 12 in. and 15 in. diameters.
3. Manufacturer: Advanced Drainage Systems, Inc., (800) 742-1933.
4. Joints: Couplings and fittings as manufactured by ADS.

a. Manufacturer: Advanced Drainage Systems, Inc. (ADS), Madera, CA. Tel. (800) 733-1993.

2.2 DRAINAGE STRUCTURES AND DEVICES

A. General:

1. Drainage structures shall be constructed where and as shown in Drawings. Reference Civil for additional requirements.
2. Provide and install all fittings and adapters as required for Storm Sewer connections from drainage devices and structures to the terminus of piping.

B. Hardscape Surface Area Drains

1. Type: Refer to Contract Drawings.
2. Installation: Refer to Contract Drawings.

C. Groundcover and Planting Surface Areas

1. Type: Atrium style, Refer to Contract Drawings
2. Installation: Refer to Contract Drawings.

D. Lawn Surface Areas

1. Type: Atrium style, Refer to Contract Drawings
2. Installation: Refer to Contract Drawings.

E. Slot or Trench Linear Area Drains

1. Type: Atrium style, Refer to Contract Drawings
2. Installation: Refer to Contract Drawings.

2.3 UNDERDRAIN PIPE AND FITTINGS

A. Material shall be equal to "ADS" Polyethylene tubing with "Drain-Gard" and fittings as manufactured by Advanced Drainage Systems, Ennis, Texas, (214) 875-6991 or Landscape Architect approved equal(s).

B. Tubing perforations shall be saw slots, longitudinally spaced four (4") inches on center, four (4) rows, and 90 degrees apart.

C. Spun bonded nylon fabric shall be wrapped fully around tubing coils.

D. Coordinate threaded connections for penetrations through metal planter skins.

2.4 ACCESSORIES

A. Sand Backfill: Fine granular material naturally produced by the disintegration of rock, sufficiently free of organic material, mica, loam, clay and other deleterious substances to be thoroughly suitable for pipe bedding.

B. Drainage Gravel: Clean, washed gravel 3/8" inch to 3/4" inch, no fines. Crushed stone shall be rejected.

2.5 PERMEABLE BACKFILL

A. Reference the Civil Engineer or Soils Engineer contract documents and recommendations.

2.6 IMPORTED STRUCTURAL BACKFILL: Reference Civil or Structural Engineer contract documents and recommendations.

2.7 FILTER FABRIC

A. Filter Fabric: "Mirafi FW402" woven geotextile. Mirafi 365 South Holland Drive: Pendergrass, GA 30567; Telephone 706 693 2226.

2.8 SUBDRAINAGE MATERIALS:

A. Filter Fabric: "Mirafi FW402" woven geotextile. Mirafi 365 South Holland Drive: Pendergrass, GA 30567; Telephone 706 693 2226.

B. Drainage Stone: Clean washed gravel 3/8" inch to 3/4" inch, no fines. Crushed stone shall be rejected.

PART 3 - EXECUTION

3.1 EXAMINATION

A. NO WORK UNDER THIS SECTION SHALL COMMENCE UNTIL SUBMITTALS UNDER THIS SECTION HAVE BEEN REVIEWED ACCORDINGLY BY THE LANDSCAPE ARCHITECT.

B. Prior to commencing Work under this Section, Contractor shall examine previously installed Work from other trades and verify that such Work is complete and to the point where Work herein may commence properly. Do not proceed with Work until unsatisfactory conditions have been corrected.

C. Contractor shall notify the Landscape Architect, in writing, on the anticipated commencement date and length of duration of the Work installation herein this section.

D. Verification of Conditions: Verify exact locations and quantity of all drains relative to planting areas and adjacent to and within paving, prior to beginning of work. Identify required lines, levels, contours, and datum. Immediately report to Landscape Architect all discrepancies found prior to installation of drains.

E. Deviations: Make no deviations from specified line or grade without written acceptance of change by Landscape Architect.

3.2 GENERAL

A. Existing Utilities: Where grade or alignment of pipe is obstructed by existing utility structures such as conduits, ducts or pipes, permanently support, relocate, remove or reconstruct the obstruction.

B. Deviations: Make no deviations from specified line or grade without written acceptance of change by Landscape Architect.

