

SPECIFICATION MANUAL

**BRAKES PLUS
601 NORTH CZECH RD
YUKON, OK.**

June 13, 2024



45 SPYGLASS DRIVE
LITTLETON, CO 80123
(303) 881-8925

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DIVISION 0

BIDDING INFORMATION

SECTION 00220

SOIL INVESTIGATION DATA

PART 1 GENERAL

1.01 INVESTIGATION

- A. Soil and subsurface investigations for this Project were conducted at the Project Site. See sheet A0 (Cover Sheet) for information concerning this soils report.
- B. A copy of the report is available for review at the office of the Architect.
- C. Bidders are urged to examine soils investigation data.
- D. Bidders should visit the Project Site and acquaint themselves with all existing site conditions.

1.02 INTERPRETATION

- A. Soil investigation data is provided only for information and convenience of Bidders.
 - 1. The Owner, Development Manager and Architect disclaim any responsibility for accuracy, true location and extent of soils investigation that has been prepared by others.
 - 2. Owner, Development Manager and Architect further disclaim responsibility for interpretation of that data by Bidders; as in projecting soil bearing values, rock profiles, soil stability and presence, level, and extent of underground water.
- B. Soil investigation data is a part of the Contract Documents.

END OF DOCUMENT

SECTION 00230
PROPERTY SURVEY

PART 1 GENERAL

1.01 SURVEY

- A. Bidders should visit the Project Site and acquaint themselves with all existing site conditions.
- B. Contact the civil engineer for this project for a copy of the property survey.

1.01 INTERPRETATION

- A. Survey data is provided only for information and convenience of Bidders.
 - 1. The Owner and Architect disclaim any responsibility for accuracy, true location and extent of information that has been prepared by others.
 - 2. Owner and Architect further disclaim responsibility for interpretation of that information by Bidders.
- B. Survey data are not part of the Contract Documents.

END OF DOCUMENT

SECTION 00700

GENERAL CONDITIONS OF THE CONTRACT

1.01 GENERAL CONDITIONS

- A. The General Conditions of the Contract for Construction, AIA Document A201 Fourteenth Edition, 1997, hereinafter referred to as General Conditions shall become part of the Contract Documents by reference.
- B. Copies of the form may be examined at the office of the Architect.

END OF DOCUMENT

**SECTION 00900
SPECIAL CONDITIONS**

PART 1 GENERAL

1.01 MODIFICATIONS TO GENERAL CONDITIONS

A. Payments

1. Immediately after execution of the contract, the contractor shall submit for approval a break down of the contract sum. (CSI format)
2. Unless explicitly stipulated differently in the contract, the contractor shall receive payments based only on the work completed and the evaluation in accordance with the owner's architect approved breakdown.
3. The payments shall be in the amount of ninety percent (90%) for completed work and materials and equipment delivered to and properly stored on the job.
4. The owner will retain ten percent (10%) of the total cost of the contract until final acceptance of the building.

B. Insurance

1. The contractor shall carry state required workmans compensation insurance for every person employed by him/her on the premises and shall maintain such insurance in full force during the entire time of this contract.
2. The contractor shall carry state required minimum coverages, but not less than the following:
 - a. Comprehensive general and automotive liability insurance not less than \$1,000,000,
 - b. Property damage insurance not less than \$1,000,000

C. Completion

1. All work shall be substantially completed at within the time stipulated in the contract agreement, unless extended by written agreement for justifiable delays, if any.

D. Performance

1. By submitting a bid, the bidder represents and warrants that he has examined the drawings and specification and all other information supplied as part of the bid documents, and found that they are adequate for the proper completion of the project.
2. The contractor shall be responsible for verifying field measurements before ordering materials and prefabricated items. Any necessary adjustments

between field measurements and the drawings shall be made in accordance with the decision of the architect.

3. The contractor shall coordinate the work for all trades and schedule the timing so as not to cause delays to any phase of construction due to late scheduling of interconnected work.
4. After substantial completion of the project, the contractor shall complete all defects and omissions noted at the final inspection within the time period agreed upon.
5. The General Conditions require the contractor to pay for testing of work and materials. Change this such that the owner will pay for this testing.

E. Soils Investigation

1. Follow all recommendations as shown in the soils and foundation investigation report prepared for this project.

END OF DOCUMENT

DIVISION 1

GENERAL REQUIREMENTS

SECTION 01010 SUMMARY OF WORK

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 PROJECT DESCRIPTION

- A. The Project consists of a New Building for a Brakes Plus auto service center as outlined on the drawings and specifications.
- B. The Work consists of the construction of 1-story buildings and associated site work.

1.03 DEFINITIONS

- A. The term "Owner" refers to Brakes Plus. The Owner is guaranteed access to the project at all times.
- B. The term "Developer" refers to the contracted development partner, their consultants (including, but not limited to, Architect of Record, Civil Engineer, Geotechnical Services, etc), Contractors, Vendors, and all other related team members.
- C. The term "Architect", "Engineer", "Contractor", etc., refers to those under service to the Owner.
- D. The Owner shall have all necessary job-specific documents prepared under the direct supervision and control of design professionals licensed in the appropriate jurisdiction.

1.04 CONTRACTOR USE OF PREMISES

- A. General: During the construction period the Contractor shall have full use of the premises for construction operations, including use of the site. The Contractor's use of the premises is limited only by the Owner's right to perform construction operations with its own forces or to employ separate contractors on portions of the project.

1.05 OWNER-FURNISHED ITEMS

- A. The Owner will provide equipment for production processes. The Work includes providing support systems to receive Owner's equipment, and mechanical and electrical connections.
1. The Owner will arrange and pay for delivery of Owner-furnished items in accordance with the Contractor's Construction Schedule, and will inspect deliveries for damage.
 2. If Owner-furnished items are damaged, defective or missing, the Owner will arrange for replacement. The Owner will also arrange for manufacturer's field services, and the delivery of manufacturer's warranties and bonds to the Contractor.
 3. The Contractor is responsible for designating the delivery dates of Owner-furnished items in the Contractor's Construction Schedule and for receiving, unloading and handling Owner-furnished items at the site. The Contractor is responsible for protecting Owner-furnished items from damage, including damage from exposure to the elements, and to repair or replace items damaged as a result of his operations.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

SECTION 01018

OWNER/TENANT FURNISHED ITEMS

PART 1 – GENERAL

1.01 OWNER'S RIGHT TO INSTALL ITEMS AND/OR EQUIPMENT PURCHASED UNDER SEPARATE CONTRACTS.

- A. Owner retains the right to install, in coordination with Contractor's construction schedule, as many items and/or as much equipment as he may require during the progress of the work, before completion of the various parts of the work. This shall not in any way evidence completion of the work or any portion thereof, nor it signify tenant's acceptance of the work or any portion thereof.

1.02 CATEGORIES OF ITEMS

- A. By Owner:

Items shown or noted "By Owner" on the drawings and/or in the specifications shall be furnished by the Owner to Contractor for supervision by Contractor as part of the Construction contract. Contractor shall receive, to the extent of unloading at the job site as required, store and be responsible to the extent of carrying necessary insurance to cover items in case of theft, fire, loss, malicious damage and other miscellaneous damage. Included, but not inclusive, in this category are:

 - 1. Service equipment, as indicated on Sheet A2-2 of the construction drawings. This equipment shall be furnished, assembled and set in place under separate contract with final connection to mechanical, electrical and plumbing, to be by the Owner as shown on the equipment, mechanical, electrical and plumbing drawings.
 - 2. Install Owner provided signs.
 - 3. Install miscellaneous decorative items:
 - a. Owner provided wall hanging.
 - b. Owner provided graphics.
 - 4. Telephone (private) are Owner provided; General Contractor to coordinate with supplier/installer for efficient scheduling of rough-ins, testing, hook-up, etc.
 - 5. Cash registers and capture machines are Owner provided; General Contractor to coordinate with supplier/installer for efficient scheduling

of rough-ins, testing, hook-up, etc.; all conduits and routings shown in construction documents to be adhered to.

6. Security system is Owner provided; General Contractor to coordinate with supplier/installer for efficient scheduling of rough-ins, testing, hook-up, etc.
7. Owner provided seating and furniture.

1.03 RECEIPT OF ITEMS

- A. During the course of construction, some deliveries of equipment and miscellaneous items will be made to the job site by common carrier. Contractor shall receive and inspect items for conformance to delivery ticket(s) and for damage. If during receipt any missing or damaged items are observed, Contractor shall:
 1. Make notation of any and all discrepancies on the delivery ticket(s).
 2. Call delivery carrier and advise him of the problem.
 3. Call the Owner and advise him of the problem.

END OF SECTION

SECTION 01025

SCHEDULE OF VALUES

PART 1 – GENERAL

1.01 Summary

- A. Unless otherwise stated in the Agreement, the general contractor shall provide a detailed breakdown of the Contract Sum as a Schedule of Values that are allocated to each part of the Work
- B. Before submitting the first Application for Payment, the general contractor shall submit a proposed Schedule of Values to the Owner.
- C. Provide copies of subcontracts and other data acceptable to the Owner to substantiate the sums described.

END OF SECTION

SECTION 01027

APPLICATIONS FOR PAYMENT

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section specifies administrative and procedural requirements governing the Contractor's Applications for Payment
- B. Coordinate the Schedule of Values and Applications for Payment with the Contractor's Construction Schedule, List of Subcontracts, and Submittal Schedule.

1.03 SCHEDULE OF VALUES

- A. Coordinate preparation of the Schedule of Values with preparation of the Contractor's Construction Schedule.
- B. Correlate line items in the Schedule of Values with other required administrative schedules and forms, including:
 - 1. Contractor's construction schedule.
 - 2. Application for Payment form
 - 3. List of subcontractors
 - 4. List of products
 - 5. Schedule of submittals
- C. Submit the Schedule of Values to the Owner at the earliest feasible date, but in no case later than 7 days before the date scheduled for submittal of the initial Application for Payment
- D. Identification: Include the following Project identification on the Schedule of Values:
 - 1. Project name and location
 - 2. Name of the Architect
 - 3. Project number
 - 4. Contractor's name and address
 - 5. Date of submittal

1.04 APPLICATIONS FOR PAYMENT

- A. Each application for Payment shall be consistent with previous applications and payments as certified and paid for by the Owner
- B. Payment Application Times: Each progress payment date is as indicated in the Agreement. The period of construction Work covered by each Application of Payment is the period indicated in the Agreement.
- C. Payment Application Forms: Use AIA Document G702 and Continuation Sheets G703 as the form for Application for Payment.
- D. Application Preparation: Complete every entry on the form, including notarization and execution by person authorized to sign legal documents on behalf of the Owner. Incomplete applications will be returned without action.
 - 1. Entries shall match data on the Schedule of Values and Contractor's Construction Schedule. Use updated schedules if revisions have been made.
 - 2. Include amounts of change orders and Construction Change Directives issued prior to the last day of the construction period covered by the application.
- E. Transmittal: Submit 3 executed copies of each Application for Payment to the Owner by means ensuring receipt within 24 hours; one copy shall be complete, including waivers of lien and similar attachments, when required.
 - 1. Transmit each copy with a transmittal form listing attachments, and recording appropriate information related to the application in a manner acceptable to the Owner.
- F. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of the first Application for Payment include the following:
 - 1. List of subcontractors
 - 2. Schedule of Values
 - 3. Contractor's Construction Schedule (preliminary, if not final)
 - 4. Submittal Schedule (preliminary, if not final)
 - 5. Copies of building permits
 - 6. Copies of authorizations and licenses from governing authorities for performance of the Work
 - 7. Initial progress report
 - 8. Report of pre-construction meeting
 - 9. Certificates of insurance and insurance policies
 - 10. Performance and payment bonds (if required)
 - 11. Data needed to acquire Owner's insurance

G. Application for Payment at Substantial Completion: Following issuance of the Certificate of Substantial Completion, submit an Application for Payment; this application shall reflect any Certificates of Partial Substantial Completion issued previously for the Owner occupancy of designated portions of the Work. Administrative actions and submittals that shall proceed or coincide with this application include:

1. Occupancy permits and similar approvals
2. Warranties (guarantees) and maintenance agreements
3. Test/adjust/balance records
4. Maintenance instructions
5. Meter readings
6. Start-up performance reports
7. Changeover information related to Tenant's occupancy, use, operation and maintenance.
8. Final cleaning
9. Application for reduction of retainage, and consent of surety (if required)
10. List of incomplete Work, recognized as exceptions to Owner's Certificate of Substantial Completion.

H. Final Payment Application: Administrative actions and submittals which must precede or coincide with submittal of final payment Application for Payment include the following:

1. Completion of Project closeout requirements
2. Completion of items specified for completion after Substantial Completion
3. Assurance that unsettled claims will be settled
4. Assurance that Work not complete and accepted will be completed without undue delay
5. Transmittal of required Project construction records to Owner
6. Proof that taxes, fees and similar obligations have been paid
7. Removal of temporary facilities and services
8. Removal of surplus materials, rubbish and similar elements
9. Change of door locks to Tenant's access (if required)

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION (Not Used)

END OF SECTION

SECTION 01030

ALTERNATES

PART 1 – GENERAL

1.01 Summary

- A. List the price for each alternate in the Bid Form. Include the cost of modifications to other work to accommodate each alternate. Include related costs such as overhead and profit.
- B. The Owner will determine which alternates will be included in the Contract.
- C. Alternates are listed in this section. See the Drawings and Specifications for particulars.
- D. Coordinate alternates with related work to ensure that work affected by each selected alternate is properly executed.

END OF SECTION

SECTION 01035
MODIFICATION PROCEDURES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 REQUIREMENTS INCLUDED

- A. Procedures for processing Change Orders.

1.03 FORMS

- A. Architects Supplemental Instructions: AIA G710
- B. Proposal Request Forms: AIA G709.
- C. Construction Change Directive Forms: AIA G714.
- D. Change Order Forms: AIA G701

1.04 DOCUMENTATION OF CHANGE IN CONTRACT SUM AND CONTRACT TIME

- A. Maintain detailed records of work done. Provide full information required for evaluation of proposed changes, and to substantiate costs of changes in the Work.
- B. Document each quotation for a change in cost or time with sufficient data to allow evaluation of the quotation.
- C. On request, provide additional data to support computations:
 - 1. Quantities of products, labor, and equipment.
 - 2. Taxes, insurance and bonds.
 - 3. Overhead and profit.
 - 4. Justification for any change in Contract Time.
 - 5. Credit for deletions from Contract, similarly documented.
- D. Support each claim for additional costs, and for work done, with additional information:

1. Origin and date of claim.
2. Dates and times work was performed, and by whom.
3. Time records and wage rates paid.
4. Invoices and receipts for products, equipment, and subcontracts, similarly documented.

1.05 PRELIMINARY PROCEDURES

- A. Architect may submit an Architect's supplemental instruction to define minor instructions or interpretations related to the work without change in contract time or cost.
- B. Architect may submit a Proposal Request or Construction Change Directive which includes: Detailed description of change with supplementary or revised Drawings and Specifications, the projected time for executing the change, with a stipulation of any overtime work required, and the period of time during which the requested price will be considered valid.
- C. Contractor may initiate a change by submittal of a Proposed Change (PC) request to Architect describing the proposed change with a statement of the reason for the change, and the effect on Contract Sum and Contract Time with full documentation, and a statement of the effect Work of separate contractors, if applicable. Document any requested substitutions in accordance with Section 01600.

1.06 CONSTRUCTION CHANGE DIRECTIVE

- A. Architect may issue a Construction Change Directive, signed by Owner, instructing Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
- B. Construction Change Directive will describe changes in the Work, and will designate method of determining any change in Contract Sum or Contract Time.
- C. Promptly execute the change in Work.

1.07 PROPOSED CHANGE (PC)

- A. Contractor will respond to Proposal Requests and Construction Change Directives in writing by submittal of a Proposed Change (PC) to Architect describing the proposed change with an itemization of the effect on Contract Sum and Contract Time with full documentation, and a statement of the effect on Work of separate contractors, if applicable. Document any requested substitutions in accordance with Section 01600.

1.08 LUMP SUM CHANGE ORDER

- A. Will be based on Proposal Request or Construction Change Directive and Contractor's lump sum quotation, or Contractor's request for Change Order as approved by Architect.

1.09 UNIT PRICE CHANGE ORDER

- A. Submit itemized account and supporting data after completion of change, within time limits in Conditions of the Contract.
- B. Architect will determine the change allowable in Contract Sum and Contract Time as provided in Conditions of the Contract.

1.010 EXECUTION OF CHANGE ORDERS

- A. Contractor will issue Change Orders for signatures of parties as provided in Conditions of the Contract.
- B. Change Orders will be prepared in triplicate with full supporting documentation attached to each copy.
- C. Architect will sign and forward to Owner for signature.

1.011 CORRELATION OF CONTRACTOR SUBMITTALS

- A. Promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order as a separate line item and adjust the Contract Sum as shown on Change Order.
- B. Promptly revise Construction Schedules to reflect any change in Contract Time, revise sub-schedules to adjust times for other items of work affected by the change, and resubmit.
- C. Promptly enter changes in Project Record Documents.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION (Not Used)

END OF SECTION

SECTION 01040

PROJECT COORDINATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section specifies administrative and supervisory requirements necessary for Project coordination including, but not necessarily limited to:
 - 1. Coordination.
 - 2. Administrative and supervisory personnel.
 - 3. General installation provisions.
 - 4. Cleaning and protection.
- B. Field engineering is included in Section "Field Engineering".
- C. Progress meetings, coordination meetings and pre-installation conferences are included in Section "Project Meetings".
- D. Requirements for the Contractor's Construction Schedule are included in Section "Submittals".

1.03 COORDINATION

- A. Coordination: Coordinate construction activities included under various Sections of these Specifications to assure efficient and orderly installation of each part of the Work. Coordinate construction operations included under different Sections of the Specifications that are dependent upon each other for proper installation, connection, and operation.
 - 1. Where installation of one part of the Work is dependent on installation of other components, either before or after its own installation, schedule construction activities in the sequence required to obtain the best results.
 - 2. Where availability of space is limited, coordinate installation of different components to assure maximum accessibility for required maintenance, service and repair.

3. Make adequate provisions to accommodate items scheduled for later installation.
- B. Where necessary, prepare memoranda for distribution to each party involved outlining special procedures required for coordination. Include such items as required notices, reports, and attendance at meetings.
1. Prepare similar memoranda for the Owner and separate Contractors where coordination of their Work is required.
- C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
1. Preparation of schedules.
 2. Installation and removal of temporary facilities.
 3. Delivery and processing of submittals.
 4. Progress meetings.
 5. Project Close-out activities.
- D. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials.
1. Salvage materials and equipment involved in performance of, but not actually incorporated in, the work. Refer to other sections for disposition of salvaged materials that are designated as Owner's property.

1.04 PART 2 - PRODUCTS (Not Used)

1.05 PART 3 - EXECUTION

A. GENERAL INSTALLATION PROVISIONS

1. Inspection of Conditions: Require the Installer of each major component to inspect both the substrate and conditions under which Work is to be performed. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner.
2. Manufacturer's Instructions: Comply with manufacturer's installation instructions and recommendations, to the extent that those instructions and recommendations are more explicit or stringent than requirements contained in Contract Documents.

3. Inspect materials or equipment immediately upon delivery and again prior to installation. Reject damaged and defective items.
4. Provide attachment and connection devices and methods necessary for securing Work. Secure Work true to line and level. Allow for expansion and building movement.
5. Visual Effects: Provide uniform joint widths in exposed Work. Arrange joints in exposed Work to obtain the best visual effect. Refer questionable choices to the Architect for final decision.
6. Recheck measurements and dimensions, before starting each installation.
7. Install each component during weather conditions and Project status that will ensure the best possible results. Isolate each part of the completed construction from incompatible material as necessary to prevent deterioration.
8. Coordinate temporary enclosures with required inspections and tests, to minimize the necessity of uncovering completed construction for that purpose.
9. Mounting Heights: Where mounting heights are not indicated, install individual components at standard mounting heights recognized within the industry for the particular application indicated. Refer questionable mounting height decisions to the Architect for final decision.

1.06 CLEANING AND PROTECTION

- A. During handling and installation, clean and protect construction in progress and adjoining materials in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- B. Clean and maintain completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- C. Limiting Exposures: Supervise construction activities to ensure that no part of the construction completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

END OF SECTION

SECTION 01045

CUTTING AND PATCHING

PART 1 - GENERAL

1.01 SUMMARY

- A. Cut and patch as required to complete work for:
 - Visual quality as directed by the Architect.
 - Plumbing, HVAC, electrical, and communication systems.
 - Fire resistance ratings.
 - Inspection, preparation, and performance.
- B. Cut and patch with care to avoid damage to work, safety hazards, violation of warranty requirements, building code violations, or maintenance problems.

PART 2 – MATERIALS AND PRODUCTS

1.02 MATERIALS

- A. Match existing materials with new materials so that patching work is undetectable.

PART 3 – EXECUTION

1.03 INSTALLATION

- A. Inspect field conditions to identify all work required.
- B. Notify Architect of work that might disrupt building operations.
- C. Perform work with workmen skilled in the trades involved. Prepare sample area of each type of work for approval. Protect adjacent work from damage and dirt.
- D. For cutting work, use proper cutting tools, not chopping tools. Make neat holes. Minimize damage to adjacent work. Check for concealed utilities and structure before cuttings.
- E. Make patches, seams, and joints durable and inconspicuous. Tolerances for patching shall be the same as for new work.

- F. Clean work areas and areas affected by cutting and patching operations as described in Section 01800 on CLEANING.

END OF SECTION

SECTION 01050
FIELD ENGINEERING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. General: This Section specifies administrative and procedural requirements for field engineering services, including, but not necessarily limited to, the following:
 - 1. Land survey Work.
 - 2. Civil engineering services.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

1.03 EXAMINATION

- A. Verify layout information shown on the Drawings, in relation to the property survey and existing benchmarks before proceeding to layout the Work. Locate and protect existing benchmarks and control points. Preserve permanent reference points during construction.
 - 1. Do not change or relocate benchmarks or control points without prior written approval. Promptly report lost or destroyed reference points, or requirements to relocate reference points because of necessary changes in grades or locations.
 - 2. Promptly replace lost or destroyed project control points. Base replacements on the original survey control points.
- B. Establish and maintain a minimum of two permanent benchmarks on the site, referenced to data established by survey control points.

- C. Existing utilities and equipment: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities and other construction.

- 1. Prior to construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer and water service piping.

1.04 PERFORMANCE

- A. Working from lines and levels established by the property survey, establish benchmarks and markers to set lines and levels at each story of construction and elsewhere as needed to properly locate each element of the Project. Calculate and measure required dimensions within indicated or recognized tolerances. Do not scale Drawings to determine dimensions.
 - 1. Advise entities engaged in construction activities, of marked lines and levels provided for their use.
 - 2. As construction proceeds, check every major element for line, level and plumb.
- B. Site Improvements: Locate and lay out site improvements, including pavements, stakes for grading, fill and topsoil placement, utility slopes and invert elevations by instrumentation and similar appropriate means.
- C. Building Lines and Levels: Locate and lay out building foundations, column grids and locations, floor levels and control lines and levels required for mechanical and electrical Work.
- D. Existing Utilities: Furnish information necessary to adjust, move or relocate existing structures, utility poles, lines, services or other appurtenances located in, or affected by construction. Coordinate with local authorities having jurisdiction.

END OF SECTION

SECTION 01090

DEFINITIONS AND STANDARDS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 DEFINITIONS

- A. General: Basic Contract definitions are included in the General Conditions.
- B. Indicated refers to graphic representations, notes or schedules on the Drawings, or other Paragraphs or Schedules in Specifications, and similar requirements in Contract Documents. Where terms such as "shown," "noted," "scheduled," and "specified" are used, it is to help locate the reference; no limitation on location is intended except as specifically noted.
- C. Directed: Terms such as "directed", "requested", "authorized", "selected", "approved", "required", and "permitted" mean "directed by the Architect", "requested by the Architect", and similar phrases. However, no implied meaning shall be interpreted to extend the Architect's responsibility into the Contractor's area of construction supervision.
- D. Approve: The term "approved," where used in conjunction with the Architect's action on the Contractor's submittals, applications, and requests, is limited to the duties and responsibilities of the Architect as stated in General and Supplementary Conditions. Such approval shall not release the Contractor from responsibility to fulfill Contract requirements unless otherwise provided in the Contract Documents.
- E. Regulation: The term "Regulations" includes laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, as well as rules, conventions, and agreements within the construction industry that control performance of the Work, whether lawfully imposed by authorities having jurisdiction or not.
- F. Furnish: The term "furnish" is used to mean "supply and deliver to the Project site, ready for unloading, unpacking, assembly, installation, and similar operations."
- G. Install: The term "install" is used to describe operations at project site including the actual "unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations."
- H. Provide: The term "provide" means "to furnish and install, complete and ready for

the intended use."

- I. Installer: An "Installer" is the Contractor or an entity engaged by the Contractor, either as an employee, subcontractor, or sub-subcontractor for performance of a particular construction activity, including installation, erection, application, and similar operations. Installers are required to be experienced in the operations they are engaged to perform.
 - 1. The term "experienced," when used with the term "Installer" means having a minimum of 5 previous Projects similar in size and scope to this Project, being familiar with the precautions required, and having complied with requirements of the authority having jurisdiction.
- J. Project Site is the space available to the Contractor for performance of construction activities, either exclusively or in conjunction with others performing other construction activities as part of the Project. The extent of the Project Site is shown on the Drawings and may or may not be identical with the description of the land upon which the Project is to be built.
- K. Testing Laboratories: A "testing laboratory" is an independent entity engaged to perform specific inspections or tests, either at the Project Site or elsewhere, and to report on and, if required, to interpret results of those inspections or tests.

1.03 SPECIFICATION FORMAT AND CONTENT EXPLANATION

- A. Specification Format: These Specifications are organized into Divisions and Sections based on the Construction Specifications Institute's 16-Division format and MASTER FORMAT numbering system.
- B. Trades: Use of titles such as "carpentry" is not intended to imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to trades persons of the corresponding generic name.

1.04 INDUSTRY STANDARDS

- A. Applicability of Standards: Except where the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents. Such standards are made a part of the Contract Documents by reference. Individual Sections indicate which codes and standards the Contractor must keep available at the Project Site for reference.
- B. Publication Dates: Where the date of issue of a referenced standard is not specified, comply with the standard in effect as of date of Contract Documents.

- C. Updated Standards: At the request of the Architect, Contractor, or authority having jurisdiction, submit a Change Order proposal where an applicable code or standard has been revised and reissued after the date of the Contract Documents and before performance of Work affected. The Architect will decide whether to issue a Change Order to proceed with the updated standard.
- D. Conflicting Requirements: Where compliance with two or more standards is specified, and they establish different or conflicting requirements for minimum quantities or quality levels, the most stringent requirement will be enforced, unless the Contract Documents indicate otherwise. Refer requirements that are different, but apparently equal, and uncertainties as to which quality level is more stringent to the Architect for a decision before proceeding.
- E. Minimum Quantity or Quality Levels: In every instance the quantity or quality level shown or specified shall be the minimum to be provided or performed. The actual installation may comply exactly, within specified tolerances, with the minimum quantity or quality specified, or it may exceed that minimum within reasonable limits. In complying with these requirements, indicated numeric values are minimum or maximum values, as noted, or appropriate for the context of the requirements. Refer instances of uncertainty to the Architect for a decision before proceeding.
- F. Copies of Standards: Each entity engaged in construction on the Project is required to be familiar with industry standards applicable to that entity's construction activity. Copies of applicable standards are not bound with the Contract Documents.
 - 1. Where copies of standards are needed for performance of a required construction activity, the Contractor shall obtain copies directly from the publication source.
- G. Abbreviations and Names: Trade association names and titles of general standards are frequently abbreviated. Where such acronyms or abbreviations are used in the Specifications or other Contract Documents, they mean the recognized name of the trade association, standards generating organization, authority having jurisdiction, or other entity applicable to the context of the text provision. Refer to the "Encyclopedia of Associations," published by Gale Research Co., available in most libraries.

1.05 GOVERNING REGULATIONS/AUTHORITIES

- A. The Architect has contacted authorities having jurisdiction where necessary to obtain information necessary for the preparation of Contract Documents; that information may or may not be of significance to the Contractor. Contact authorities having jurisdiction directly for information and decisions having a

bearing on the Work.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

SECTION 01200

PROJECT MEETINGS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section specifies administrative and procedural requirements for project meetings.

1.03 RECONSTRUCTION CONFERENCE

- A. Conduct a pre-construction conference at the Developer's office after award of the Contract for Construction, before the commencement of work. Notify the Owner, Developer, Architect, and other affected parties of scheduled meeting date.

1.04 PROGRESS MEETINGS

- A. Conduct progress meetings at the Project site at regularly scheduled intervals. Notify the Owner, Developer, and Architect of scheduled meeting dates. Coordinate dates of meetings with preparation of the payment request.
- B. Attendees: In addition to representatives of the Contractor, each subcontractor, supplier or other entity concerned with current progress or involved in planning, coordination or performance of future activities shall be represented at these meetings by persons familiar with the Project and authorized to conclude matters relating to progress.
- C. Agenda: Review items of significance that could affect progress. Include topics for discussion as appropriate to the current status of the Project.
- D. Contractor's Construction Schedule: Determine where each activity is in relation to the Contractor's Construction Schedule, whether on time or ahead or behind schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

- E. Schedule Updating: Revise the construction schedule after each progress meeting where revisions to the schedule have been made or recognized.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION (Not Used)

END OF SECTION

SECTION 01300

SUBMITTALS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section specifies administrative and procedural requirements for submittals required for performance of the Work, including:
 - 1. Contractor's construction schedule.
 - 2. Submittal schedule.
 - 3. Shop Drawings.
 - 4. Product Data.
 - 5. Samples.
- B. Administrative Submittals: Refer to other Division-1 Sections and other Contract Documents for requirements for administrative submittals. Such submittals include, but are not limited to:
 - 1. Permits.
 - 2. Applications for payment.
 - 3. Insurance certificates.
 - 4. List of Subcontractors.

1.03 SUBMITTAL PROCEDURES

- A. Coordination: Coordinate preparation and processing of submittals with performance of construction activities. Transmit each submittal sufficiently in advance of performance of related construction activities to avoid delay.
 - 1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals and related activities that require sequential activity.
 - 2. Coordinate transmittal of different types of submittals for related elements of the Work so processing will not be delayed by the need to review submittals concurrently for coordination.
 - a. The Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
 - b. The Owner reserves the right to review any submittal before it is processed by the Architect, and will notify the Contractor which submittals

he intends to review at the Pre-construction Conference.

- B. Processing: Allow sufficient review time so that installation will not be delayed as a result of the time required to process submittals, including time for re-submittals.
- C. Submittal Preparation: Place a permanent label or title block on each submittal for identification. Indicate the name of the entity that prepared each submittal on the label or title block.
 - 1. Include the following information on the label for processing and recording action taken.
 - a. Project name.
 - b. Date.
 - c. Name and address of Contractor.
 - d. Name and address of subcontractor.
 - e. Name and address of supplier.
 - f. Name of manufacturer.
 - g. Number and title of appropriate Specification Section.
 - h. Drawing number and detail references, as appropriate.
- D. Submittal Transmittal: Package each submittal appropriately for transmittal and handling. Transmit each submittal from Contractor to Architect using a transmittal form. Submittals received from sources other than the Contractor will be returned without action.
 - 1. On the transmittal clearly identify relevant information and requests for data. On the form, or separate sheet, record deviations from Contract Document requirements, including minor variations and limitations. Include Contractor's certification that information complies with Contract Document requirements.

1.04 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Bar-Chart Schedule: Prepare a fully developed, horizontal bar- chart type Contractor's construction schedule.

1.05 SHOP DRAWINGS

- A. Submit 1 set of reproducible and three copies to the Architect for review. After Architect's review, reproducible and one copy will be returned to the Contractor.

1.06 PRODUCT DATA

- A. Mark each copy to show applicable choices and options. Where printed Product Data includes information on several products, some of which are not required, mark copies to indicate the applicable information.

- B. Submittals: Submit 2 copies of each required submittal; submit 4 copies where required for maintenance manuals. The Architect will retain one, and will return the other marked with action taken and corrections or modifications required.

1.07 SAMPLES

- A. Samples of all finish materials shall be provided to Owner for approval prior to ordering and/or installing.
- B. Submit three sets of samples to illustrate functional characteristics of the product, with integral parts and attachment devices. One set of samples will be returned to Contractor and the other retained by Owner.
- C. Include identification on each sample, giving full information.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

SECTION 01400

QUALITY CONTROL SERVICES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section specifies administrative and procedural requirements for quality control services.
- B. Quality control services include inspections and tests and related actions including reports, coordinated by General Contractor, performed by independent agencies, governing authorities, and the Owner. They do not include Contract enforcement activities performed by the Architect.
- C. Inspection and testing services are required to verify compliance with requirements specified or indicated. These services do not relieve the Contractor of responsibility for compliance with Contract Document requirements.
- D. Requirements of this Section relate to customized fabrication and installation procedures, not production of standard products.
 - 1. Specific quality control requirements for individual construction activities are specified in the Sections that specify those activities. Those requirements, including inspections and tests, cover production of standard products as well as customized fabrication and installation procedures.
 - 2. Inspections, test and related actions specified are not intended to limit the Contractor's quality control procedures that facilitate compliance with Contract Document requirements.
 - 3. Requirements for the Contractor to provide quality control services required by the Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

1.03 RESPONSIBILITIES

- A. Contractors Responsibilities: General Contractor shall schedule and coordinate quality control and special inspections with the inspectors doing the inspections. At the owner's option, the general contractor can delete specific portions of the quality control inspections that are performed by others (i.e. bldg. dept.) as part of their responsibilities. All other required quality control inspections and special inspections not performed by others are to remain the responsibility of the G.C. for

scheduling and coordination. The inspection work will be done via a direct contract between the inspector and the owner (ie the work will be paid by the owner directly to the inspecting personnel).

1. Retesting: The General Contractor is responsible for retesting where results of required inspections, tests or similar services prove unsatisfactory and do not indicate compliance with Contract Document requirements, regardless of whether the original test was the Contractor's responsibility.
 - a. Cost of retesting construction revised or replaced by the Contractor is the Contractor's responsibility, where required tests were performed on original construction.
2. Associated Services: The Owner shall provide and Contractor shall cooperate with agencies performing required inspections, tests and similar services and provide reasonable auxiliary services as requested. Notify the agency sufficiently in advance of operations to permit assignment of personnel. Auxiliary services required include but are not limited to:
 - a. Providing access to the Work and furnishing incidental labor and facilities necessary to facilitate inspections and tests.
 - b. Taking adequate quantities of representative samples of materials that require testing or assisting the agency in taking samples.
 - c. Providing facilities for storage and curing of test samples, and delivery of samples to testing laboratories.
 - d. Providing the agency with a preliminary design mix proposed for use for materials mixes that require control by the testing agency.
 - e. Security and protection of samples and test equipment at the Project site.

1.04 SUBMITTALS

- A. The independent testing agency shall submit a certified written report of each inspection, test or similar service, to the Architect, in duplicate, unless the Contractor is responsible for the service. If the Contractor is responsible for the service, submit a certified written report of each inspection, test or similar service through the Contractor, in duplicate.
 1. Submit additional copies of each written report directly to the governing authority, when the authority so directs.

1.05 QUALITY ASSURANCE

- A. Qualification for Service Agencies: Engage inspection and testing service agencies as a portion of the cost of the work, including independent testing laboratories, which are prequalified as complying with "Recommended Requirements for Independent Laboratory Qualification" by the American Council of Independent Laboratories, and which specialize in the types of inspections and tests to be

performed.

1. Each independent inspection and testing agency engaged on the Project shall be authorized by authorities having jurisdiction to operate in the State in which the Project is located.

PART 2 – PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.01 REPAIR AND PROTECTION

- A. General: Upon completion of inspection, testing, sample-taking and similar services, repair damaged construction and restore substrates and finishes to eliminate deficiencies, including deficiencies in visual qualities of exposed finishes. Comply with Contract Document requirements for "Cutting and Patching."
- B. Protect construction exposed by or for quality control service activities, and protect repaired construction.
- C. Repair and protection is the Contractor's responsibility, regardless of the assignment of responsibility for inspection, testing or similar services.

END OF SECTION

SECTION 01500

TEMPORARY FACILITIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section specifies requirements for temporary services and facilities, including utilities, construction and support facilities, security and protection.
- B. Temporary utilities required include but are not limited to:
 - 1. Water service and distribution.
 - 2. Temporary electric power and light.
 - 3. Telephone service.
 - 4. Storm and sanitary sewer.
- C. Temporary construction and support facilities required include but are not limited to:
 - 1. Temporary heat.
 - 2. Field offices and storage sheds.
 - 3. Temporary roads and paving.
 - 4. Sanitary facilities, including drinking water.
 - 5. Dewatering facilities and drains.
 - 6. Temporary enclosures.
 - 7. Temporary Project identification signs and bulletin boards.
 - 8. Waste disposal services.
 - 9. Rodent and pest control.
 - 10. Construction aids and miscellaneous services and facilities.
- D. Security and protection facilities required include but are not limited to:
 - 1. Temporary fire protection.
 - 2. Barricades, warning signs, lights.
 - 3. Environmental protection.

1.03 SUBMITTALS

- A. Temporary Utilities: Retain reports of tests, inspections, meter readings and similar

procedures performed on temporary utilities.

1.04 QUALITY ASSURANCE

- A. Regulations: Comply with industry standards and applicable laws and regulations if authorities having jurisdiction, including but not limited to:
 - 1. Building Code requirements.
 - 2. Health and safety regulations.
 - 3. Utility company regulations.
 - 4. Police, Fire Department and Rescue Squad rules.
 - 5. Environmental protection regulations.
- B. Standards: Comply with NFPA Code 241, "Building Construction and Demolition Operations", ANSI-A10 Series standards for "Safety Requirements for Construction and Demolition", and NECA Electrical Design Library "Temporary Electrical Facilities."
- C. Electrical Service: Comply with NEMA, NECA and UL standards and regulations for temporary electric service. Install service in compliance with National Electric Code (NFPA 70).
- D. Inspections: Arrange for authorities having jurisdiction to inspect and test each temporary utility before use. Obtain required certifications and permits.

1.05 PROJECT CONDITIONS

- A. Temporary Utilities: At the earliest feasible time, when acceptable to the Owner, change over from use of temporary service to use of the permanent service.
- B. Conditions of Use: Keep temporary services and facilities clean and neat in appearance. Operate in a safe and efficient manner. Take necessary fire prevention measures. Do not overload facilities, or permit them to interfere with progress. Do not allow hazardous dangerous or unsanitary conditions, or public nuisances to develop or persist on the site.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. General: Provide new materials; if acceptable to the Architect, undamaged previously used materials in serviceable condition may be used. Provide materials suitable for the use intended.
- B. Lumber and Plywood: Comply with requirements in Division-6 Section "Rough Carpentry."

1. For job-built temporary offices, shops and sheds within the construction area, provide UL labeled, fire treated lumber and plywood for framing, sheathing and siding.
 2. For signs and directory boards, provide exterior type, Grade B-B High Density Concrete Form Overlay Plywood conforming to PS-1, of sizes and thickness indicated.
 3. For fences and vision barriers, provide exterior type, minimum 3/8" thick plywood.
 4. For safety barriers, sidewalk bridges and similar uses, provide minimum 5/8" thick exterior plywood.
- C. Gypsum Wallboard: Provide gypsum wallboard complying with requirements of ASTM C 36 on interior walls of temporary offices.
- D. Roofing Materials: Provide UL Class "A" standard weight asphalt shingles complying with ASTM D 3018, or UL Class "C" mineral surfaced roll roofing complying with ASTM D 249 on roofs of job- built temporary offices, shops and sheds.
- E. Paint: Comply with requirements of Division-9 Section "Finish Painting."
1. For job-built temporary offices, shops, sheds, fences and other exposed lumber and plywood, provide exterior grade acrylic-latex emulsion over exterior primer.
- F. Tarpaulins: Provide waterproof, fire-resistant, tarpaulins.
- G. Water: Provide potable water approved by local health authorities.

2.02 EQUIPMENT

- A. General: Provide new equipment; if acceptable to the Architect, undamaged, previously used equipment in serviceable condition may be used. Provide equipment suitable for use intended.
- B. Water Hoses: Provide 3/4" heavy-duty, abrasion-resistant, flexible rubber hoses 100 ft. long, with pressure rating greater than the maximum pressure of the water distribution system; provide adjustable shut-off nozzles at hose discharge.
- C. Electrical Outlets: Provide properly configured NEMA polarized outlets to prevent insertion of 110-120 volt plugs into higher voltage outlets. Provide receptacle outlets equipped with ground-fault circuit interrupters, reset button and pilot light, for connection of power tools and equipment.
- D. Electrical Power Cords: Provide grounded extension cords; use "hard-service" cords where exposed to abrasion and traffic. Provide waterproof connectors to connect separate lengths of electric cords, if single lengths will not reach areas where construction activities are in progress.

- E. Lamps and Light Fixtures: Provide general service incandescent lamps of wattage required for adequate illumination. Provide guard cages or tempered glass enclosures, where exposed to breakage. Provide exterior fixtures where exposed to moisture.
- F. Heating Units: Provide temporary heating units that have been tested and labeled by UL, FM or another recognized trade association related to the type of fuel being consumed.
- G. Temporary Toilet Units: Provide self-contained single-occupant toilet units of the chemical, aerated recirculation, or combustion type, properly vented and fully enclosed with a glass fiber reinforced polyester shell or similar nonabsorbent material.

2.03 First Aid Supplies: Comply with governing regulations.

- A. Fire Extinguishers: Provide hand-carried, portable UL-rated, class "A" fire extinguishers for temporary offices and similar spaces. In other locations provide hand-carried, portable, UL-rated, class "ABC" dry chemical extinguishers, or a combination of extinguishers of NFPA recommended classes for the exposures.
 - 1. Comply with NFPA 10 and 241 for classification, extinguishing agent and size required by location and class of fire exposure.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Use qualified personnel for installation of temporary facilities. Locate facilities where they will serve the Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required.
- B. Provide each facility ready for use when needed to avoid delay. Maintain and modify as required. Do not remove until facilities are no longer needed, or are replaced by authorized use of completed permanent facilities.

3.02 TEMPORARY GRADING, DEWATERING, AND PAVING

- A. Maintain accessibility for construction operations to site at all times, including during inclement weather.
- B. Rough grade site to drain away from building at earliest opportunity in construction sequence, and control surface runoff.