C. Verification: Verify rim elevations of area drains relative to adjacent paving prior to beginning of work.

3.3 INSTALLATION; GENERAL

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 shall take design considerations into account. Install piping as indicated, to extent practical.

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. Maintain swab or drag in line, and pull past each joint as it is completed.

C. Use manholes for changes in direction, unless fittings are indicated. Use fittings for branch connections, unless direct tap into existing sewer is indicated.

D. Use 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. Install gravity-flow piping and connect to building or site storm drains, of sizes and in locations indicated. Terminate piping as indicated.

1. Install piping pitched down in direction of flow, at minimum slope of 1 percent, unless otherwise indicated.
2. Install piping with cover per the drawings

3.4 PIPE JOINT CONSTRUCTION AND INSTALLATION

A. General: Join and install pipe and fittings according to installations indicated.

B. PE Pipe and Fittings: As follows:

1. Join pipe, tubing, and fittings with couplings for soil tight joints according to manufacturer's written instructions.
2. Install according to ASTM D 2321 and manufacturer's written instructions.
3. Install corrugated piping according to the Corrugated Polyethylene Pipe Association's "Recommended Installation Practices for Corrugated Polyethylene Pipe and Fittings."

C. PVC Sewer Pipe and Fittings: As follows:

1. Join pipe and gasketed fittings with gaskets according to ASTM D 2321.
2. Install according to ASTM D 2321.

3.5 CATCH-BASIN INSTALLATION

A. Set drain frames and covers with tops flush with pavement and/or planting surface.

B. Install landscape drains in accordance with manufacturer's requirements.

3.6 CONCRETE PLACEMENT

A. Place cast-in-place concrete according to Section 321316 "Landscape Architectural Concrete Pavement" and 321223 "Cast-In-Place Concrete for Landscape Elements" for requirements under this section.

3.7 DRAINAGE SYSTEM INSTALLATION

A. Assemble and install components according to manufacturer's written instructions.

B. Install with top surfaces of components, except piping, flush with finished surface.

C. Coordinate with filter fabric and landscape soil contractor. Insure those contractors install filter fabric and provide soil loading fill to top edge

3.8 CLEANOUT INSTALLATION

A. Layout Clean-outs as needed to limit clean-outs in lawn areas and/or crossing or intersecting various types of pavements. Contact Landscape Architect for review of clean-out location(s) prior to installation.

B. Install cleanouts and riser extension from sewer pipe to cleanout 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.

C. 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.

D. Set cleanout frames and covers in concrete pavement, stone surfaces, aggregate surfacing or modular unit pavements with tops flush with pavement surface.

3.9 TRENCHING AND BACKFILLING

A. Backfill trenches to top of pipe plus six inches (6") with sand.

B. When trench excavated to line and grade indicated in drawings encounters hardpan, rock, mud, quicksand, debris, or other unsuitable bedding material, trench shall be further excavated to a suitable limit as directed by Landscape Architect. Excavation shall then be backfilled with approved import material that will provide adequate pipe bedding. Import material will be cement stabilized sand unless otherwise specified by Engineer.

C. Backfill:

1. Backfill the remaining trench with on site excavated material. If excavated material is unsuitable for compaction, use imported suitable material approved by Landscape Architect
2. Do not permit sand backfill material to mix with structural backfill within the subdrain area
3. All trench backfill shall be compacted to ninety five (95%) percent relative density.
4. Coordinate testing with Geotechnical lab services.

D. Obstructions and Debris: Remove hardpan, rock, mud, quicksand, debris or other unsuitable bedding material. Further excavate the trench a suitable limit as directed by the Engineer. Backfill with import material approved by the Engineer that will provide adequate pipe bedding.

3.10 PIPE INSTALLATION

A. All pipes shall be installed and tested in accordance with Civil Engineers requirements.

B. PVC Pipe: Install as detailed in the Drawings and in accordance with the manufacturer's current printed specifications.

3.11 SUB-SURFACE, TRENCH AND BED DRAINAGE SYSTEMS

A. Install to locations and rim elevations as shown and detailed on the Drawings.

B. Connect to pipe stubouts in strict accordance with the manufacturer's current printed specifications.

C. Preparation of Trench: Accurately excavate trench as shown on the Drawings.

D. Filter Fabric: Place fabric in bottom of trench and extend up sides and beyond trench. Overlap 12 inches at connection ends of roll.