- C. Eliminate sediment from entering the storm sewer system employing measures required to filter runoff including, but not limited to, straw bales and silt fencing.
- D. Maintain drive aisles for vehicle access at all times. Provide crushed gravel base as temporary roadways. Incorporate base into final paving section as specified.
- E. Provide shallow sump pits and pumps required to control continual rainfall. Filter discharge from pumps prior to release to the storm sewer system.
- F. Verify all discharge is compatible with local jurisdictions before its release.

3.03 TEMPORARY UTILITY INSTALLATION

- A. General: Engage the appropriate local utility company to install temporary service or connect to existing service. Where the company provides only part of the service, provide the remainder with matching, compatible materials and equipment; comply with the company's recommendations.
 - 1. Arrange with the company and existing users for a time when service can be interrupted, where necessary, to make connections for temporary services.
 - 2. Provide adequate capacity at each stage of construction. Prior to temporary utility availability, provide trucked-in services.
 - 3. Obtain easements to bring temporary utilities to the site, where the Owner's easements cannot be used for that purpose.
- B. Use Charges: Cost or use charges for temporary facilities are not chargeable to the Owner or Architect, and will not be accepted as a basis of claims for a Change Order.
- C. Water Service: Install water service and distribution piping of sizes and pressures adequate for construction until permanent water service is in use.
 - 1. Sterilization: Sterilize temporary water piping prior to use.
- D. Temporary Electric Power Service: Provide weatherproof, grounded electric power service and distribution system of sufficient size, capacity, and power characteristics during construction period. Include meters, transformers, overload protected disconnects, automatic ground-fault interrupters and main distribution switch gear.
 - 1. Except where overhead service must be used, install electric power service underground.
 - 2. Power Distribution System: Install wiring overhead, and rise vertically where least exposed to damage. Where permitted, wiring circuits not exceeding 125 Volts, AC 20 ampere rating, and lighting circuits may be nonmetallic sheathed cable where overhead and exposed for surveillance.

- E. Temporary Lighting: Whenever overhead floor or roof deck has been installed, provide temporary lighting with local switching.
 - 1. Install and operate temporary lighting that will fulfill security and protection requirements, without operating the entire system, and will provide adequate illumination for construction operations and traffic conditions.
- F. Temporary Telephones: Provide temporary telephone service for all personnel engaged in construction activities, throughout the construction period. Install telephone on a separate line for each temporary office and first aid station.
- G. Sewers and Drainage: If sewers are available, provide temporary connections to remove effluent that can be discharged lawfully. If sewers are not available or cannot be used, provide drainage ditches, dry wells, stabilization ponds and similar facilities. If neither sewers nor drainage facilities can be lawfully used for discharge of effluent, provide containers to remove and dispose of effluent off the site in a lawful manner.
 - 1. Filter out excessive amounts of soil, construction debris, chemicals, oils and similar contaminants that might clog sewers or pollute waterways before discharge.
 - 2. Connect temporary sewers to the municipal system as directed by the sewer department officials.
 - 3. Maintain temporary sewers and drainage facilities in a clean, sanitary condition. Following heavy use, restore normal conditions promptly.
 - 4. Provide earthen embankments and similar barriers in and around excavations and sub-grade construction, sufficient to prevent flooding by runoff of storm water from heavy rains.

3.04 TEMPORARY CONSTRUCTION AND SUPPORT FACILITIES INSTALLATION

- A. Locate field offices, storage sheds, sanitary facilities and other temporary construction and support facilities for easy access.
 - 1. Maintain temporary construction and support facilities until near Substantial Completion. Remove prior to Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to the Owner.
 - 2. Provide incombustible construction for offices, shops and sheds located within the construction area, or within 30 feet of building lines. Comply with requirements of NFPA 241.
- B. Temporary Heat: Provide temporary heat required by construction activities, for curing or drying of completed installations or protection of installed construction from adverse effects of low temperatures or high humidity. Select safe equipment

that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce the ambient condition required and minimize consumption of energy.

- C. Heating Facilities: Except where use of the permanent system is authorized, provide vented self-contained LP gas or fuel oil heaters with individual space thermostatic control.
 - 1. Use of gasoline-burning space heaters, open flame, or salamander type heating units is prohibited.
- D. Field Offices: Provide insulated, weathertight temporary offices of sufficient size to accommodate required office personnel at the Project site. Keep the office clean and orderly for use for small progress meetings. Furnish and equip offices as follows:
- E. Storage and Fabrication Sheds: Install storage and fabrication sheds, sized, furnished and equipped to accommodate materials and equipment involved, including temporary utility service. Sheds may be open shelters or fully enclosed spaces within the building or elsewhere on the site.
- F. Temporary Paving: Construct and maintain temporary roads and paving to adequately support the indicated loading and to withstand exposure to traffic during the construction period. Locate temporary paving for roads, storage areas and parking where the same permanent facilities will be located. Review proposed modifications to permanent paving with the Architect.
- G. Paving: Comply with Division-2 Section "Asphalt Concrete Paving" for construction and maintenance of temporary paving.
 - 1. Coordinate temporary paving development with subgrade grading, compaction, installation and stabilization of subbase, and installation of base and finish courses of permanent paving.
 - 2. Install temporary paving to minimize the need to rework the installations and to result in permanent roads and paved areas that are without damage or deterioration when occupied by the Owner.
- H. Sanitary facilities include temporary toilets, wash facilities and drinking water fixtures. Comply with regulations and health codes for the type, number, location, operation and maintenance of fixtures and facilities. Install where facilities will best serve the Project's needs.
 - 1. Provide toilet tissue, paper towels, paper cups and similar disposable materials for each facility. Provide covered waste containers for used material.
- I. Temporary Enclosures: Provide temporary enclosure for protection of construction in progress and completed, from exposure, foul weather, other construction

operations and similar activities.

1. Where heat is needed and the permanent building enclosure is not complete, provide temporary enclosures where there is no other provision for containment of heat. Coordinate enclosure with ventilating and material drying or curing requirements to avoid dangerous conditions and effects.
 2. Install tarpaulins securely, with incombustible wood framing and other materials. Close openings of 25 square feet or less with plywood or similar materials.
 3. Close openings through floor or roof decks and horizontal surfaces with load-bearing wood-framed construction.
- J. Project Identification and Temporary Signs: Provide preservative treated wood posts for Owner's sign in location specified by Owner's representative. Do not permit installation of unauthorized signs.
- K. Collection and Disposal of Waste: Collect waste from construction areas and elsewhere daily. Comply with requirements of NFPA 241 for removal of combustible waste material and debris. Enforce requirements strictly. Do not hold materials more than 7 days during normal weather or 3 days when the temperature is expected to rise above 80 deg F (27 deg C). Handle hazardous, dangerous, or unsanitary waste materials separately from other waste by containerizing properly. Dispose of material in a lawful manner.
- L. Rodent and Pest Control: Before deep foundation Work has been completed, retain a local exterminator or pest control company to recommend practices to minimize attraction and harboring of rodents, roaches and other pests. Employ this service to perform extermination and control procedures at regular intervals so the Project will be relatively free of pests and their residues at Substantial Completion. Perform control operations in a lawful manner using environmentally safe materials.
- M. Stairs: Until permanent stairs are available, provide temporary stairs where ladders are not adequate. Cover finished permanent stairs with a protective covering of plywood or similar material so finishes will be undamaged at the time of acceptance.

3.05 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Temporary Fire Protection: Until fire protection needs are supplied by permanent facilities, install and maintain temporary fire protection facilities of the types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 10 "Standard for Portable Fire Extinguishers," and NFPA 241 "Standard for Safeguarding Construction, Alterations and Demolition Operations."
1. Locate fire extinguishers where convenient and effective for their intended purpose, but not less than one extinguisher on each floor at or near each usable stairwell.
 2. Store combustible materials in containers in fire-safe locations.

3. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire protection facilities, stairways and other access routes for fighting fires. Prohibit smoking in hazardous fire exposure areas.
 4. Provide supervision of welding operations, combustion type temporary heating units, and similar sources of fire ignition.
- B. Permanent Fire Protection: At the earliest feasible date in each area of the Project, complete installation of the permanent fire protection facility, including connected services, and place into operation and use. Instruct key personnel on use of facilities.
 - C. Barricades, Warning Signs and Lights: Comply with standards and code requirements for erection of structurally adequate barricades. Paint with appropriate colors, graphics and warning signs to inform personnel and the public of the hazard being protected against. Where appropriate and needed provide lighting, including flashing red or amber lights.
 - D. Enclosure Fence: Provided enclosure fence with lockable gates when site conditions or local jurisdiction dictates.
 - E. Security Enclosure and Lockup: Install substantial temporary enclosure of partially completed areas of construction. Provide locking entrances to prevent unauthorized entrance, vandalism, theft and similar violations of security.
 1. Storage: Where materials and equipment must be stored, and are of value or attractive for theft, provide a secure lockup. Enforce discipline in connection with the installation and release of material to minimize the opportunity for theft and vandalism.
 - F. Environmental Protection: Provide protection, operate temporary facilities and conduct construction in ways and by methods that comply with environmental regulations, and minimize the possibility that air, waterways and subsoil might be contaminated or polluted, or that other undesirable effects might result. Avoid use of tools and equipment which produce harmful noise. Restrict use of noise making tools and equipment to hours that will minimize complaints from persons or firms near the site.

3.06 OPERATION, TERMINATION AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. Limit availability of temporary facilities to essential and intended uses to minimize waste and abuse.
- B. Maintenance: Maintain facilities in good operating condition until removal. Protect from damage by freezing temperatures and similar elements.
 1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation and similar facilities on a 24-hour day basis where required to

- achieve indicated results and to avoid possibility of damage.
2. Protection: Prevent water filled piping from freezing. Maintain markers for underground lines. Protect from damage during excavation operations.
- C. Termination and Removal: Unless the Architect requests that it be maintained longer, remove each temporary facility when the need has ended, or when replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with the temporary facility. Repair damaged Work, clean exposed surfaces and replace construction that cannot be satisfactorily repaired.
1. Materials and facilities that constitute temporary facilities are property of the Contractor. The Owner reserves the right to take possession of Project identification signs.
 2. Remove temporary paving or road base that is not intended for or acceptable for integration into permanent paving. Where the area is intended for landscape development remove soil and aggregate fill that does not comply with requirements for fill or subsoil in the area. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances which might impair growth of plant materials or lawns. Repair or replace street paving, curbs and sidewalks at the temporary entrances, as required by the governing authority.
 3. At Substantial Completion, clean and renovate permanent facilities that have been used during the construction period, including but not limited to:
 - a. Replace air filters and clean inside of ductwork and housings.
 - b. Replace significantly worn parts and parts that have been subject to unusual operating conditions.
 - c. Replace lamps that are burned out or noticeably dimmed by substantial hours of use.

END OF SECTION

SECTION 01600

MATERIALS AND EQUIPMENT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section specifies administrative and procedural requirements governing the Contractor's selection of products for use in the Project.
 - 1. The Contractor's Construction Schedule is included under Section "SUBMITTALS."
- B. Standards: Refer to Section "Definitions and Standards" for applicability of industry standards to products specified.

1.03 DEFINITIONS

- A. Definitions used in this Article are not intended to change the meaning of other terms used in the Contract Documents, such as "specialties," "systems," "structure," "finishes," "accessories," and similar terms. Such terms are self-explanatory and have well recognized meanings in the construction industry.
- B. "Products" are items purchased for incorporation in the Work, whether purchased for the Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
- C. "Named Products" are items identified by manufacturer's product name, including make or model designation, indicated in the manufacturers published product literature that is current as of the date of the Contract Documents.
- D. "Materials" are products that are substantially shaped, cut, worked, mixed, finished, refined or otherwise fabricated, processed, or installed to form a part of the Work.
- E. "Equipment" is a product with operational parts, whether motorized or manually operated, that requires service connections such as wiring or piping.

1.04 QUALITY ASSURANCE

- A. Source Limitations: To the fullest extent possible, provide products of the same kind, from a single source.
- B. Compatibility of Options: When the Contractor is given the option of selecting between two or more products for use on the Project, the product selected shall be compatible with products previously selected, even if previously selected products were also options.

1.05 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store and handle products in accordance with the manufacturer's recommendations, using means and methods that will prevent damage, deterioration and loss, including theft.
 - 1. Schedule delivery to minimize long-term storage at the site and to prevent overcrowding of construction spaces.
 - 2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft and other losses.
 - 3. Deliver products to the site in the manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting and installing.
 - 4. Inspect products upon delivery to ensure compliance with the Contract Documents, and to ensure that products are undamaged and properly protected.
 - 5. Store products at the site in a manner that will facilitate inspection and measurement of quantity or counting of units.
 - 6. Store heavy materials away from the Project structure in a manner that will not endanger the supporting construction.
 - 7. Store products subject to damage by the elements above ground, under cover in a weather tight enclosure, with ventilation adequate to prevent condensation. Maintain temperature and humidity within range required by manufacturer's instructions.

PART 2 - PRODUCTS

2.01 PRODUCT SELECTION

- A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, unused at the time of installation.
 - 1. Provide products complete with all accessories, trim, finish, safety guards and other devices and details needed for a complete installation and for the intended use and effect.

2. Standard Products: Where available, provide standard products of types that have been produced and used successfully in similar situations on other projects.
- B. Product Selection Procedures: Product selection is governed by the Contract Documents and governing regulations, not by previous Project experience.
 - C. Proprietary Specification Requirements: Where only a single product or manufacturer is named, provide the product indicated. No substitutions will be permitted.
 - D. Semi-proprietary Specification Requirements: Where two or more products or manufacturers are named, provide one of the products indicated. No substitutions will be permitted.
 - E. On approved equal: Where specification allows for substitutions of products, submit documentation of proposed substitution to architect for his review. Architect will review substitution for compliance with the contract documents if the submittal has been clearly identified and edited to the options and components applicable to the specific case. Owner's representative will consider Architect's recommendation on substituted products, and make final decision as to the acceptance of the product.
 - F. Compliance with Standards, Codes and Regulations: Where the Specifications only requires compliance with an imposed code, standard or regulation, select a product that complies with the standards, codes or regulations specified.
 - G. Visual Selection: Where specified product requirements include the phrase "...as selected from manufacturer's standard colors, patterns, textures..." or a similar phrase, select a product and manufacturer that complies with other specified requirements. The Architect will select the color, pattern and texture from the product line selected.

PART 3 - EXECUTION

3.01 INSTALLATION OF PRODUCTS:

- A. Comply with manufacturer's instructions and recommendations for installation of products in the applications indicated. Anchor each product securely in place, accurately located and aligned with other Work.
1. Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

END OF SECTION

SECTION 01631

PRODUCT SUBSTITUTIONS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section specifies administrative and procedural requirements for handling requests for substitutions made after award of the Contract.
- B. Standards: Refer to Section "Definitions and Standards" for applicability of industry standards to products specified.
 - 1. Procedural requirements governing the Contractor's selection of products and product options are included under Section "Materials and Equipment."

1.03 DEFINITIONS

- A. Definitions used in this Article are not intended to change or modify the meaning of other terms used in the Contract Documents.

1.04 SUBMITTALS

- A. Substitution Request Submittal: Requests for substitution will be considered if received within 10 days after commencement of the Work. Requests received more than 10 days after commencement of the Work may be considered or rejected at the discretion of the Architect and Owner's representative.
 - 1. Submit 3 copies of each request for substitution for consideration. Submit requests in the form and in accordance with procedures required for Change Order proposals.
 - 2. Identify the product, or the fabrication or installation method to be replaced in each request. Provide complete documentation showing compliance with the requirements for substitutions, and the following information, as appropriate:
 - a. Product Data, including Drawings and descriptions of products, fabrication and installation procedures.
 - b. Samples, where applicable or requested.

- c. A detailed comparison of significant qualities of the proposed substitution with those of the Work specified. Significant qualities may include elements such as size, weight, durability, performance and visual effect.
 - d. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by the Owner and separate Contractors, that will become necessary to accommodate the proposed substitution.
 - e. A statement indicating the substitution's effect on the Contractor's Construction Schedule compared to the schedule without approval of the substitution. Indicate the effect of the proposed substitution on overall Contract Time.
 - f. Cost information, including a proposal of the net change, if any in the Contract Sum.
 - g. Certification by the Contractor that the substitution proposed is equal-to or better in every significant respect to that required by the Contract Documents, and that it will perform adequately in the application indicated. Include the Contractor's waiver of rights to additional payment or time, that may subsequently become necessary because of the failure of the substitution to perform adequately.
- B. Architect's Action: Architect shall review requests for substitution and recommend action to the Owner's representative. Owner's representative shall issue final approval or rejection of substitution to Architect. Within a reasonable time, the Architect will notify the Contractor of acceptance or rejection of the proposed substitution. If a decision on use of a proposed substitute cannot be made or obtained within a reasonable time use the product specified by name. Acceptance will be in the form of a Change Order if the proposed substitution requires a change in cost or time..

PART 2 - PRODUCTS

2.01 SUBSTITUTIONS

- A. Conditions: The Contractor's substitution request will be received and considered by the Architect when one or more of the following conditions are satisfied, as determined by the Architect; otherwise requests will be returned without action except to record noncompliance with these requirements.
- 1. Extensive revisions to Contract Documents are not required.
 - 2. Proposed changes are in keeping with the general intent of Contract Documents.
 - 3. The request is timely, fully documented and properly submitted.
 - 4. The request is directly related to an "or approved equal" clause or similar language in the Contract Documents.
 - 5. The specified product or method of construction cannot be provided within the

Contract Time. The request will not be considered if the product or method cannot be provided as a result of failure to pursue the Work promptly or coordinate activities properly.

6. The specified product or method of construction cannot receive necessary approval by a governing authority, and the requested substitution can be approved.
7. A substantial advantage is offered the Owner, in terms of cost, time, energy conservation or other considerations of merit, after deducting offsetting responsibilities the Owner may be required to bear. Additional responsibilities for the Owner may include additional compensation to the Architect for redesign and evaluation services, increased cost of other construction by the Owner or separate Contractors, and similar considerations.
8. The specified product or method of construction cannot be provided in a manner that is compatible with other materials, and where the Contractor certifies that the substitution will overcome the incompatibility.
9. The specified product or method of construction cannot be coordinated with other materials, and where the Contractor certifies that the proposed substitution can be coordinated.
10. The specified product or method of construction cannot provide a warranty required by the Contract Documents and where the Contractor certifies that the proposed substitution provide the required warranty.
11. The Contractor's submittal and Architect's acceptance of Shop Drawings, Product Data or Samples that relate to construction activities not complying with the Contract Documents does not constitute an acceptable or valid request for substitution, nor does it constitute approval.

PART 3 – EXECUTION (Not Applicable)

END OF SECTION

SECTION 01700
PROJECT CLOSEOUT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section specifies administrative and procedural requirements for project closeout, including but not limited to:
 - 1. Inspection procedures.
 - 2. Project record document submittal.
 - 3. Operating and maintenance manual submittal.
 - 4. Submittal of warranties.
 - 5. Final cleaning.
- B. Closeout requirements for specific construction activities are included in the appropriate Sections in Divisions-2 through -16.

1.03 SUBSTANTIAL COMPLETION

- A. Preliminary Procedures: Before requesting inspection for certification of Substantial Completion, complete the following. List exceptions in the request.
 - 1. In the Application for Payment that coincides with the date Substantial Completion, show 100 percent completion for the portion of the Work claimed as substantially complete. Include supporting documentation for completion as indicated in these Contract Documents and a statement showing an accounting of changes to the Contract Sum.
 - a. If 100 percent completion cannot be shown, include a list of incomplete items, and the value of incomplete construction.
 - 2. Advise Owner of pending insurance change-over requirements.
 - 3. Submit specific warranties, workmanship bonds, maintenance agreements, final certifications and similar documents.
 - 4. Obtain and submit releases enabling the Owner unrestricted use of the Work and access to services and utilities; include occupancy permits, operating certificates and similar releases.

5. Deliver tools, spare parts, extra stock, and similar items.
 6. Make final change-over of permanent locks and transmit keys to the Owner. Advise the Owner's personnel of change-over in security provisions.
 7. Complete start-up testing of systems, and instruction of the Owner's operating and maintenance personnel. Discontinue or change over and remove temporary facilities from the site, along with construction tools, mock-ups, and similar elements.
 8. Complete final clean up requirements, including touch-up painting. Touch-up and otherwise repair and restore marred exposed finishes.
- B. Inspection Procedures: On receipt of a request for inspection, the Owner's representative and Architect will either proceed with inspection or advise the Contractor of unfilled requirements. The Architect will prepare the Certificate of Substantial Completion following inspection, or advise the Contractor of construction that must be completed or corrected before the certificate will be issued.
1. The Owner's representative will repeat inspection when requested and assured that the Work has been substantially completed.
 2. Results of the completed inspection will form the basis of requirements for final acceptance.

1.04 FINAL ACCEPTANCE

- A. Preliminary Procedures: Before requesting final inspection for certification of final acceptance and final payment, complete the following. List exceptions in the request.
1. Submit the final payment request with releases and supporting documentation not previously submitted and accepted. Include certificates of insurance for products and completed operations where required.
 2. Submit an updated final statement, accounting for final additional changes to the Contract Sum.
 3. Submit a certified copy of the Architect's final inspection list of items to be completed or corrected, stating that each item has been completed or otherwise resolved for acceptance.
 4. Submit final meter readings for utilities, a measured record of stored fuel, and similar data as of the date of Substantial Completion, or when the Owner took possession of and responsibility for corresponding elements of the Work.
 5. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
- B. Re-inspection Procedure: The Owner's representative will re-inspect the Work upon receipt of notice that the Work, including inspection list items from earlier inspections, has been completed, except items whose completion has been delayed because of circumstances acceptable to the Architect.