E. Drain Rock and Pipe: Install bedding portion of drain rock and bed pipe in place. Do not damage or displace filter fabric.

F. Review: Prior to installing remaining drain rock backfill, request review by Landscape Architect for progress of the work.

G. Closing: Upon acceptance, add remaining drain rock and lap over the ends of the filter fabric as shown on the Drawings.

H. Soil Backfill: Backfill with planting soil mix to a minimum depth of 6 in. above filter fabric as shown on Drawings.

3.12 SOIL INSTALLATION

A. Reference Section 312219 “Landscape Fine Grading”

3.13 WALL DRAINAGE:

A. Set underdrain pipe to proper elevations and maintain a continuous flow line between all points. Install perforated PVC pipe with holes facing bottom of trench.

B. Fill trench with drainage gravel to correct elevation, as shown. Install filter fabric and immediately follow with the installation of a two (2") inch sand blanket.

C. Install planting soil mix and plant materials as specified in Section 329113 "Soil Preparation".

3.14 PERFORATED DRAIN PIPE IN TRENCH

A. Preparation of Trench: Accurately excavate trench as shown on the Drawings.

B. Filter Fabric: Place fabric in bottom of trench and extend up sides and beyond trench. Overlap 12 inches at connecting ends of roll.

C. Drain Rock and Pipe: Install bedding portion of drain rock and bed pipe in place. Do not damage or displace filter fabric.

D. Review: Prior to installing remaining drain rock backfill, request review by Landscape Architect for progress of the work.

E. Closing: Upon acceptance, add remaining drain rock and lap over the ends of the filter fabric as shown on the Drawings.

F. Soil Backfill: Backfill to a minimum depth of 6 inches above filter fabric as shown on Drawings.

G. Protection: Be responsible for protection of trench drain installation until commencement of work scope under Section 329113 "Soil Preparation".

3.15 AREA DRAINS: Install as shown on the Drawings and in strict accordance with the manufacturer's current specifications.

3.16 PROTECTION

A. General: Keep clean and protect sub-drainage system, trench drain and area drainage installations until commencement of work under Section 329113 "Soil Preparation".

1. Clear interior of piping and structures of dirt and superfluous material as work progresses. Maintain swab or drag in piping, and pull past each joint as it is completed.
2. In large, accessible piping, brushes and brooms may be used for cleaning.
3. In small pipes, place a temporary plug in end of incomplete piping at end of each day and when work stops.
4. Flush piping between manholes and other structures to remove collected debris, if required by authorities having jurisdiction.

B. Sediments: Regularly inspect and clean all drain sediment buckets to prevent flooding. Sweep or hose clean all trench drains as necessary.

C. Sub-drain: Monitor sub-drainage systems and immediately identify all problems with drainage. Make adjustments as necessary to maintain proper sub-drainage.

3.17 FIELD QUALITY CONTROL

A. Tests: Field density test for compaction.

B. Manufacturer's Field Service: Installation of drainage matting.

C. 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. Crushed, broken, cracked, or otherwise damaged piping.

3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
4. Re-inspect and repeat procedure until results are satisfactory.
5. Do not enclose, cover, or put into service before inspection and approval.

D. Testing: After installing drainage fill to top of pipe, test drain piping with water to ensure free flow before backfilling. Remove obstructions, replace damaged components, and repeat test until results are satisfactory.

1. Test completed piping systems according to authorities having jurisdiction.
2. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
3. Submit separate reports for each test.

4. Where authorities having jurisdiction do not have published procedures, perform tests as follows:

    a. PVC and ADS Piping: Test according to AWWA standards for Testing and Maintenance and repair items as follows:

        1) Leaks and pipes that do not completely drain constitute defects that must be repaired.

            a) Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.
            b) Excavate and reinstall pipes that do not drain such that positive drainage occurs within the drainage system.

3.18 CLEAN-UP

A. Keep all areas of work clean, neat and orderly at all times.

B. Upon completion of work, remove off the site all surplus materials, tools, equipment, rubbish and debris resulting from the Work.

END OF SECTION