1. Upon completion of re-inspection, the Owner's representative will advise the Contractor of Work that is incomplete or of obligations that have not been fulfilled but are required for final acceptance.
2. If necessary, re-inspection will be repeated.

1.05 RECORD DOCUMENT SUBMITTALS

- A. General: Do not use record documents for construction purposes; protect from deterioration and loss in a secure, fire-resistive location; provide access to record documents for the Architect's reference during normal working hours.
- B. Record Drawings: Maintain a clean, undamaged set of blue or black line white-prints of Contract Drawings and Shop Drawings. Mark the set to show the actual installation where the installation varies substantially from the Work as originally shown. Mark whichever drawing is most capable of showing conditions fully and accurately; where Shop Drawings are used, record a cross-reference at the corresponding location on the Contract Drawings. Give particular attention to concealed elements that would be difficult to measure and record at a later date.
 1. Upon completion of mark-up, submit complete set of record Product Data to the Architect for the Owner's records.
- C. Miscellaneous Record submittals: Refer to other Specification Sections for requirements of miscellaneous record-keeping and submittals in connection with actual performance of the Work. Immediately prior to the date or dates of Substantial Completion, complete miscellaneous records and place in good order, properly identified and bound or filed, ready for continued use and reference. Submit to the Architect for the Owner's records.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.01 CLOSEOUT PROCEDURES

- A. Operating and Maintenance Instructions: Arrange for each installer of equipment that requires regular maintenance to meet with the Owner's personnel to provide instruction in proper operation and maintenance. If installers are not experienced in procedures, provide instruction by manufacturer's representatives. Include a detailed review of the following items:
 1. Maintenance manuals.
 2. Record documents.

3. Spare parts and materials.
4. Tools.
5. Lubricants.
6. Fuels.
7. Identification systems.
8. Control sequences.
9. Hazards.
10. Cleaning.
11. Warranties and bonds.
12. Maintenance agreements and similar continuing commitments.

B. As part of instruction for operating equipment, demonstrate the following procedures:

1. Start-up.
2. Shutdown.
3. Emergency operations.
4. Noise and vibration adjustments.
5. Safety procedures.
6. Economy and efficiency adjustments.
7. Effective energy utilization.

3.02 FINAL CLEANING

- A. General: General cleaning during construction is required by the General Conditions and included in Section "Temporary Facilities".
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to the condition expected in a normal, commercial building cleaning and maintenance program. Comply with manufacturer's instructions.

END OF SECTION

SECTION 01740

WARRANTIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section specifies general administrative and procedural requirements for warranties required by the Contract Documents, including manufacturer's standard warranties on products and special warranties.
 - 1. Refer to the General Conditions for terms of the Contractor's special warranty of workmanship and materials.
 - 2. General closeout requirements are included in Section "Project Closeout."
 - 3. Specific requirements for warranties for the Work and products and installations that are specified to be warranted are included in the individual Sections of Divisions-2 through -16.
 - 4. Certifications and other commitments and agreements for continuing services to Owner are specified elsewhere in the Contract Documents.
- B. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the Work that incorporates the products, nor does it relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the Contractor.

1.03 WARRANTY REQUIREMENTS

- A. Related Damages and Losses: When correcting warranted Work that has failed, remove and replace other Work that has been damaged as a result of such failure or that must be removed and replaced to provide access for correction of warranted Work.
- B. Reinstatement of Warranty: When Work covered by a warranty has failed and been corrected by replacement or rebuilding; reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.
- C. Replacement Cost: Upon determination that Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of Contract Documents. The Contractor is responsible for the cost of

replacing or rebuilding defective Work regardless of whether the Owner has benefited from use of the Work through a portion of its anticipated useful service life.

- D. Owner's Recourse: Written warranties made to the Owner are in addition to implied warranties, and shall not limit the duties, obligations, rights and remedies otherwise available under the law, nor shall warranty periods be interpreted as limitations on time in which the Owner can enforce such other duties, obligations, rights, or remedies.

- 1. Rejection of Warranties: The Owner reserves the right to reject warranties and to limit selections to products with warranties not in conflict with requirements of the Contract Documents.

- E. The Owner reserves the right to refuse to accept Work for the Project where a special warranty, certification, or similar commitment is required on such Work or part of the Work, until evidence is presented that entities required to countersign such commitments are willing to do so.

1.04 SUBMITTALS

- A. Submit written warranties to the Architect prior to the date certified for Substantial Completion. If the Architect's Certificate of Substantial Completion designates a commencement date for warranties other than the date of Substantial Completion for the Work, or a designated portion of the Work, submit written warranties upon request of the Architect.
- B. When a special warranty is required to be executed by the Contractor, or the Contractor and a subcontractor, supplier or manufacturer, prepare a written document that contains appropriate terms and identification, ready for execution by the required parties. Submit a draft to the Owner through the Architect for approval prior to final execution.

END OF SECTION

DIVISION 2

SITE WORK

SECTION 02000
SITE PREPARATION

PART 1 -- GENERAL

1.01 WORK

- A. Provide sitework as shown on the Drawings and specified herein.
- B. Provide all materials, equipment, and labor required to complete the work as drawn and specified.
- C. Related work includes excavation, trenching, utilities, grading and compaction as required.

1.02 QUALITY STANDARDS

- A. Provide experienced, well-trained workers competent to complete the work as specified.
- B. Unless approved by the Architect, provide all related products and accessories from one manufacturer.
- C. Use materials from manufacturers and suppliers specified or approved by the Architect.
- D. All work shall comply with governing building and safety codes.

1.03 SUBMITTALS

- A. Submit the following within 5 calendar days after receiving the Notice to Proceed.

1.04 MATERIALS HANDLING

- A. Provide all materials required to complete the work as shown on the Drawings and specified herein.
- B. Deliver, store, and transport materials to avoid damage to the materials or to any other work.

1.05 PRECONSTRUCTION AND PREPARATION

- A. Examine and verify that job conditions are satisfactory for speedy and acceptable work.
- B. Notify Architect when work is scheduled to be started and completed.
- C. Use agreed schedule for installation and for field observation by Architect.

END OF SECTION

SECTION 02001

SITEWORK

PART 1 GENERAL

1.01 SUMMARY

- A. All required sitework, including but not limited to; clearing, earthwork, paving, utilities, drainage, and landscaping.

1.02 RELATED WORK

- A. Developer shall provide all required design data, including but not limited to; plat, survey, planning and zoning documents, geotechnical report, environmental hazard reports, traffic studies, etc., related to the specific project site.
- B. Section 01400 - Testing and Responsibilities.
- C. Division 15 - Water and Sewer Connections.
- D. Division 16 - Electrical Connections.

1.03 WORK INCLUDED

- A. Demolition, including hazardous material abatement.
- B. Site preparation, clearing, and grubbing.
- C. Earthwork, grading, excavation, fill, and compaction.
- D. Drainage and storm sewer.
- E. Piped utilities.
- F. Paving and surfacing.
- G. Power and communication utilities.
- H. Landscaping and irrigation.

1.04 SUBMITTALS

- A. Submit test reports for excavation, filling, grading, and subgrade operations.

1.05 REGULATORY REQUIREMENTS

- A. Obtain all required permits, fees, licenses, and inspections.
- B. Arrange for all required regulatory inspections and approvals.
- C. Verify applicable codes and regulations.
- D. Comply with all applicable codes and regulations.

1.06 WARRANTY

- A. Warranty entire landscape package for a period of one year, or one complete growing season, whichever is longer. The warranty shall include the replacement of all defective materials.

PART 2 PRODUCTS

2.01 EARTHWORK

- A. Provide materials, whether from on-site or off-site, approved by Geotechnical Engineer.
- B. Subsoil: Excavated material, graded free of lumps larger than 6 inches, rocks larger than 2 inches, and free from frozen material or debris.
- C. Provide tennite treatment in subgrade where directed by Owner.

2.02 PIPED UTILITIES

- A. Provide materials in compliance with local ordinances for material, size, and installation.

2.03 PAVING

- A. Provide asphalt materials in compliance with local paving and AASHTO standards.
- B. Provide aggregates, mixes, tack, and prime coats required to produce a smooth consistent finish.
- C. Provide concrete materials and cement-type compatible with soil characteristics.
- D. Provide anti-spalling compound on all site concrete.

2.04 LANDSCAPING

- A. Provide specimens compatible with local climates. Plant according to local requirements and temporarily support trees until fully established.

PART 3 EXECUTION

3.01 EARTHWORK

- A. Place materials within compaction and moisture requirements in the accepted Geotechnical Report.
- B. Prepare subgrade for surface schedule, remove unstable materials below paving and slab areas, or below foundation members.
- C. Protect and dewater open excavations.

3.02 FIELD QUALITY CONTROL

- A. Quality Control Testing During Construction: Allow testing service to inspect and approve subgrades and fill layers before further construction work is performed. Notify testing service not less than 8 working hours in advance.
- B. Test Evaluations: If in opinion of Architect, based on testing service reports and inspections, subgrade or fills which have been placed are below specified density, provide additional compaction and testing until specified density is obtained.
- C. Testing Agency Will Test As Follows: Field density tests in accordance with ASTM D2922 or D1556. Check calibration curves furnished with moisture gauges in accordance with ASTM D3017.
 - 1. Paved Areas: Conduct at least one field density test for every 5,000 square feet of each lift being placed or compacted.
 - 2. Building Slab: Conduct at least one field test for every 2,000 square feet of each lift being placed or compacted.
 - 3. Conduct at least one field density test for each 200 cubic yard of backfill for trenches, and not less than one test for each 250 lineal feet.

3.03 PAVING

- A. Place materials in compliance with local regulations for temperature and moisture. Do not pave over frozen substrate.

3.04 PIPED UTILITIES

- A. Install utilities in acceptable bedding, compact trenches in compliance with

accepted Geotechnical Report.

- B. Maintain integrity of existing main systems. Schedule required outages with affected parties.

END OF SECTION

SECTION 02050

DEMOLITION

PART 1 -- GENERAL

- 1.01 Provide work and materials as shown.

PART 2 -- MATERIALS

2.01 PROTECTIVE BARRIERS AND COVERS

- A. Provide demolition materials, barriers, protective covers, etc. to complete the work as specified.

PART 3 -- CONSTRUCTION

3.01 SITEWORK PREPARATION

- A. Obtain all required permits and approvals and obey all restrictions, deadlines, and notification requirements of governing agencies.
- B. Notify owners of adjacent properties of impending work.
- C. Identify and clearly mark underground utility lines, pipe, cable, and conduits.

3.02 SURVEY CHECK

- A. Check site survey for errors, and make necessary corrections.

3.03 SUBSURFACE INVESTIGATION/SOIL TESTS

- A. Conduct required soil investigations and tests and maintain marks at soil test locations.

3.04 SITEWORK -- DEMOLITION

- A. Demolish and remove all work indicated on Drawings.
- B. Follow all permit requirements and governing regulations.
- C. Protect adjacent private or public property from dust or debris.
- D. Completely control and remove all demolition debris, scraps, and dust.

3.05 CONSTRUCTION PROTECTION

- A. Provide sturdy barriers and covers as necessary for safety and to protect remaining work.
- B. Provide security lighting, fencing, and warning signs.

3.06 PLANT PROTECTION

- A. As directed by the Architect, label existing shrubs and trees to remain, be relocated, or to be removed.
- B. Erect barricades and fences as required to protect planting and related property.
- C. Provide protection and maintenance for existing and new plants.

END OF SECTION

SECTION 02200

EARTHWORK, EXCAVATION, GRADING, AND BACKFILL

PART 1 -- GENERAL

1.01 Provide work and materials as shown.

PART 2 -- MATERIALS

2.01 FILL

- A. Fill materials shall be sampled and tested as directed by the Architect.

PART 3 -- EXECUTION

3.01 PREPARATION

- A. Obtain and obey all applicable regulations regarding grading and excavation.
- B. Identify, mark, and protect from damage all existing underground pipes, conduits, and cable.
- C. Provide amply engineered shoring and bracing as required by site conditions.
- D. Provide temporary drains and/or pumps to remove ground water.
- E. Prepare a survey record drawing to record all new site conditions.

3.02 GRADING AND EXCAVATION

- A. Grade and excavate to lines, grades, and elevations as shown in the Drawings.
- B. Protect buried water, sewer, steam, or gas lines.
- C. Remove and store reusable topsoil as directed by the Architect.
- D. VEGETATION PRESERVATION: Do not remove trees or shrubs without the specific approval of the Architect. Damaged vegetation shall be replaced.
- E. REQUIREMENTS OF REGULATORY AGENCIES: Adhere to State and local code requirements for the disposal of trees and shrubs removed from the site.
- F. OWNERSHIP OF REMOVED MATERIALS AND VEGETATION: Unless noted otherwise, removed materials become the property of the Contractor.
- G. PROTECTION OF VEGETATION: Rope, or fence off vegetation that is to remain to prevent damage.
- H. GRUBBING: Grub construction area to a minimum depth of one foot below the existing grade.

1. STRUCTURAL EXCAVATIONS: Remove entire main roots and stump roots.
2. STUMP REMOVAL: Remove stumps to a depth of at least 18 inches under lowest elevation of the excavation.

3.03 EXCAVATION

- A. Excavate for utilities, footings, and all other work shown in the Drawings and specified herein.
- B. Immediately investigate and report to the Architect any unexpected subsurface conditions that appear during excavation.
- C. Keep foundation and footing trenches uniform in slope, width, and direction as per Drawings.
- D. Large boulders and rock to be removed will be removed at no additional cost to the Owner.
- E. The Soils Report governs existing subsurface conditions.
- F. CONCEALED CONDITIONS: Variations from Contract Documents Conditions not apparent at the start of Work will be adjusted as described in the Contract Conditions.
- G. SOIL STIFFNESS: When information concerning subsurface soil stiffness is not available, assume an angle of repose of degrees under optimum moisture conditions. No angle of repose can be assumed when soil is under adverse moisture conditions. Where concrete surfaces are shown vertical or steeper than the angle of repose, forms are required.
- H. Governing documents: The following Documents govern the Work:
 1. Occupational Safety and Health Administration recommendations; Chapter XVII, 1926.652
- I. FILL AND BACKFILL MATERIAL:
 1. Foundations, Slabs and Backfill shall be per soils report recommendations.
 2. The overexcavated site shall be observed by a representative of the Soils Engineer prior to fill placement and the first density test should be conducted when 18 inches of fill have been placed.
- J. COMPACTION: Compaction shall be per soils report recommendations.
- K. VAPOR BARRIER: Provide a 6 mil polyethylene plastic film vapor barrier under all floor slabs that receive floor covering. Provide vapor barrier under all other areas if recommended by the soils report.

3.04 SITE MAINTENANCE DURING GRADING AND EXCAVATION

- A. Control excavation dust so that no dust blows onto neighboring public or private property.
- B. Do frequent and thorough cleanups and remove potentially harmful substances strictly according to governing regulations.

3.05 PRIOR TO BACKFILL

- A. Before backfilling, the Architect must approve work completed below finish grade.
- B. Underground utilities that will be concealed must be inspected, tested, and approved.
- C. Remove all formwork, trash, and debris.

3.06 BACKFILL AND COMPACTION

- A. Perform backfill and compaction in a systematic pattern, to assure complete and consistent work. Layer backfill in 6 inch to 12 inch increments and compact all fill.
- B. Place termite and other soil poisons as directed by the Architect along with backfill.
- C. Use stabilized fill material of an approved type and from an approved source. Do not allow any debris to be mixed with fill.
- D. Protect foundation and retaining walls during backfilling.

3.07 BELOW GRADE WATERPROOFING

- A. Thoroughly waterproof basement foundation walls (if applicable) before backfilling.
- B. Notify the Architect of below-grade waterproofing, and arrange for observation of the work.
- C. Alternately place backfill at two sides of a wall, to avoid unbalanced loading.
- D. Correctly replace boundary markers, monuments, and stakes if they are moved or damaged.

3.08 SUBGRADE PREPARATION FOR PAVING

- A. Identify and locate existing underground construction such as drains, sewers, and utility mains.
- B. Provide graded slopes as required for positive pavement slopes to drains.
- C. Backfill systematically and in layers, compact all fill, and thoroughly compact trenches or pits beneath paving.
- D. Install base course firmly, and wet it down prior to concrete application. Protect base course from frost and flooding.

3.09 SURFACE DRAINAGE

- A. Provide drainage catchers for roof water as well as for surface runoff.
- B. Provide surface storm drainage as per Drawings and free of impediments to smooth drain flow.

3.10 IRRIGATION AND SPRINKLERS

- A. Lay out the work as per Site Drawings and install pipe and materials as shown in Plumbing Drawings.
- B. Do electrical work related to irrigation and sprinkler controls, and coordinate with plumbing.
- C. Pressure-test the system to make sure it's leak free.
- D. Test and adjust the system until it operates correctly.

END OF SECTION

SECTION 02500

PAVING

PART 1 -- GENERAL

1.01 WORK

- A. Provide and install paving materials as shown on the Drawings and specified herein .
- B. Provide all related materials, equipment, and labor required to complete the work specified.
- C. Other related work includes grading and compaction as required and excavation, trenching, and utilities work required to be completed before paving.

1.02 QUALITY STANDARDS

- A. Provide experienced, well-trained workers competent to complete the work as specified.
- B. Unless approved by the Architect, provide all related products and accessories from one manufacturer.
- C. Use materials from manufacturer and suppliers specified or approved by the Architect.
- D. All work shall comply with governing building and safety codes.

1.03 SUBMITTALS

- A. Submittals as per instructions in General Conditions. Submit within 7 calendar days after receiving the Notice to Proceed.

1.04 MATERIALS HANDLING

- A. Provide all materials required to complete the work as shown on the Drawings and specified herein.
- B. Deliver, store, and transport materials to avoid damage to the product or to any other work and return any products or materials delivered in an unsatisfactory condition.
- C. Materials and products delivered will be certified by the manufacturer to be as specified.
- D. Store materials in a safe, secure location, protected from weather.

1.05 PRECONSTRUCTION AND PREPARATION

- A. Examine and verify that job conditions are satisfactory for speedy and acceptable work.

- B. Confirm there are no conflicts between this work and work of other trades, and that work of other trades that must precede this work has been completed.
- C. Notify Architect when work is scheduled to be started and completed.

END OF SECTION

SECTION 02510

PORTLAND CEMENT CONCRETE PAVING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings, City Standards & Specifications and general provisions of the Contract, including General and Supplementary Conditions and Division -1 Specification Sections, apply to this section.

1.02 SUMMARY

- A. This Section includes exterior portland cement concrete paving for the following:
 - 1. Roadways.
 - 2. Parking lots.
 - 3. Curbs and gutters.
 - 4. Walkways.

1.03 RELATED SECTIONS

- A. Division 2 Section "Earthwork" for subgrade preparation, grading and subbase course.

1.04 SUBMITTALS

- 1. Submit written reports to Engineer and Owner's Construction Manager for each class of concrete at least 15 days prior to start of work. Do not begin concrete production until proposed mix designs have been reviewed.
- 2. Design mixes for each class of concrete. Include revised mix proportions when characteristics of materials, project conditions, weather, test results or other circumstances warrant adjustments.
- 3. Laboratory test reports for evaluation of concrete materials and mix design tests.

1.05 QUALITY ASSURANCE

- A. Concrete Standards: Comply with provisions of the following standards, except where more stringent requirements are indicated.
 - 1. American Concrete Institute (ACI) 301, "Specifications for Structural Concrete for Buildings."
 - 2. ACI 318, "Building Code Requirements for Reinforced Concrete."
 - 3. Concrete Reinforcing Steel Institute (CRSI) "Manual of Standard Practice."

PART 2 - PRODUCTS

2.01 FORMS

- A. Form Materials: Plywood, metal metal-framed plywood, or other acceptable panel-type materials to provide full-depth, continuous, straight, smooth exposed surfaces. Use flexible or curved forms for curves of a 100 foot or less radius.

2.02 REINFORCING MATERIALS

- A. Reinforcing Bars and Tie Bars: ASTM A 615, Grade 60, deformed.

- B. Epoxy-Coated Reinforcing Bars: ASTM A775 with ASTM A 615, Grade 60 deformed steel bars.
- C. Plain, Cold-Drawn Steel Wire: ASTM A 82.
- D. Welded Steel Wire Fabric: ASTM A 185.
 - 1. Furnish in flat sheets, not rolls.
- E. Deformed-Steel Welded Wire Fabric: ASTM A 497.
- F. Fabricated Bar Mats: Welded or clip-assembled steel bar mats, ASTM A 184. Use ASTM A615, Grade 60 steel bars, unless otherwise indicated.
- G. Joint Dowel Bars: Plain steel bars, ASTM A 615, Grade 60. Cut bars true to length with ends square and free of burrs.
- H. Supports for Reinforcement: Chair, spacers, dowel bar supports and other devices for spacing, supporting, and fastening reinforcing bars, welded wire fabric, and dowels in place. Use wire bar-type supports complying with CRSI specifications.
 - 1. Use supports with sand plates or horizontal runners where base material will not support chair legs.

2.03 CONCRETE MATERIALS

- A. Portland Cement: ASTM C150, Type I or see Geotechnical report for sulfate resistant cement requirements.
 - 1. Use one brand of cement throughout Project unless otherwise acceptable to Engineer.
- B. Fly Ash: ASTM C618, Type F.
- C. Normal-Weight Aggregates: ASTM C33, Class 4, and as follows. Provide aggregates from a single source.
 - 1. Maximum Aggregate Size: 3/4 inches.
 - 2. Do not use fine or coarse aggregates that contain substances that cause spalling.
 - 3. Local aggregates not complying with ASTM C 33 that have been shown to produce concrete of adequate strength and durability by special tests or actual service may be used when acceptable to the Materials Engineering Lab.
- D. Water: Potable.
- E. Fiber Reinforcement: Synthetic fibers engineered and designed for secondary reinforcement of concrete slabs, complying with ASTM C1116, Type III.

2.04 ADMIXTURES

- A. Provide concrete admixtures that contain not more than 0.1 percent chloride ions.
- B. Air-Entraining Admixture: ASTM C260, certified by manufacturer to be compatible with other required admixtures.
- C. Water-Reducing Admixture: ASTM C494, Type A.

- D. High-Range Water-Reducing Admixture: ASTM C494, Type F or Type G.
- E. Water-Reducing and Accelerating Admixture: ASTM C494, Type E.
- F. Water-Reducing and Retarding Mixture: ASTM C494, Type D.
- G. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:

2.05 CURING MATERIALS

- A. Absorptive Cover: Burlap cloth made from jute or kenaf, weighing approximately 9 oz. per square yard, complying with AASHTO M 182, Class 2.
- B. Moisture-Retaining cover: One of the following, complying with ASTM C171.
 - 1. Waterproof paper.
 - 2. Polyethylene film.
 - 3. White burlap-polyethylene sheet.
- C. Clear Waterborne Membrane-Forming Curing Compound: ASTM C309, Type I, Class B.
 - 1. Provide material that has a maximum volatile organic compound (VOC) rating of 350 mg per liter.
- D. Evaporation Control: Monomolecular film-forming compound applied to exposed concrete slab surfaces for temporary protection from rapid moisture loss.
- E. Products: Subject to compliance with requirements, provide one of the following:
 - 1. Clear Waterborne Membrane-Forming Curing Compound:
 - a. Clear Cure Water Base: Anti-Hydro Co., Inc.
 - b. Spartan Cote WB; the Burke Co.
 - c. W.B. Resin Cure; Conspec Marketing and Mfg. Co.
 - d. Sealco VOC; Cormix Construction Chemicals
 - e. Safe Cure and Seal (J-18); Dayton Superior Corp.
 - f. Diamond Clear VOX; Euclid Chemical Co.
 - g. Aqua Kure-Clear; La mbert Corp.
 - h. Dress & Seal #22 WB; L & M Construction Chemicals, Inc.
 - i. Masterkure 100W; Master Builders, Inc.
 - j. 1100 Clear Series; W.R. Meadows, Inc.
 - k. Metcure; Metalcrete Industries.
 - l. Kure-N-Seal WB; Sonneborn-Chemrex.
 - m. Horncure 100; Tamms/A.C. Horm.
- F. Evaporation Control:
 - 1. Aquafilm; Conspec Marketing and Mfg. Co.
 - 2. Eucobar; Euclid chemical Co.
 - 3. E-Con; L & M Construction Chemicals, Inc.
 - 4. Confilm; Master Builders, Inc.

2.06 RELATED MATERIALS

- A. Traffic Paint: Alkyd-resin ready-mixed, complying with AASHTO M 248, Type N.

1. Color: Traffic Yellow (2 coats).

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

2.07 CONCRETE MIX

- A. Prepare design mixes for each type and strength of normal-weight concrete by either laboratory trial batch or field experience methods as specified in ACI 301. For the trial batch method, use a qualified independent testing agency for preparing and reporting proposed mix designs.
- B. Do not use the Owner's field quality-control testing agency as the independent testing agency.
- C. Limit use of fly ash to 10% of cement content by weight.
- D. Proportion mixes according to ACI 211.1 and ACI 301 to provide normal-weight concrete with the following properties:
1. Compressive Strength (28 Day): 4,000 psi.
 2. Maximum Water-Cement Ratio at Point of Placement: 0.45.
 3. Slump Limit at Point of Placement: 3 inches.
- E. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content as follows with a tolerance of plus or minus 1 1/2%.
- F. Fiber Reinforcement: Add to mix at rate of 1.5 lb. per cubic yard, unless manufacturer recommends otherwise.
- G. Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, project conditions, weather, test results, or other circumstances warrant.

2.08 CONCRETE MIXING

- A. Ready-Mixed Concrete: Comply with requirements and with ASTM C94. When air temperature is between 85 degrees F (30 degrees C) and 90 degrees F (32 degrees C), reduce mixing and delivery time from 1 1/2 hours to 75 minutes; when air temperature is above 90 degrees F (32 degrees C), reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.01 SURFACE PREPARATION

- A. Proof-roll prepared subbase surface to check for unstable areas and verify need for additional compaction. Do not begin paving work until such conditions have been corrected and are ready to receive paving.
- B. Remove loose material from compacted subbase surface immediately before placing concrete.

3.02 EDGE FORMS AND SCREED CONSTRUCTION

- A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides for paving to required lines, grades, and elevations. Install forms to allow continuous progress of work and so that forms can remain in place at least 24 hours after concrete placement.
- B. Check completed formwork and screeds for grade and alignment to following tolerances:
 - 1. Top of Forms: Not more than 1/8 inch in 10 feet.
 - 2. Vertical Face on Longitudinal Axis: Not more than 1/4" in 10 feet.

3.03 PLACING REINFORCEMENT

- A. General: Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars" for 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 fabric 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 to adjacent mats.

3.04 JOINTS

- A. General: Construct contraction, construction, and isolation joints true to line with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to the centerline, unless otherwise indicated.
- B. When joining existing paving, place transverse joints to align with previously placed joint, unless indicated otherwise.
- C. Contraction Joints: Provide weakened-plane contraction joints, sectioning concrete into areas as shown on Drawings. Construct contraction joints for a depth equal to at least 1/4 of the concrete thickness, as follows:
- D. Tooled Joints: Form contraction joints in fresh concrete by grooving and finishing each edge of joint with a radiuses jointer tool.
- E. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8 inch wide joints into hardened concrete when cutting action will not tear, abrade, or otherwise damage surface and before development of random contraction cracks.
- F. Construction Joints: Set construction joints at side and end termination of paving and at locations where paving operations are stopped for more than 1/2 hour, unless paving terminates at isolation joints.

1. Provide preformed galvanized steel or plastic keyway section forms or bulkhead forms with keys, unless indicated otherwise. Embed keys at least 1 1/2 inches into concrete.
 2. Continue reinforcement across construction joints unless indicated otherwise. Do not continue reinforcement through sides of strip paving unless indicated.
 3. Provide tie bars at sides of paving strips where indicated.
 4. Use bonding agent on existing concrete surfaces that will be joined with fresh concrete.
- G. Isolation Joints: Form isolation 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 50 feet, unless indicated otherwise.
 2. Extend joint fillers full width and depth of joint, not less than 1/2 inch or more than 1 inch below finished surface where joint sealant is indicated. Place top of joint filler flush with finished concrete surface when no joint sealant is required.
 3. Furnish joint fillers in one-piece lengths for full width being placed wherever possible. Where more than one length is required, lace or clip joint filler sections together.
 4. Protect top edge of joint filler during concrete placement with a metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.
 5. Installation of joint fillers and sealants is specified in Division 7 Section "Paving Joint Sealants."
 6. 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.

3.05 CONCRETE PLACEMENT

- A. Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast in. Notify other trades to permit installation of their work.
- B. Remove snow, ice, or frost from subbase surface and reinforcing before placing concrete. Do not place concrete on surfaces that are frozen.
- C. Moisten subbase to provide a uniform dampened condition at the time concrete is in place. Do not place concrete around manholes or other structures until they are at the required finish elevation and alignment.
- D. Comply with requirements and with ACI 304R for measuring, mixing, transporting, and placing concrete.
- E. 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.
- F. When concrete placing is interrupted for more than 1/2 hours, place a construction joint.
- G. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- H. Consolidate concrete by mechanical vibrating equipment supplemented by hand-spading, rodding or tamping. Use equipment and procedures to consolidate concrete complying with ACI 309R.
- I. 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 reinforcing, dowels, and joint devices.

- J. Screed paved surfaces with a straightedge and strike off. Use full floats or darbies to form a smooth surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces prior to beginning finishing operation.
- K. Curbs and Gutter: When automatic machine placement is used for curb and gutter placement, submit revised mix design and laboratory test results that meet or exceed requirements.
- L. Produce curbs and gutters to required cross section, lines, grade, finish, and jointing as specified for formed concrete. If results are not acceptable, remove and replace with formed concrete.
- M. Slip-Form Pavers: When automatic machine placement is used for paving, submit revised mix design and laboratory test results that meet or exceed requirements. Produce paving to required thickness, lines, grades, finish, and jointing as required for formed paving.
 - 1. Compact subbase and prepare subgrade of sufficient width to prevent displacement of paver machine during operations.
- N. When adjoining pavement lanes are placed in separate pours, do not operate equipment on concrete until pavement has attained 85 percent of its 28 day compressive strength.
- O. Cold-Weather Placement: Comply with provisions of ACI 306R 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 degrees F (4 degrees C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 degrees F (10 degrees C) and not more than 80 degrees F (27 degrees 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 accepted in mix designs.
- P.P. Hot-Weather Placement: Place concrete complying with ACI 305R and as specified when hot weather conditions exist.
 - 1. Cool ingredients before mixing to maintain concrete temperature at time of placement to below 90 degrees F (32 degrees C). Mixing water may be chilled or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
 - 2. Cover reinforcing steel with water soaked burlap if it becomes too hot, so that steel temperatures will not exceed the ambient air temperature immediately before embedding in concrete.
 - 3. Fog spray forms, reinforcing steel, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.06 CONCRETE FINISHING

- A. Float Finish: Begin floating 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 flating if area is small or inaccessible to power units. Finish surfaces to true planes within a tolerance of 1/4 inch in 10 feet as determined by a 10 foot long straightedge placed anywhere on the surface in any direction. Cut down high spots and fill low spots. Refloat surface immediately to a uniform granular texture.
- B. Medium to Coarse Textured Broom Finish: Provide a coarse finish by striating surface 1/16 inch to 1/8 inch deep with a stiff bristled broom, perpendicular to line of traffic.
- C. Final Tooling: Tool edges of paving, gutters, curbs, and joints formed in fresh concrete with a jointing tool to the following radius. Repeat tooling of edges and joints after applying surface finishes. Eliminate tool marks on concrete surfaces. Provide radius as shown on drawings.

3.07 CONCRETE PROTECTION AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with the recommendations of ACI 306R for cold weather protection and ACI 305R for hot weather protection during curing.
- B. Evaporation Control: In hot, dry, and windy weather, protect concrete from rapid moisture loss before and during finishing operations with an evaporation control material. Apply according to manufacturer's instructions after screeding and bull floating, but before floating.
- C. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.
- D. Curing Methods: Cure concrete by moisture curing, moisture-retaining cover curing, curing compound, or a combination of these as follows:
 - 1. Moisture Curing: Keep surfaces continuously moist for not less than 7 days with the following materials:
 - a. Water: Continuous Fog Spray.
 - b. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with a 12 inch lap over adjacent absorptive covers.
 - 2. Moisture Retaining Cover Curing: Cover concrete surfaces with moisture retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover materials and waterproof tape.
- E. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's directions. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.

3.08 TRAFFIC PAINT

- A. Traffic Paint: Apply traffic paint for striping and other markings with mechanical equipment to produce uniform straight edges. Apply at manufacturer's recommended rates to provide a 15 mil minimum wet film thickness.

3.09 FIELD QUALITY CONTROL TESTING

- A. General Contractor to employ a qualified independent testing and inspection agency to sample materials, perform tests, and submit test reports during concrete placement as follows:
1. Sampling Fresh Concrete: STM C 172, except modified for slump to comply with ASTM C 94.
 2. Slump: STM C143, one test at point of placement for each compressive strength test but no less than one test for each day's pour of each type of concrete. Additional tests will be required when concrete consistency changes.
 3. Air Content: ASTM C231, pressure method; one test for each compressive strength test but no less than one test for each day's pour of each type of air entrained concrete.
 4. Concrete Temperature: ASTM C 1064, one test hourly when air temperature is 40 degrees F (4 degrees C) and below, and when 80 degrees F (27 degrees C) and above, and one test for each set of compressive strength specimens.
 5. Compression Test Specimens; ASTM C 31, one set of four standard cylinders for each concrete class exceeding 5 cubic yards but less than 25 cubic yards, plus one set for each additional 50 cubic yards. Test one specimen at 7 days, test two specimens at 28 days, and retain one specimen in reserve for later testing if required.
- B. When frequency of testing will provide fewer than five strength tests for a given class of concrete, conduct testing from at least five randomly selected batches or from each batch if fewer than five are used.
- C. When total quantity of a given class of concrete is less than 50 cubic yards, Engineer may waive strength testing if adequate evidence of satisfactory strength is provided.
- D. When strength of field cured cylinders is less than 85 percent of companion laboratory cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in place concrete.
- E. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive strength test results equal or exceed specified compressive strength and no individual strength test results falls below specified compressive strength by more than 500 psi.
- F. Test results will be reported in writing to Engineer, Owner's Construction Manager, concrete manufacturer, and Contractor within 24 hours of testing. Reports of compressive strength tests shall contain the Project identification name and number, date of concrete placement, name of concrete placement, name of concrete testing agency, concrete type and class, location of concrete batch in paving, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7 day and 28 day tests.
- G. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted but shall not be used as the sole basis for acceptance or rejection.
- H. Additional Tests: The testing agency will make additional tests of the concrete when test results indicate slump, air entrainment, concrete strengths, or other requirements have not been met, as directed by Engineer. Testing agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42, or by other methods as directed.

3.10 REPAIRS AND PROTECTION

- A. Remove and replace concrete paving that is broken, damaged, or defective, or does not meet the requirements of this Section.
- B. Drill test cores where directed by Engineer when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement areas with portland cement concrete bonded to paving with epoxy adhesive.
- C. Protect concrete from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.
- D. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep concrete paving not more than 2 days prior to date scheduled for Grand Opening.

END OF SECTION

SECTION 02520

HOT-MIXED ASPHALT PAVING

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Hot-mixed asphalt paving over prepared subbase.

1.02 SUBMITTALS

- A. Material Certificates signed by material producer and Contractor, certifying that each material item complies with or exceeds specified requirements.

1.03 SITE CONDITIONS

- A. Weather Limitations: Apply prime and tack coats when ambient temperature is above 50°F. and when temperature has not been below 35°F. for 12 hours immediately prior to application. Do not apply when base is wet or contains an excess of moisture.
- B. Construct hot-mixed asphalt surface course when atmospheric temperature is above 40°F. and when base is dry. Base course may be placed when air temperature is above 30°F. and rising.
- C. Grade Control: Establish and maintain required lines and elevations.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Use locally available materials and gradations that exhibit a satisfactory record of previous installations.
- B. Coarse aggregate: sound, angular crushed stone, crushed gravel, or properly cured crushed blast furnace slag, complying with ASTM D692.
- C. Fine aggregate: sharp-edged natural sand or sand prepared from stone, properly cured blast furnace slag, gravel, or combinations, complying with ASTM D1073.
- D. Mineral filler: rock or slag dust, hydraulic cement, or other inert material complying with ASTM D242.
- E. Asphalt cement: ASTM D3381 for viscosity-graded material; ASTM D946 for penetration-graded material.
- F. Prime coat: cut-back asphalt type, ASTM D2027; MC-30, MC-70 or MC-250.
- G. Tack coat: emulsified asphalt; ASTM D977.

2.02 ASPHALT-AGGREGATE MIXTURE

- A. Provide plant-mixed, hot-laid asphalt-aggregate mixture complying with ASTM D3515 and as recommended by local paving authorities to suit project conditions.

PART 3 – EXECUTION

3.01 SURFACE PREPARATION

- A. Proof-roll prepared subbase surface to check for unstable areas and areas requiring additional compaction.
- B. Notify Contractor of unsatisfactory conditions. Do not begin paving work until deficient subbase areas have been corrected and are ready to receive paving.
- C. Prime Coat: Apply at rate of 0.20 to 0.50 gal. per sq. yd., over compacted subgrade. Apply material to penetrate and seal, but not flood, surface. Cure and dry as long as necessary to attain penetration and evaporation of volatile.
- D. Tack Coat: Apply to contact surfaces of previously constructed asphalt or Portland cement concrete and surfaces abutting or projecting into hot-mixed asphalt pavement. Distribute at rate of 0.05 to -0.15 gal. per sq. yd. of surface.
- E. Allow to dry until at proper condition to receive paving.
- F. Exercise care in applying bituminous materials to avoid smearing of adjoining concrete surfaces. Remove and clean damaged surfaces.

3.02 PLACING MIX

- A. General: Place hot-mixed asphalt mixture on prepared surface, spread, and strike off. Spread mixture at minimum temperature of 225° F. Place areas inaccessible to equipment by hand. Place each course to required grade, cross-section, and compacted thickness.
- B. Paver Placing: Place in strips not less than 10 feet wide, unless otherwise acceptable to Architect. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Complete base course for a section before placing surface course.
- C. Immediately correct surface irregularities in finish course behind paver. Remove excess material forming high spots with shovel or lute.
- D. Joints: Make joints between old and new pavements, or between successive days' work, to ensure continuous bond between adjoining work. Construct joints to have same texture, density, and smoothness as other sections of hot-mixed asphalt course. Clean contact surfaces and apply tack coat.
- E. Curbs: Construct curbs over compacted pavement surfaces. Apply a light tack coat unless pavement surface is still tacky and free from dust.
- F. Place curb materials to cross-section indicated or, if not indicated, to local standard shapes, by machine or by hand, in wood or metal forms. Tamp hand-placed materials and screed to smooth finish. Remove forms as soon as material has cooled.

3.03 ROLLING

- A. General: Begin rolling when mixture will bear roller weight without excessive displacement.

- B. Compact mixture with hot hand tampers or vibrating plate compactors in areas inaccessible to rollers.
- C. Breakdown Rolling: Accomplish breakdown or initial rolling immediately following rolling of joints and outside edge. Check surface after breakdown rolling and repair displaced areas by loosening and filling, if required, with hot material.
- D. Second Rolling: Follow breakdown rolling as soon as possible, while mixture is hot. Continue second rolling until mixture has been evenly compacted.
- E. Finish Rolling: Perform finish rolling while mixture is still warm enough for removal of roller marks. Continue rolling until roller marks are eliminated and course has attained 95 percent laboratory density.
- F. Patching: Remove and replace paving areas mixed with foreign materials and defective areas. Cut out such areas and fill with fresh, hot hot-mixed asphalt. Compact by rolling to specified surface density and smoothness.
- G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.
- H. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.04 FIELD QUALITY CONTROL

- A. General: Testing in-place hot-mixed asphalt courses for compliance with requirements for thickness and surface smoothness will be done by Owner's testing laboratory. Repair or remove and replace unacceptable paving as directed by Architect.
- B. Thickness: In-place compacted thickness tested in accordance with ASTM D3549 will not be acceptable if exceeding following allowable variations:
 - 1. Base Course: Plus or minus $\frac{1}{2}$ ".
 - 2. Surface Course: Plus or minus $\frac{1}{4}$ ".
- C. Surface Smoothness: Test finished surface of each hot-mixed asphalt course for smoothness, using 10'-0" straightedge applied parallel with and at right angles to centerline of paved area. Surfaces will not be acceptable if exceeding the following tolerances for smoothness:
 - 1. Base Course Surface: $\frac{1}{4}$ ".
 - 2. Wearing Course Surface: $\frac{3}{16}$ ".
 - 3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is $\frac{1}{4}$ ".
- D. Check surface areas at intervals as directed by Architect.

END OF SECTION

SECTION 02600

UTILITIES

PART 1 -- GENERAL

1.01 WORK

- A. Provide water supply line, sanitary sewer, perimeter site drain, and storm sewer work and material as shown.
- B. Provide everything required to complete the Work as shown on the Drawings and specified herein.

1.02 QUALITY STANDARDS

- A. Provide experienced, well-trained workers competent to complete the Work as specified.
- B. Unless approved by the Architect, provide all related products and accessories from one manufacturer.
- C. Use products and accessories from a manufacturer specified or approved by the Architect.
- D. All work shall comply with manufacturer's instructions and governing building and safety codes.

1.03 SUBMITTALS

- A. Submit the following within 5 calendar days after receiving the Notice to Proceed.

1.04 MATERIALS HANDLING

- A. Provide all materials required to complete the Work as shown on Drawings and specified herein.
- B. Deliver, store, and transport materials to avoid damage to the product or to any other work. Return any products or materials delivered in a damaged or unsatisfactory condition. Materials and products delivered will be certified by the manufacturer to be as specified.
- C. Store materials in a safe, secure location, protected from dirt, moisture, contaminants, and weather.

1.05 PRECONSTRUCTION AND PREPARATION

- A. Examine and verify that job conditions are satisfactory for speedy and acceptable work. Confirm there is no conflict between this work and governing building and safety codes, or between this work and work of other trades. Confirm that work of other trades that must precede this work has been completed.
- B. Meet all requirements to secure any applicable warranty.

- C. Notify and receive approval from the Architect as to when work is to be started and completed.

END OF SECTION

SECTION 02610

UNDERGROUND UTILITIES

PART 1 -- GENERAL

1.01 Provide all work and material as shown.

PART 2 -- MATERIALS

2.01 Provide water line, perimeter site drain, sanitary sewer, and storm sewer lines.

PART 3 -- CONSTRUCTION -- UNDERGROUND UTILITIES

3.01 PREPARATION AND COORDINATION

- A. Identify work to be completed by project subcontractors, local utility companies and any special work to be provided by the Owner.
- B. Coordinate utility trenching to keep open trenchwork to a minimum, avoid duplicate trenching, and avoid potentially damaging crossover trenching.
- C. Install sanitary sewer drainage first, followed by storm sewers, water supply and other utilities.
- D. Check utility company or subcontractor plans to assure their work is coordinated with other work, trees and planting that are to be protected, and existing construction.

3.02 INSTALLATION -- GENERAL INSTRUCTIONS FOR ALL UTILITIES

- A. Install pipe and cable work as per instructions of manufacturers and utility companies.
- B. Protect trenches against bulging soil and cave-ins. Seal openings of uncompleted pipework closed during off-work hours.
- C. Protect pipe by installing coated or wrapped pipe with care to avoid damage. Repair any damaged portions of coated or wrapped pipe to match the protection of the original. Provide thorough caulking of pipe thread connections.
- D. Place valve and meter boxes on compacted soil, level with final elevation of finish pavement or landscaping. Do not allow any part of valve and meter boxes to rest on piping or valves.
- E. Verify connection point to building service lines. Excavation and pressure tests must comply with utility company requirements and codes. Slope gas lines to main lines, and slope main lines to drip catchers, to avoid water accumulation. Do not allow gas lines to make contact with other piping or conduit. Keep gas lines beyond code minimum distance from water lines.

- F. Pipe depth to comply with utility company requirements and local regulations. Do not permit heavy equipment traffic over or near gas line trenches. Clearly mark backfilled gas line trenches as warning to other excavators.
- G. Test and connect as required by governing agency and utility company: Repair or replace defective work as directed by the Architect.

END OF SECTION

SECTION 02660
WATER DISTRIBUTION

PART 1 -- GENERAL

1.01 Provide water distribution as shown on the Drawings and specified herein.

PART 2 -- MATERIALS

2.01 WATER PIPING, BELOW AND OUTSIDE BUILDING

- A. Pipe and fittings:
- B. Copper Tubing as per ASTM B88, Type K annealed. Wrought copper fittings and compression joints.
- C. Fittings and specials shall resist 150 psi unless specified otherwise.
- D. Valve working pressure of no less than 150 psi.

PART 3 -- CONSTRUCTION AND INSTALLATION

3.01 INSTALLATION

- A. Maintain a minimum distance of 10 feet between water mains and storm or sanitary sewers. Prevent pipe movement from momentum of water flow.
- B. Protect pipe from freezing temperatures.
- C. Repair or replace defective work as directed by the Architect.
- D. At completion of work, test as required by governing agency and utility company. Connect to utility line or meter as per utility company requirements.

END OF SECTION

SECTION 02700

SEWERAGE

PART 1 -- GENERAL

1.01 WORK

- A. Provide sanitary sewerage as shown on the Drawings and specified herein.

PART 2 -- MATERIALS

2.01 PIPE AND FITTINGS

- A. Pipe:
 - 1. PVC pipe and fittings: Extra strength, minimum of SDR 35. ABS pipe and fittings: ASTM D2680.

PART 3 -- INSTALLATION

3.01 PIPE LAYING

- A. Place sewer line and connections according to the approved drawing. Make firm bedding; compact if necessary, before laying pipe. Lay pipe from lower grade to upgrade, with spigot ends of bell and spigot pipe aligned in direction of flow. Install and adjust joints to assure watertightness.
- B. Handle pipe with care and protect from damage.
- C. Remove extraneous material from pipe interior. After laying, flush sewer lines clear of dirt and debris.
- D. Locate manholes so that covers will align with finish elevations of pavement or landscaping. Provide manhole inverts as detailed and install cleanouts, capped and accessible for maintenance.
- E. Upon completion, remove all debris and excess materials from site. Replace or repair defective work as directed by the Architect.

END OF SECTION

SECTION 02725

TRENCH DRAIN & SAND/OIL SEPARATOR

PART 1 -- GENERAL

1.01 WORK

- A. Provide trench drains and sand/oil interceptor as shown on the Drawings and specified herein.

PART 2 -- MATERIALS

2.01 PRODUCTS

- A. Trench drain:
- B. PolyDrain by ABT Inc. Fabricated polyester polymer concrete, 150mm (6in) wide, 100mm (4in) ID with radiused bottom, having following attributes:
 - 1. Lengths: 1000mm (39.2in) and 500mm (19.6in)
 - 2. Bottoms: slope to provide 0.6%
 - 3. Anchoring ribs: full length
 - 4. Grate locking slots: blind, vibration damping, thermoplastic
 - 5. Interlocking ends
 - 6. Available to 90m (294ft), continuous slope using sidewall extensions
- C. Grates:
 - 1. Four point independently anchored frame and grate, model number 515AF as manufactured by ABT Incorporated
- D. Sand/Oil Separator
 - 1. 1000 gallon (unless specified otherwise on drawings) by ABT Incorporated.

PART 3 -- INSTALLATION

3.01 CONTACT INFORMATION

- A. Contact Tim Gallegos with ABT Incorporated for installation instructions. ABT Inc., P.O. Box 837, 259 Murdock Road, Troutman, NC 28166. (303) 346-9633. (303) 525-5598 Cell

END OF SECTION

SECTION 02810

LANDSCAPE IRRIGATION SYSTEM

PART 1 - GENERAL

1.01 WORK INCLUDED:

- A. The specifications set forth herein pertain to the installation of an underground irrigation system.

1.02 RELATED WORK:

- A. The application provisions of the General Conditions and Supplementary Conditions of these specifications shall govern the work of this section as if it were written here in full.
- B. This work shall consist of installing a complete underground irrigation system as shown on the drawings. The Contractor shall include all labor, materials, permits and equipment necessary for the installation of a complete system according to the plans and specifications. No substitutions of material or the procedure shall be made concerning these documents without the written consent of an approved equal by the Contract Administrator. The work shall comply with the requirements of all legally constituted Authorities having jurisdiction.
- C. Related Work Specified Elsewhere:
 - 1. Soil Preparation: Section 02920
 - 2. Sodding: Section 02930
 - 3. Planting: Section 02950

1.03 QUALITY ASSURANCE:

- A. Irrigation Drawings: The irrigation drawings are essentially diagrammatic. Due to the scale of the drawings, all characteristics of the system (i.e., sleeving, fittings, etc.) may not be represented. The Contractor shall carefully inspect the site and plan his work accordingly, supplying any materials and equipment necessary to install said characteristics.
 - 1. The Contractor shall notify the Owner of any discrepancies of site dimensions, obstructions, etc. that were not shown on the drawings and that might not have been known during the preparation of irrigation drawings. If such notification is not made, Contractor shall assume all expenses and responsibility for any revisions necessary.

2. Work called for on the drawings by notes or on details shall be furnished and installed whether or not specifically mentioned in the specifications.
3. Design locations of heads, valves and lines are approximate. Contractor shall make minor adjustments of locations to avoid obstacles. All finish grades shall be approved prior to installation of the irrigation system.

B. Contractor Qualifications:

1. Work shall be performed in accordance with the best standards of practice relating to the various trades. The Contractor shall be highly skilled and proficient in the installation of irrigation systems of this magnitude. If requested by the Owner, Contractor shall submit a list of three (3) projects of equal complexity with references. Contractor must have a minimum of five (5) years' experience with projects of comparable size. The Contractor shall coordinate installation of irrigation systems with other trades on the project.

C. Inspection:

1. The owner reserves the right to observe installation of the irrigation system at any time and to eject any and all materials or workmanship that does not meet project specifications and standards. Materials used without prior consent of the Owner may be rejected and removed at Contractor's expense. Approval of materials shall indicate that materials visually meet specifications, but this acceptance shall not relieve Contractor of any warranty.
2. Before final acceptance of the project, the Contractor shall show evidence to the owner that all submittals, etc., have been received by the Owner.
3. Contractor shall give Owner 48 hours notice with request for staking or for field observation. Head and valve staking is to be approved prior to installation.

D. Ordinances and Regulations: Contractor shall observe all state and local laws, ordinances and regulations concerning the materials and installation of the irrigation system.

1.04 SUBMITTALS:

A. Material List:

1. A material list of all products and materials to be used on the project shall be submitted to the Owner prior to installation of irrigation system.
2. Owner reserves the right to reject any and all materials that have been installed but have not been approved.

3. Manufacturer's warranties shall not relieve the Contractor of his liability for project warranty. Such warranties shall only supplement the project warranty.

B. Operation and Maintenance Manuals:

1. Contractor is to deliver to Owner the following before final acceptance of the irrigation system:
 - a. Index sheet of Contractor's address and phone number.
2. List of materials and manufacturer's representatives with addresses and phone numbers.
3. Operating and maintenance instruction of all equipment with shutdown and startup procedures for the irrigation system.

C. Additional equipment:

1. Equipment to be furnished as part of this contract to the Owner at the completion of the project before final acceptance of irrigation system:
 - a. Two (2) manual drain valve keys of appropriate length.
 - b. Two (2) gate valve or stop and waste valve keys of appropriate length.
 - c. Three (3) quick coupler keys and two (2) matching hose swivels.
 - d. Two (2) sets of special tools for maintaining each type of sprinkler head and valve supplied.
 - e. Two (2) keys for each automatic controller.

D. As-Built Drawing:

1. Before final acceptance of the irrigation system Contractor shall supply the Owner with a reproducible Mylar As-Built drawing. Drawing shall include dimensioned locations of all equipment and piping as listed in the irrigation schedule on the plans. Drawing to include dimensioned changes in location of sprinkler heads, zoning changes, connection to existing water lines, and any other items as requested. As-Built drawings are to be updated weekly throughout the length of the project. The Owner shall not approve any pay requests if the As-Built drawings are not current.

1.05 PROTECTION OF PROPERTY AND SAFETY MEASURES:

A. Property and Utilities:

1. All trees, shrubs, flowers, fences, buildings, walks, roadways and other property shall be protected from damage. Any damage to said property shall be repaired or replaced to the Owner's satisfaction at the Contractor's expense. Open trenches left exposed shall be flared and barricaded as per OSHA regulations by the Contractor. Contractor shall restore all areas to their original condition. Contractor shall be responsible to contact utility companies and the Owner's representative for staked locations of all utilities on the property. If staked utilities are damaged by the Contractor the utilities shall be repaired at the Contractor's expense.
2. All trenching and other work within three feet of existing trees shall be done by hand so as not to damage tree roots or limbs. All trenches shall be no less than one foot from the trunk of any tree.
3. Promptly notify Owner of unexpected sub-surface conditions.

B. Replacement of Paving and Curbs:

1. Damage caused by trenching crossing existing and/or proposed roadways, paths, curbing, etc., shall be kept to a minimum and all damaged areas shall be restored to their original condition at the Contractor's expense. This will include compaction of sub-grade to ninety five percent (95%) relative compaction.
2. Restoration shall take the following course:
 - a. Match existing paving sections for asphalt paving. Thoroughly compact sub-base, base course, and bituminous course, matching grade of existing paving. No rough or rolled grades will be allowed.
 - b. Blacktop Curbs: Hot mix bituminous curb mix tamed and shaped to match adjoining curbs.
 - c. Concrete Paving: Concrete to match adjoining concrete work, with expansion joints.
 - d. Sidewalks: Concrete to match adjoining concrete work.

1.06 MATERIAL HANDLING, STORAGE AND CLEANUP:

- A. Material Handling and Storage: Contractor shall be cautious in handling and installing pipe and materials. Owner reserves the right to reject any and all materials that are damaged. Damaged and defective pipe and equipment is to be removed from the site. Contractor shall make arrangements with the Owner to store materials on site.
- B. Cleanup: Contractor shall endeavor to keep the site clean at all times. At the completion of the project, the Contractor shall remove all construction equipment and surplus materials from the premises, leaving the area in a clean and acceptable condition. Surplus materials shall include

unsuitable excavated materials, rocks, trash and debris. Any equipment or debris which is not removed shall be removed at the expense of the Contractor.

1.07 FLUSHING, TESTING AND COVERAGE:

- A. Flushing: All lines shall be thoroughly flushed to eliminate any foreign matter before sprinkler heads are set.
- B. Testing: In the presence of the Owner, the Contractor shall conduct a pressure test on the mainline pipe at a pressure of 100 psi. Any leaks or breaks during the test shall be repaired and the mainline will be tested until accepted. All test equipment and pumps shall be supplied by the Contractor as part of the contract.
- C. Coverage: After the sprinkler heads have been installed and before installation of sod, the Contractor shall conduct a coverage test in the presence of the Owner to determine if irrigated areas are receiving the proper amount of water. As directed by the Owner, the Contractor shall make adjustments for proper coverage at no additional expense. This shall include changing of nozzle patterns. Contractor shall perform, at no additional expense, the required work to correct any coverage problems due to deviations from irrigation plans or to problems caused by installing according to plans when it is obvious that the plans are inadequate, without bringing it first to the attention of the Owner.
 - 1. Any areas which do not conform to the designed characteristics of the drawings and unauthorized changes or poor installation practices shall be repaired or replaced at Contractor's expense.

1.08 PRELIMINARY ACCEPTANCE:

- A. Preliminary inspection will occur after completion of entire irrigation system. Provide 48 hours' notice to consultant for inspection.
- B. Preliminary inspection will evaluate the performance, coverage, appearance and conformance of the system to that of the drawings. Contractor shall rework or replace items that do not meet consultant's approval.
- C. Consultant will provide punch list of items to be corrected.
- D. Contractor will correct all punch list items at his expense.

1.09 FINAL INSPECTION:

- A. Upon completion of punch list items, Contractor will give consultant 48 hours' notice to set up final inspection. Final inspection will take place after all as-built drawings, controller charts and submittals have been provided to and accepted by the Owner.
- B. If, after inspection, the consultant determines that all work conforms to the drawings, he will issue a written notice of acceptance.
- C. Final acceptance will not be given until all punch list items and subsequent new items are corrected. Funds shall be withheld from the Contractor to pay for any subsequent inspection as deemed necessary by the Owner to ensure compliance with contract drawings, specifications and details.
- D. If the consultant determines that the irrigation system is obviously not completed to warrant a final inspection, the Contractor shall pay the consultant to cover costs for final inspection.

1.10 WINTERIZATION:

- A. Contractor shall be responsible for draining of the irrigation system at the close of the sprinkling season and for startup of the system in the spring as requested by Owner. Contractor shall use compressed air or an acceptable equivalent to drain system. Contractor shall adjust system (sprinkler heads, coverage, etc.) as part of startup procedures.

1.11 WARRANTY:

- A. It shall be the responsibility of the Contractor to insure the satisfactory operation of the entire irrigation system and the workmanship and the restoration of the project area. The entire system, including materials, shall be warranted to be complete and remain operable in every detail by the Contractor for a period of one (1) year from date of final acceptance, and the Contractor agrees to make any adjustments or repair any defects occurring within the one-year warranty period within seven (7) calendar days from receipt of notice of malfunction by the Owner. If Contractor neglects to perform these duties within the specified time, the Owner may make such repairs at the Contractor's expense; provided however, that in the case of an emergency, where in the judgment of the Owner delay would cause serious loss or damage, repairs or replacement may be made by verbal communication and without notice being sent to the Contractor, and the Contractor shall pay the cost thereof. Any settling or irrigation trenches during the warranty period shall be repaired at Contractor's expense.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. P.V.C. Pipe:

1. This specification describes the properties and performance required for polyvinyl chloride pipe. Pipe shall be suitable for use at maximum hydrostatic working pressure of 200 psi or 160 psi as noted on plans. Pipe shall be made from clean, virgin, NSF approved, type 1, grade 1 P.V.C., conforming to Astin Resin specification D1784-60 and project standard D2241 for P.V.C. 1120 SDR 26 or SDR 21. P.V.C. pipe is to be belled end and solvent weld. Solvent cement and primer shall be of the type prescribed by manufacturer.
2. Markings and Declaration of Compliance: Marking shall show the size, series, identification, and manufacturer's trade name at intervals of not more than 20 feet. Pipe shall include the seal of approval of the National Sanitation Foundation spaced at intervals required by NSF regulations.

B. P.V.C. Fittings: All pipe fittings to be schedule 40 P.V.C. (ASTM D2466) unless specifically noted otherwise.

C. Flexible Plastic Pipe: All flexible plastic pipe shall conform to all requirements of the United States Department of Commerce Commercial Standard CS-256-63, ASTM D2239, PE 2306-80, NSF polyethylene pipe.

D. Flexible Pipe Fittings: Insert plaster pipe fittings (ASTM D2609) shall be used with stainless steel worm gear clamps.

E. Brass Pipe and Fittings:

1. Brass pipe shall be 85% red brass, (ANSI) Schedule 40.
2. Fittings shall be medium brass, 125 pound class, screwed type.

F. Copper Pipe: Copper pipe shall have the requirements of Type K, ASTM B88. Fittings shall be copper or cast bronze. Silver solder shall be used for joints.

G. Sprinkler Heads: Sprinkler heads shall be of the type and model as indicated on drawings.

H. Automatic Control Valves: Automatic control valves shall be of the make specified, designed to operate with the specified controller with sizes and model as listed on drawings. Control valve shall be normally closed type and shall have manual bleed nut and manual flow control.

- I. Drip Valve Assemblies: Drip valve assembly shall be of the type, size and style as indicated on the drawings. Strainer shall have 120 mesh nylon screen with 1/2" blow-out. Pressure reducing valve shall have manual adjusting nut.
- J. Drip Emitters: Drip emitters shall be of the type, style and size as indicated on the drawings.
- K. Drip Line Blow Out Stubs: Install drip line blow out stubs at ends of drip tubing.
- L. Quick Coupler: Quick coupler valves shall be of the type, size and style as indicated on the drawings. Quick coupler valves shall be two piece with rubber locking cover.
- M. Automatic Controller: The automatic controller shall be furnished and located as shown on the plans. The controller shall be of the type, size and model number as shown. Controller shall be grounded.
- N. Control Valve Wiring: Irrigation control wiring shall be #14 gauge solid A.W.G. and shall be U.F., U.L. approved. Control wires to be red, common wires to be white and master valve wires to be black.
- O. Valve Boxes: Valve boxes shall be of the type, size and style as indicated on the details. Use one (1) valve box for each valve installed. Where multiple valve boxes occur, arrange in symmetric order and appearance. No valve box extensions will be accepted.
- P. Backflow Preventer: Backflow preventer shall be of the type, model, and size as indicated on drawings.

PART 3 - EXECUTION

3.01 INSTALLATION:

- A. Trenching:
 - 1. Trenching and installation of irrigation system shall not commence until final grading has been completed and approved by the Owner.
 - 2. Trenches shall be cut to true line and grade, and shall be excavated so that the pipe shall drain uniformly toward the drain valves deemed necessary to properly drain the system. Minimum grade of piping to drain shall be 3"/100'. All debris and rocks shall be removed from trenches. For piping 3" and larger, trench width shall be sufficient for

installation of pipe with a clearance of at least 4 inches horizontally on both sides of pipe within trench.

3. Pipe pulling may be used if soil conditions are acceptable to the Owner.
4. Installation of Depth of Piping:
 - a. Depth of mainline from top of pipe is 18"
 - b. Depth of lateral (rotor) from top of pipe is 18"
 - c. Depth of lateral (pop-up) from top of pipe is 12"
 - d. Depth of wiring - side of mainline

B. Plastic Pipe and Fittings:

1. All pipe and fittings shall be installed as per manufacturer's recommendations. No pipe shall be installed in temperatures of 40 degrees F or less. Plastic pipe shall be snaked horizontally in trench and square cut with burrs removed from inside of pipe. Provide for thermal expansion and contraction. For threaded connections use sealants that are recommended by the manufacturer for use with plastic. Do not use oil-based pipe joint compounds. Assemble threaded connections by tightening 1 to 1-1/2 turns beyond finger tight.
2. Solvent weld joints shall be made according to manufacturer's recommendations. Allow joints to set at least 24 hours before pressure is applied to the piping.
3. Install two (2) clamps on all polyethylene fittings 1-1/2" or greater.

C. Backfilling:

1. All backfilling shall be done with approved soil, free of any debris including rock and debris 1" in diameter or larger, and shall be puddled and/or mechanically tamped to prevent settling. Backfilling shall not be done with frozen or caked soil. Excess debris encountered during backfill process shall be removed at the Contractor's expense. Backfill shall be compacted to 90% standard proctor density. Any backfill soil removed due to unsuitability shall be replaced with new approved soil at the Contractor's expense. Any settling during the warranty period of the backfill material shall be repaired at the Contractor's expense including any damage to other items affected by the settling.
2. All lateral lines shall be installed in trenches with a minimum of 6" clearance.
3. Do not install lateral lines within 2' of lines of other trades.

- D. Installation of Piping Under Paving: All piping that is to be located under areas where asphalt or concrete paving is to be installed shall be installed

at an 18" depth below top of road base. Piping is to be encased in sand 4" on all sides. Add backfill in 6" lifts and use mechanical tamping to reach 95% standard proctor density.

1. Contractor is to match and install new paving and base with existing paving and base where cutting is necessary for installation of piping.
 2. Installation of piping under existing walks is to be done with jacking or boring. Any cracking or breaking of the walk is to be repaired at Contractor's expense.
- E. Sprinkler Heads: All sprinkler heads located in turf areas shall be adjusted vertically to be flush with final lawn grades. Install heads as swing joint assemblies. Angle of nipples relative to lateral lines shall be no more than 45 degrees and no less than 15 degrees.
- F. Automatic Control Valves: Installation of automatic control valves shall be as indicated on the details. All control valves shall be installed as close as possible to the locations as shown on plans.
- G. Drip Valve Assemblies: Installation of drip valve assemblies shall be as indicated on the details.
- H. Drip Emitters and Tubing: Installation of drip emitters and tubing shall be as indicated on the details. Drip tubing is to be installed at a depth of 4" below top of grade. In this case, top of grade does not include mulch or rock layer. Drip line blow out stubs are to be installed at all ends of drip tubings. Install drip tubing in turf areas as lateral piping.
- I. Quick Coupling Valves: All quick coupling valves shall be installed as double swing joint assemblies of schedule 40 PVC. Angle of nipple relative to mainline shall be no more than 45 degrees and no less than 15 degrees. Install as per detail.
- J. Automatic Controller:
1. Automatic controller shall be installed as per manufacturer's recommendations and/or irrigation details. Each controller shall have its own separate ground wire and reduced, laminated as-built drawing installed in the door. Controller charts shall be legible and color coded to show valve numbers and their respective zones. Charts are to be hermetically sealed.
 2. All work performed as electrical installation shall conform to applicable codes. All high voltage electrical work shall be performed by a licensed electrician. The Contractor shall be responsible for the electrical connection of the controller with the metered electrical line at the base of the controller as provided by the Owner.

3. Install one valve output surge protection arrestor on each control and common wire.
 4. Install a circuit breaker and electrical on/off switch for each controller.
- K. Control Wiring: Installation of control wires shall be strung as close as possible to the mainline with such wires to be located on one side of pipe. Wiring to be installed in separate trench if not along mainline. All underground electrical connections shall be made with Rainbird Pentite connectors. Any splices not within control valve boxes shall be installed in a Carson #910-12 valve box. The Contractor shall leave a minimum loop of 24" at each control valve, each splice and every 100 feet of wiring. Wiring is to be bundled every 20 feet with one (1) control wire used for every control valve. Install two (2) spare #14-1 wires along complete entirety of mainline from controllers to farthest control valve on each and every branch of mainline. Color to be blue.
- L. Drain Valves: Manual drain valves shall be installed as per details. Contractor shall supply, locate and install drain valve so as to drain entire mainline.
- M. Backflow Preventer: Installation of backflow preventer shall be as indicated on the details. Install as per local and state codes.

END OF SECTION 02810

SECTION 02900

LANDSCAPING

PART 1 -- GENERAL

1.01 WORK

- A. Provide and install trees, plants, and ground cover as shown on the Drawings and specified herein.
- B. Provide all related materials, equipment, and labor required to complete the Work as specified.
- C. Other related work includes additional grading and compaction as required; and excavation, trenching, and utilities work required to be completed before planting.

1.02 QUALITY STANDARDS

- A. Provide experienced, well-trained workers competent to complete the Work as specified.
- B. Provide all materials from one supplier who specializes in landscape materials of the types specified and is approved by the Architect.
- C. Perform all work as per governing building, safety, and zoning codes.

1.03 SUBMITTALS

- A. Submit within 10 calendar days after receiving the Notice to Proceed: A list of materials to be provided for this work, supplier's specifications required to prove compliance with these Specifications and supplier's planting instructions.

1.04 MATERIALS HANDLING

- A. Provide all materials required to complete the Work as shown on Drawings and specified herein.
- B. Return any materials delivered in an unsatisfactory condition. Materials delivered will be certified by the supplier to be as specified.
- C. Transport materials to avoid damage to the product or to any other work. Store materials in a safe, secure location, protected from weather.

1.05 PRECONSTRUCTION AND PREPARATION

- A. Examine and verify that job conditions are satisfactory for speedy and acceptable work. Confirm there are no conflicts between this work and work of other trades. Confirm that work of other trades that must precede this work has been completed.
- B. Notify the Architect when work is scheduled to be started and completed.

PART 2 -- MATERIALS

2.01 PLANTS, SOD, AND RELATED MATERIAL

- A. Provide plants and related materials as shown on the drawings.
- B. Plant materials must be from a fully qualified plant supply nursery approved by the Architect. Plant materials shall be certified by independent inspection.
- C. Provide general ASPA approved grade cultivated grass sod with strong fibrous root system. Machine cut with 1/2 inch to 1 inch topsoil base. Grass type must be suited to local climate, microclimate, and growing conditions.
- D. Fertilizer:
 - 1. Provide Fertilizer as shown on the drawings.

PART 3 -- LANDSCAPE INSTALLATION

3.01 COORDINATION AND PREPARATION

- A. Coordinate planting with site improvements not yet installed such as drains, irrigation, paving, etc. Permit finish grade to drain without interruption or diversion due to construction.
- B. Keep subsoil and topsoil free of foreign matter and construction debris.
- C. Provide and install topsoil as per instructions of the plant supplier, clean and free of foreign matter, clays, gravel, and subsoil. See subsoil grading elevations for thickness of topsoil layer. Till and loosen subsoil, to bond with topsoil. Do all required subsoil and topsoil bond preparation. Compact topsoil evenly.

3.02 PLANTING PROCEDURES

- A. Prepare soil, provide water, and install plants according to the instructions of the plant supplier.
- B. Protect planting areas and tree trunks from damage from construction or any other source.
- C. Handle plants with care and as instructed by the supplier. Especially never lift plants by trunks or stems.
- D. Reject and replace all plants that have been damaged during shipping, handling, and planting.
- E. Provide one year plant replacement warranty.

END OF SECTION

SECTION 02970

LANDSCAPE AND IRRIGATION MAINTENANCE

PART 1 - GENERAL

1.01 WORK INCLUDED:

- A. Furnish all supervision, labor, material, equipment and transportation required to maintain the plantings, seeding, sodding, and irrigation system called for under this contract, including all existing trees, in an attractive, healthy, operable condition for a period of one or two years (see Bid Form) from the date of initial acceptance and through the end of the growing season (November 1). This includes winter watering as required, irrigation system winterization and spring start-ups as well as coordination with district maintenance personnel.

1.02 RELATED WORK:

- A. Related Documents: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 - General Specifications, apply to work of this section.
- B. Related Work Specified Elsewhere:
 - 1. Underground Irrigation System: Section 02810
 - 2. Soil Preparation: Section 02920
 - 3. Seeding and Sodding: Section 02930
 - 4. Plantings: Section 02950

1.03 PREMAINTENANCE INSPECTION:

- A. At the completion of all planting operations under this contract, and prior to the beginning of the maintenance period, the pre-maintenance inspection shall be performed. At the time of pre-maintenance inspection, the Contractor shall have all planting areas free of weeds and neatly cultivated. All plant basins shall be in good repair. Irrigation systems shall be fully operational with all heads properly adjusted. All debris and litter shall be cleaned up and all walkways and curbs shall be cleaned of soil and debris left from planting operations. The inspection will not occur until these conditions are met.

PART 2 - CONTRACTUAL REQUIREMENTS

2.01 MAINTENANCE:

- A. The maintenance period shall commence from the date of initial acceptance by the Owner of the contract work in accordance with these Specifications and continue as stated above.
- B. On or before 45 days prior to the expiration of the maintenance period, the Owner and the Contractor shall conduct a final inspection of the work. The Owner shall prepare a list of any defects discovered during such final inspection ("punch list") and submit the punch list to the Contractor. Any additional defects discovered subsequent to the final inspection of the work but prior to the date of final acceptance (as hereinafter defined) shall also be submitted to the Contractor for repair at the cost and expense of the Contractor. Upon completion by the Contractor of the terms contained on the punch list and any other items subsequently discovered prior to the date of Final Acceptance, the Owner shall deliver a written notice of Final Acceptance to the Contractor.

2.02 PERFORMANCE OF WORK:

- A. The contractor's work force and equipment shall be acceptable to the Owner. Prior to the commencement of the maintenance period, the Contractor shall submit to the Owner an outline of the equipment and crew sizes to be utilized throughout the maintenance period. In the event that Owner shall find any items identified as unacceptable, Contractor shall make the revisions noted by the Owner at no cost to the Owner.
- B. Subcontractors: In the event that the Contractor desires to use subcontractors for certain aspects of the maintenance operation, Contractor shall be required to submit to the Owner a complete list of all proposed subcontractors for Owner's approval.

2.03 SCHEDULING/PROGRESS REPORTS

- A. Scheduling: Prior to the beginning of the growing season, Contractor shall submit to the Owner a detailed schedule identifying all activities which are to be performed during the maintenance period. Examples of such commitments include the regularly scheduled day of the week for mowing and other operations and the month and week which are scheduled for other major activities such as fertilization and pruning. It is not the Owner's intent to require the Contractor to meet each deadline on a specific day, but merely to identify the general time periods for such activities. Contractor may modify the schedule due to environmental

conditions, providing that Owner is notified in advance of any modifications.

- B. Progress Reports: Contractor shall submit on a bi-weekly basis a progress report describing the activity which has occurred during the previous weeks. Reports shall be in the format as shown on the attached exhibit or of a similar nature which is acceptable to the Owner. Reports shall be delivered to the Owner's office not later than 5:00 p.m. on the Tuesday following the report period.
- C. Notification: Contractor shall be required to notify the Owner a minimum of 24 hours in advance of all major work (except mowing) in order that the Owner may have the option of being present at the time of the work. Examples of such work are: fertilization, tree spraying and pruning, plant material replacement, major sprinkler repair or other activities relating to the repair of hardscape items. In the event that proper notification is not given by the Contractor, the Owner shall have the right to require the Contractor to reschedule any such work until such time that the Owner is available. The above provision applies only to work which could be perceived as normal or regularly scheduled maintenance, emergency repairs do not apply.

2.04 FAILURE TO PERFORM

- A. In the event that, in the Owner's opinion, action has not been taken on the part of the Contractor to correct any problems or make any repairs which affect the health of the Owner's landscaping, the Owner may take whatever action that is deemed necessary to effect such repairs. All costs associated with this work shall be deducted from any payments due to the contractor. In the event that sufficient funds are not available to cover these costs, the Owner reserves the right to take whatever action is necessary in accordance with the performance bond requirements of this contract.

2.05 LICENSES, TAXES AND INSURANCE

- A. Licenses: Contractor agrees to obtain and pay for all licenses required by the City, County, State and Federal governments that are necessary for the legal conduct of his business.
- B. Taxes: Contractor agrees to pay all applicable taxes, including sales taxes on materials supplied.
- C. Insurance: Contractor shall maintain all insurance policies in accordance with the General Conditions of the contract through the entire term of the maintenance period.

PART 3 - EXECUTION

3.01 TREE AND SHRUB CARE

- A. Watering: Maintain a large enough water basin around plants so that enough water can be applied to establish moisture through the major root zone. When hand watering, use a water wand to break the water force. Use mulches to reduce evaporation and frequency of watering. Winter watering is the responsibility of the Contractor throughout the maintenance period as many times as required to prevent the newly planted material from desiccation.
- B. Pruning: Prune as required to remove dead or diseased limbs.
- C. Stakes and guys are to be inspected to prevent girdling of trunks or branches, and to prevent rubbing that causes bark wounds. Removal and replacement of stakes and guys will be as directed by the Owner.
- D. Weed Control: Tree and shrub basins and shrub beds shall be kept free of weeds and grasses on a weekly basis. Herbicides must be approved by the Owner prior to use. Frequent soil cultivation that destroys shallow roots will not be allowed. Use of mulches to prevent seed germination is encouraged.
- E. Insect and Disease Control: Control of insects and disease with approved materials, to prevent damage that injures or impairs the appearance of the plant material.
- F. Fertilization: Once in early April, once in early June and once in early August, trees and shrubs shall be fertilized by means of foliar application of an approved water soluble fertilizer. Contractor will be required to submit fertilizer specifications to Owner for acceptance.
- G. Replacement of Plants: Remove dead and dying plants and replace with plants of an equal size, condition and variety of the original planting plan, to be paid for by the Contractor during the maintenance/guaranty period. Replacement of trees may be made in the spring-summer planting season only. Make replacements within 7 days of notification (except as season prohibits), remove unacceptable plant within two (2) days of notification.
- H. Tree Protection: Remove the wrap from all trees at beginning of growing season, approximately April 15; wrap trees from bottom up in late fall, approximately November 15 (Cottonwoods not to be wrapped).

- I. Emergency Repairs: Contractor shall be available to Owner at any time to perform emergency repairs that may be necessary. Costs will be Contractor's submitted hourly rates.
- J. Any use of pesticides shall be in accordance with all applicable regulatory agencies laws.

3.02 FESCUE TURF CARE

- A. Mowing and Edging: All Fescue turf shall be mowed to a minimum of three (3) inches. Mowing shall be done at least every seven (7) days (Thursdays are preferred) during spring and fall seasons, and as needed at other seasons. Edges of all curbs and sidewalks shall be trimmed at least twice monthly or as need for neat appearance. Clippings shall either be vacuumed or blown off and removed from walks and streets. Trash should be picked up before each mowing. Mowing schedule will be coordinated with Owner.
 - 1. Removal of grass clippings will be required as directed by Owner.
 - 2. Note: Under no circumstances will stripping of lower branches (raising up) be permitted on any trees or shrubs.
- B. Watering: Turf shall be watered at such frequency as weather conditions require, to replenish soil moisture below root zone. Watering shall always be done in the evening. Normally a total of one and one-half inches of water are needed weekly in hot weather.
- C. Fertilization and Weed Control: Fescue turf shall be fertilized with accepted material 20/10/5 plus 3" iron three times per growing seasons at a rate of 1-1/4 pounds of nitrogen per 1,000 square feet once in April, once between June 20 and July 7, and one time between September 1 and September 30.
- D. Weed Control: Control broad leaf weeds with selected herbicides as accepted by the Owner. Follow label directions for all chemical applications.
- E. Insect and Disease Control: Insects and disease treatment shall be by application of necessary insecticides and fungicides as conditions of turf requires.

3.03 NON-IRRIGATED TURF

- A. Mowing: The irrigated grass (brome-fescue mix) shall be mowed to a height of three inches every seven days or as often as necessary to keep the turf below the 3" height.
- B. Watering: Water as frequently as needed with temporary irrigation system to obtain turf establishment. All watering shall be done in such a way as to encourage deep root growth and drought-tolerance.
- C. Fertilization and Weed Control: None required.

3.04 IRRIGATION SYSTEM

- A. Contractor shall check all systems for proper operation after each mowing, and all repairs shall be made before next watering cycle. Any damage to system caused by Contractor's operations shall be repaired without charge to Owner.
- B. The Contractor shall be responsible for programming his irrigation controller(s) in terms of schedule/amount of water, etc. Contractor shall review watering schedule with Owner's Representative and shall make any modifications to the programming requested by Owner.
- C. Repair all damages to irrigation system at Contractor's expense. Repairs shall be made within one watering period.
- D. Winterization of Irrigation System: The Contractor shall be responsible for draining irrigation system in preparation for each winter after construction has been completed until the end of the maintenance/guaranty period. The Contractor shall remove water from system by use of compressed air. Remove water from drip lines by opening flushing plugs and blowing out all water.
- E. Spring Start-Up: The Contractor shall be responsible for starting up the irrigation system each spring if applicable, including the spring after the end of the maintenance/guaranty period. Contractor shall fully activate the system in order to demonstrate that it is in full working order. Any repairs that are needed as a result of improper winterization or negligence due to the Contractor, shall be corrected by the Contractor at no additional cost to the Owner.

END OF SECTION 02970

DIVISION 3

CONCRETE

SECTION 03310
CONCRETE WORK

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. Geotechnical Report.

1.02 SUMMARY:

- A. Extent of concrete work is shown on drawings.
- B. Provide vapor barrier below floor slab in M Occupancy area unless restricted by the Geotechnical Engineer.

1.03 SUBMITTALS:

- A. Product Data: Submit data for proprietary materials and items, including reinforcement and forming accessories, admixtures, patching compounds, waterstops, joint systems, curing compounds, dry-shake finish materials, and others as requested by Architect.
- B. Shop Drawings; Reinforcement: Submit original shop drawings for fabrication, bending, and placement of concrete reinforcement. Comply with ACI 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures" showing bar schedules, stirrup spacing, diagrams of bent bars, and arrangement of concrete reinforcement. Include special reinforcement required for openings through concrete structures.
- C. Samples: Submit mix designs for specified performance including names, sources, descriptions, and mix design test.

1.04 QUALITY ASSURANCE:

- A. Codes and Standards: Comply with provisions of following codes, specifications, and standards, except where more stringent requirements are shown or specified:
 - 1. ACI 301 "Specifications for Structural Concrete for Buildings".
 - 2. ACI 318 "Building Code Requirements for Reinforced Concrete".
 - 3. Concrete Reinforcing Steel Institute (CRSI), "Manual of Standard Practice".

- B. Concrete Testing Service: Engage a testing laboratory acceptable to Owner to perform material evaluation tests and to design concrete mixes.
- C. Materials and installed work may require testing and retesting at anytime during progress of work. Tests, including retesting of rejected materials for installed work, shall be done at Contractor's expense.
- D. Slab reinforcing must be positioned in the center zone of the slab depth. Owner may require independent testing to verify placement of reinforcing at their sole discretion. In such cases, retainage may be held until the placement of reinforcing is verified. Work found to be in non-compliance with the contract documents will be rejected, and shall be replaced at the contractor's expense. Retainage shall only be released upon acceptance of the application.

1.05 PROJECT CONDITIONS:

- A. Protection of Footings Against Freezing: Cover completed work at footing level with sufficient temporary or permanent cover as required to protect footings and adjacent sub-grade against possibility of freezing; maintain cover for time period as necessary.
- B. Protect adjacent finish materials against spatter during concrete placement.

PART 2 - PRODUCTS

2.01 FORM MATERIALS:

- A. Forms for Unexposed Finish Concrete: Plywood, lumber, metal, or other acceptable material. Provide lumber dressed on at least 2 edges and one side for tight fit.
- B. Form Coatings: Provide commercial formulation form-coating compounds that will not bond with, stain, nor adversely affect concrete surfaces, and will not impair subsequent treatments of concrete surfaces.
- C. Form Ties: Factory-fabricated, adjustable-length, removable or snap off metal form ties, designed to prevent form deflection and to prevent spalling concrete upon removal. Provide units which will leave no metal closer than 1-1/2" to surface.
 - 1. Provide ties which, when removed, will leave holes not larger than 1" diameter in concrete surface.

2.02 REINFORCING MATERIALS:

- A. Reinforcing Bars: ASTM A 615, Grade 60, deformed.
- B. Steel Wire: ASTM A 82, plain, cold-drawn steel.
- C. Inert Fiber Reinforcing: Fibermesh or approved equal.

2.03 CONCRETE MATERIALS:

- A. Portland Cement: ASTM C 150, Type recommended by Geotechnical Report.
 - 1. Use one brand of cement throughout project.
- B. Normal Weight Aggregates: ASTM C 33, and as herein specified. Provide aggregates from a single source for exposed concrete.
- C. For exterior exposed surfaces, do not use fine or coarse aggregates containing spalling-causing deleterious substances.
- D. Local aggregates not complying with ASTM C 33 but which have shown by special test or actual service to produce concrete of adequate strength and durability may be used when acceptable to Architect.
- E. Water: Drinkable.
- F. Air-Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures.
- G. Chemical Admixture: ASTM C494, Type A - water reducing. Type B - set retarding (use during hot weather concreting. Type C - accelerating. Type D - water reducing and retarding. Type E - water reducing and accelerating. Do not use to reduce minimum cement content.
- H. Fly Ash: ASTM C618, limit use to 15 percent of cement content by weight.
- I. Prohibited Admixtures: Calcium chloride thyocyanates or admixtures containing more than 0.1 percent chloride ions are not permitted.
- J. Use of admixtures will not relax cold weather placement requirements.

2.04 RELATED MATERIALS:

- A. Reglets: Where resilient or elastomeric sheet flashing or bituminous membranes are terminated in reglets, provide reglets of not less than 26 gage galvanized sheet steel. Fill reglet or cover face opening to prevent intrusion of concrete or debris.
- B. Non-Shrink Grout: CRD-C 621, factory pre-mixed grout consisting of:

1. Products: Subject to compliance with requirements, provide one of the following or approved equivalent product:

- a. Non-metallic aggregate, cement, water reducing and plasticizing agents. Capable of developing minimum compressive strength of 5,000 psi in 28 days.

C. Absorptive Cover: Burlap cloth weighing approximately 6 oz. per sq. yd., clean roll goods.

D. Liquid Membrane-Forming Curing Compound for interior slabs: Liquid type membrane-forming curing compound complying with ASTM C 309, Type I, Class B clear finish. Coordinate use with clear sealer for compatible applications.

1. Products: Subject to compliance with requirements, provide one of the following approved equivalent product:

- a. "Promulsion"; Protex
- b. "Cure Resin"; L & M Construction Chemicals
- c. "Hydroxide Curing Compound" Sonneborn

E. Bonding Compound: Polyvinyl acetate or acrylic base, re-wettable type.

1. Products: Subject to compliance with requirements, provide one of the following or approved equivalent product:

- a. "Everbond"; L & M Construction Chemicals
- b. "Euco Weld"; Euclid Chemical Co.
- c. "Sonocrete"; Sonneborn

F. Clear Sealer: See Section 03350.

G. Vapor Barrier: 6 mil thick clear or black polyethylene film in sales area, restrooms and offices when present. No vapor barrier in service bay area unless specifically required by soils report.

H. Caulking: Joint caulking shall be Vulken #45SSL.

2.05 PROPORTIONING AND DESIGN OF MIXES:

A. Prepare design mixes for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACI 301. If trial batch method used, use an independent testing facility acceptable to Architect for preparing and reporting proposed mix designs. The testing facility shall not be the same as used for field quality control testing.

B. Submit written reports to Architect of each proposed mix for each class of concrete

at least 15 days prior to start of work. Do not begin concrete production until mixes have been reviewed by Architect.

- C. Design mixes to provide normal weight concrete with the following properties, as indicated on structural drawings.
- D. Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant; at no additional cost to Owner and as accepted by Owner's representative.
- E. Admixtures:
 - 1. Use water-reducing admixture in concrete as required for placement and workability.
 - 2. Use non-chloride accelerating admixture in concrete slabs placed at ambient temperatures below 50 deg F (10 deg C).
 - 3. Use high-range water-reducing admixture in pumped concrete, concrete for bay area slabs, architectural concrete, concrete required to be watertight, and concrete with water/cement ratios below 0.50.
 - 4. Use air-entraining admixture in exterior exposed concrete, unless otherwise indicated. Add air-entraining admixture at manufacturer's prescribed rate.
- F. Use admixtures for water-reducing and set-control in strict compliance with manufacturer's directions.
- G. Water-Cement Ratio: Provide concrete for following conditions with maximum water-cement (W/C) ratios as follows:
 - 1. Subjected to freezing and thawing; W/C 0.50.
 - 2. Subjected to deicers/watertight; W/C 0.45.
 - 3. Subjected to brackish water, salt spray, or deicers; W/C 0.40.
- H. Slump Limits: Proportion and design mixes to result in concrete slump at point of placement as follows:
 - 1. Ramps, slabs, and sloping surfaces: Not more than 3".
 - 2. Reinforced foundation systems: Not less than 1" and not more than 3".
 - 3. Other concrete: Not less than 1" nor more than 4".

PART 3 - EXECUTION

3.01 GENERAL:

- A. Coordinate the installation of joint materials and vapor retarders with placement of forms and reinforcing steel.

3.02 FORMS:

- A. Design, erect, support, brace, and maintain formwork to support vertical and lateral, static, and dynamic loads that might be applied until such loads can be supported by concrete structure. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation, and position. Maintain formwork construction tolerances complying with ACI 347.
- B. Design formwork to be readily removable without impact, shock, or damage to cast-in-place concrete surfaces and adjacent materials.
- C. Construct forms to sizes, shapes, lines, and dimensions shown, and to obtain accurate alignment, location, grades, level and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required in work. Use selected materials to obtain required finishes. Solidly butt joints and provide back-up at joints to prevent leakage of cement paste.
- D. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses, and the like, to prevent swelling and for easy removal.
- E. Provide temporary openings where interior area of formwork is inaccessible for cleanout, for inspection before concrete placement, and for placement of concrete. Securely brace temporary openings and set tightly to forms to prevent loss of concrete mortar. Locate temporary openings on forms at inconspicuous locations.
- F. Chamfer exposed corners and edges as indicated, using wood, metal, PVC, or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.
- G. Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses, and chases from trades providing such items. Accurately place and securely support items built into forms.
- H. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, or other debris just before concrete is placed. Retightening forms and bracing after concrete placement is required to eliminate mortar leaks and maintain proper alignment.

3.03 PREPARATION

- A. Prepare previously placed concrete by cleaning with steel brush and apply bonding agent in compliance with manufacturer's instructions.
- B. Install vapor barrier, when required, at interior slab on grade. Lap joints minimum 6" and seal. Do not damage or disturb vapor. Repair damaged vapor barrier before pouring concrete slab.

3.04 PLACING REINFORCEMENT:

- A. Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars", for details and methods of reinforcement placement and supports, and as herein specified.
 - 1. Avoiding cutting or puncturing vapor retarder during reinforcement placement and concreting operations.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials which reduce or destroy bond with concrete.
- C. Accurately position, support, and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as required.
- D. Place reinforcement to obtain at least industry accepted minimum coverages for concrete protection. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.
- E. Add inert fiber reinforcing to concrete for interior slabs at the batch plant per manufacturer's instructions where specified on the structural drawings.

3.05 JOINTS:

- A. Construction Joints: Locate and install construction joints as indicated or, if not indicated, locate so as not to impair strength and appearance of the structure, as acceptable to Architect.
- B. Provide keyways at least 1-1/2" deep in construction joints in walls, slabs, and between walls and footings; accepted bulkheads designed for this purpose may be used for slabs.
- C. Place construction joints perpendicular to main reinforcement. Continue reinforcement across construction joints, except as otherwise indicated.
- D. Isolation Joints in Slabs-on-Ground: Construct isolation joints in slabs-on-ground at

points of contact between slabs-on-ground and vertical surfaces, such as column pedestals, foundation walls, grade beams, and elsewhere as indicated. Seal as specified in Division 7.

- E. Saw control joints in interior slabs on grade as soon as possible after placing concrete without dislodging aggregate to a depth of one-third of the slab depth.. Seal control joints as specified in Division 7 before slab clear sealer is applied.

3.06 INSTALLATION OF EMBEDDED ITEMS:

- A. General: Set and build into work anchorage devices and other embedded items required for other work that is attached to, or supported by, cast-in-place concrete. Use setting drawings, diagrams, instructions, and directions provided by suppliers of items to be attached thereto.
- B. Edge Forms and Screed Strips for Slabs: Set edge forms or bulkheads and intermediate screed strips for slabs to obtain required elevations and contours in finished slab surface. Provide and secure units sufficiently strong to support types of screed strips by use of strike-off templates or accepted compacting type screeds.

3.07 PREPARATION OF FORM SURFACES:

- A. Clean re-used forms of concrete matrix residue, repair and patch as required to return forms to acceptable surface condition. Owner's representative may review re-used forms for acceptable character at exposed finish concrete work.
- B. Coat contact surfaces of forms with a form-coating compound before reinforcement is placed.
- C. Thin form-coating compounds only with thinning agent of type, amount, and under conditions of form-coating compound manufacturer's directions. Do not allow excess form-coating material to accumulate in forms or to come into contact with in-place concrete surfaces against which fresh concrete will be placed. Apply in compliance with manufacturer's instructions.
- D. Coat steel forms with a non-staining, rust-preventative form oil or otherwise protect against rusting. Rust-stained steel formwork is not acceptable.

3.08 CONCRETE PLACEMENT:

- A. Reinforcing Steel Placement Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast-in. Notify other crafts to permit installation of their work; cooperate with other trades in setting such work. Moisten wood forms immediately before placing concrete where form coatings are not used.

1. Apply temporary protective covering to lower 2' of finished walls adjacent to poured floor slabs and similar conditions, and guard against spattering during placement.
- B. General: Comply with ACI 304 "Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete", and as herein specified.
1. Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as herein specified. Deposit concrete as nearly as practicable to its final location to avoid segregation.
- C. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers not deeper than 24" and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.
- D. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures for consolidation of concrete in accordance with ACI 309.

3.09 FINISHING

- A. Rough Form Finish: Texture impaired by form facing material, with tie holes and defective areas repaired and patched, and all fins and other projections exceeding 1/4 inch removed.
- B. Related Unformed Surfaces: At tops of walls, horizontal offsets and similar unformed surfaces occurring adjacent to formed surfaces, strike off smooth and finish with texture to match adjacent formed surface.
- C. Finish floors in accordance with ACI 301.
1. Float Finish: After placing slabs, do not work surface until ready for floating. Begin floating when surface water has disappeared, or when concrete is sufficiently stiff to support a power-drive float. Consolidate surface to tolerance specified. Float surface to smooth, uniform granular texture.
 2. Trowel Finish: Consolidate surface by final hand or power-driven troweling operation, free of trowel marks, uniform in texture and appearance, to tolerance specified.
- D. Pitch to drains 1/4 inch per foot nominal or as specified on the drawings.

3.10 PATCHING

- A. Conform generally to ACI 301.
- B. Notify Architect immediately upon removal of forms.
- C. Patch imperfections to conform to specified requirements.
- D. Repair interior and wall cracks exceeding 1/16 inch wide by grinding crack to 1/8 inch wide and fill with epoxy adhesive. Grind smooth and flush with adjacent surface.

3.11 DEFECTIVE CONCRETE

- A. Modify or replace concrete not conforming to required levels and lines, details, elevations and specified strength.
- B. Repair or replace concrete not properly placed or of the specified type.

3.12 FIELD QUALITY CONTROL

- A. Field testing will be performed under provisions of Section 01400.
- B. Maintain records of placed concrete items. Record date, location of pour, quantity, air temperature, and test samples taken.
- C. Form test cylinders shall be taken for every 50 or less cubic yards of each class of concrete placed each day.
 - 1. Making, curing and handling of cylinders; ASTM C31.
 - 2. Sampling; ASTM C172, slump modified per ASTM C94.
 - 3. Slump; ASTM C143.
 - 4. Air content; ASTM C231 pressure method.
 - 5. Compressive strength; ASTM C39.
- D. One slump test shall be performed for each set of test cylinders taken.
- E. Make additional tests at no cost to Owner when original tests indicate non-compliance with specifications.

3.13 TOLERANCES

- A. Conform to ACI 301 and ACI 117 requirements.

3.14 PROTECTION

- A. Protect finished work under provisions of Section 01600.

- B. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.
- C. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

3.15 CAULKING

- A. All paving joints shall be fully caulked.

3.16 SCHEDULE OF CONCRETE SURFACE FINISHES:

- A. Float Finish: Slab surfaces to receive trowel finish.
- B. Trowel Finish: Interior slab surfaces.
- C. Rough Form Finish: Surfaces of structural concrete not exposed to view.

END OF SECTION

**SECTION 03 35 00
CONCRETE FINISHING**

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Single application cure-densifier-hardener for new and existing concrete floors.
2. Precautions for avoiding staining concrete before and after application.

B. Related Section:

1. Cast-In-Place Concrete: Division 03 Cast-In-Place Concrete sections.

1.2 REFERENCES

A. American National Standards Institute (ANSI):

1. ANSI B101.1 Test Method for Measuring Wet SCOF of Common Hard-Surface Floors.
2. ANSI B101.3 Test Method for Measuring Wet DCOF of Common Hard-Surface Floors.

B. ASTM International (ASTM):

1. ASTM C779 Standard Test Method for Abrasion Resistance of Horizontal Concrete Surfaces.
2. ASTM C805 Standard Test Method for Rebound Number of Hardened Concrete.
3. ASTM C1028 Standard Test Method for Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull-Meter Method.
4. ASTM D3359 Standard Test Methods for Measuring Adhesion by Tape Test.
5. ASTM F150-06(2018) Standard Test Method for Electrical Resistance of Conductive and Static Dissipative Resilient Flooring.
6. ASTM G23 Practice for Operating Light-Exposure Apparatus (Carbon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials (Withdrawn 2000).

C. National Floor Safety Institute (NFSI):

1. Certified as High Traction by the National Floor Safety Institute (NFSI), Phase 2 testing.

D. USGBC LEED Version 4

1. Indoor VOC Emission Test; California Department of Public Health CDPH/EHLB/Standard Method Version 1.2, 2017.

E. Health Product Declaration Collaborative (HPD)

1. HPD v1.0.
2. HPD v2.1.

1.3 SUBMITTALS

A. General: Submit listed submittals in accordance with Conditions of the Contract and Section 01 33 00 - Submittal Procedures.

B. Product Data: Submit product data, including manufacturer's Spec-Data® sheet, installation instructions and technical bulletins for specified products.

C. Certificates: Manufacturer's certification that the installer is acceptable.

D. Maintenance Data: Maintenance instructions, including precautions for avoiding staining after application.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Acceptable to the manufacturer.

B. Regulatory Requirements: In accordance with all sections of this specifications and all codes

1.5 DELIVERY, STORAGE & HANDLING

A. General: Comply with Division 01 Product Requirements section.

B. Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

C. Storage and Protection: Store materials protected from exposure to harmful environmental conditions and at temperature

and humidity conditions recommended by the manufacturer.

D. Handling: Protect materials from dirt, corrosion, oil, grease and other contaminants.

PART 2 PRODUCTS

2.1 MATERIAL

A. Manufacturer: Curecrete Distribution, Inc.

1. Contact: 1203 Spring Creek Place, Springville, UT 84663-0551; Telephone: (800) 998-5664, (801) 489-5663; Fax: (801) 489-3307; Email: info@ashfordformula.com; Website: www.ashfordformula.com.

B. Cure-Densifier-Hardener: Ashford Formula is a transparent, chemically reactive, water-based treatment that penetrates into the concrete surface, forming a chemical reaction of crystalline growth that fills in the natural pores and voids in the concrete surface.

1. Abrasion Resistance to Revolving Disks: At least a 32.5% improvement over untreated samples when tested in accordance with ASTM C779.
2. Surface Adhesion: At least a 22% increase in adhesion for epoxy when tested in accordance with ASTM D3359.
3. Hardening: As follows when tested in accordance with ASTM C39:
 - a. After 7 Days: An increase of at least 40% over untreated samples.
 - b. After 28 Days: An increase of at least 38% over untreated samples.
4. Coefficient of Friction: 0.86 dry, 0.69 wet when tested in accordance with ASTM C1028.
5. Rebound Number: An increase of at least 13.3% over untreated samples when tested in accordance with ASTM C805.
6. Electrical Resistance: To ASTM F150.
7. Light Exposure Degradation: No evidence of adverse effects on treated samples when tested in accordance with ASTM G23.
8. Test Method for Measuring Wet SCOF of Common Hard-Surface Floors in accordance with ANSI B101.1.
9. Test Method for Measuring Wet DCOF of Common Hard-Surface Floors in accordance with ANSI B101.3.
10. Certified as High Traction by the National Floor Safety Institute (NFSI), Phase 2 testing.
11. Certified Compliant according to California Department of Public Health CDPH/EHLB/Standard Method Version 1.2, 2017.

PART 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

A. Compliance: Comply with manufacturer's product data, including product technical bulletins, product catalog installation instructions and product carton instructions for installation.

3.2 EXAMINATION

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

3.3 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Do not use frozen material. Thaw and agitate prior to use.
- D. If construction equipment must be used for application, diaper all components that might drip oil, hydraulic fluid or other liquids.

3.4 INSTALLATION

- A. New Concrete: Apply cure-densifier hardener to new concrete as soon as the concrete is firm enough to work on after troweling; with colored concrete, wait a minimum of 30 days before application.
1. Spray on at rate of 200 ft²/gal (5 m²/L).
 2. Keep surface wet with cure-densifier-hardener for a minimum soak-in period of 30 minutes without allowing it to dry or become slippery. If slipperiness occurs before the 30 minute time period has elapsed, apply additional cure-densifier-hardener, as needed, to keep the entire surface in a non-slippery state for the first 15 minutes; for the remaining 15 minutes, mist the surface as needed with water to keep the material in a non-slippery state. In hot weather conditions, follow manufacturer's special application procedures.
 3. When the treated surface becomes slippery after this period, lightly mist with water until slipperiness disappears.
 4. Wait for surface to become slippery again, and then flush entire surface with water to remove all cure-densifier-hardener residue.
 5. Squeegee surface completely dry, flushing any remaining slippery areas until no residue remains.
 6. Wet vacuum or scrubbing machines can be used in accordance with manufacturer's instructions to remove residue.
- B. Existing Concrete: Apply cure-densifier-hardener only to clean, bare concrete.
1. Thoroughly remove previous treatments, laitance, oil and other contaminants.
 2. Saturate surface with cure-densifier-hardener; respray or broom excess onto dry spots.
 3. Keep surface wet with cure-densifier-hardener for a minimum soak-in period of 30–40 minutes.
 4. If most of the material has been absorbed after the 30 minute soak-in period, remove all excess material, especially from low spots, using broom or squeegee.
 5. If most of the material remains on the surface after the 30 minute soak-in period, wait until the surface becomes slippery and then flush with water, removing all cure-densifier-hardener residue. Squeegee completely dry, flushing any remaining slippery areas until no residue remains.
 6. If water is not available, remove residue using squeegee.

3.5 PROTECTION

- A. Protect installed floors for at least 3 months until chemical reaction process is complete.
1. Do not allow traffic on floors for 3 hours after application.
 2. Do not allow parking of vehicles on concrete slab.
 3. If vehicles must be temporarily parked on slab, place drop cloths under vehicles during entire time parked.
 4. Do not allow pipe cutting using pipe cutting machinery on concrete slab.
 5. Do not allow temporary placement and storage of steel members on concrete slabs.
 6. Clean up spills immediately and spot-treat stains with degreaser or oil emulsifier.
 7. Clean floor regularly in accordance with manufacturer's recommendations.

END OF SECTION

DIVISION 4

MASONRY

SECTION 04200

UNIT MASONRY

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.02 DESCRIPTION OF WORK:

- A. Extent of each type of masonry work is indicated on drawings and schedule.
- B. Types of masonry work required include:
 - 1. Concrete Masonry Unit Construction.

1.03 QUALITY ASSURANCE:

- A. Single Source Responsibility for Masonry Units: Obtain exposed masonry units of uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from one manufacturer for each different product required for each continuous surface or visually related surfaces.
- B. Single Source Responsibility for Mortar Materials: Obtain mortar ingredients of uniform quality, including color for exposed masonry, from one manufacturer for each cementitious component and from one source and producer for each aggregate.

1.04 SUBMITTALS:

- A. Product Data: Submit manufacturer's conflicts for each type of masonry unit, that each type complies with specified requirements:
 - 1. ASTM C140.
 - 2. ASTM C780 for mortar types.

1.05 DELIVERY, STORAGE, AND HANDLING:

- A. Deliver masonry materials to project in undamaged condition.
- B. Store and handle masonry units to prevent their deterioration or damage due to moisture, temperature changes, contaminants, corrosion or other causes.

- C. Limit moisture absorption of concrete masonry units during delivery and until time of installation to the maximum percentage specified for Type I units for the average annual relative humidity as reported by the U.S. Weather Bureau Station nearest project site.
- D. Store cementitious materials off the ground, under cover and in dry location.
- E. Store aggregates where grading and other required characteristics can be maintained.
- F. Store masonry accessories including metal items to prevent deterioration by corrosion and accumulation of dirt.
- G. Yard age concrete masonry units a minimum of 30 days prior to delivery to the job site.

1.06 PROJECT CONDITIONS:

- A. Protection of Work: During erection, cover top of walls with waterproof sheeting at end of each day's work. Cover partially completed structures when work is not in progress.
- B. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.
- C. Do not apply uniform floor or roof loading for at least 12 hours after building masonry walls or columns.
- D. Do not apply concentrated loads for at least 3 days after building masonry walls or columns.
- E. Staining: Prevent grout or mortar or soil from staining the face of masonry to be left exposed or painted. Remove immediately grout or mortar in contact with such masonry.
- F. Protect base of walls from rain-splashed mud and mortar splatter by means of coverings spread on ground and over wall surface.
- G. Protect sills, ledges and projections from droppings of mortar.
- H. Cold Weather Protection:
 - 1. Do not lay masonry units which are wet or frozen.
 - 2. Remove any ice or snow formed on masonry bed by carefully applying heat until top surface is dry to the touch.
 - 3. Remove masonry damaged by freezing conditions.

- I. Perform the following construction procedures while masonry work is progressing. Temperature ranges indicated below apply to air temperatures existing at time of installation except for grout. For grout, temperature ranges apply to anticipated minimum night temperatures. In heating mortar and grout materials, maintain mixing temperature selected within 10° F (6°C).
1. 40°F (4°C) to 32°F (0°C):
 - a. Mortar: Heat mixing water to produce mortar temperature between 40°F (4°C) and 120°F (49°C).
 - b. Grout: Follow normal masonry procedures.
 2. 32°F (0°C) to 25°F (-4°C):
 - a. Mortar: Heat mixing water and sand to produce mortar temperatures between 40°F (4°C) and 120°F (49°C); maintain temperature of mortar on boards above freezing.
 - b. Grout: Heat grout materials to 90°F (32°C) to produce in-place grout temperature of 70°F (21°C) at end of work day.
 3. 25°F (-4°C) to 20°F (-7°C):
 - a. Mortar: Heat mixing water and sand to produce mortar temperatures between 40°F (4°C) and 120°F (49°C); maintain temperature of mortar on boards above freezing.
 - b. Grout: Heat grout materials to 90°F (32°C) to produce in-place grout temperature of 70°F (21°C) at end of work day.
 - c. Heat both sides of walls under construction using salamanders or other heat sources.
 - d. Use windbreaks or enclosures when wind is in excess of 15 mph.
 4. 20°F (-7°C) and below:
 - a. Mortar: Heat mixing water and sand to produce mortar temperatures between 40°F (4°C) and 120°F (49°C).
 - b. Grout: Heat grout materials to 90°F (32°C) to produce in-place grout temperature of 70°F (21°C) at end of work day.
 - c. Masonry Units: Heat masonry units so that they are above 20°F (-7°C) at time of laying.
 - d. Provide enclosure and auxiliary heat to maintain an air temperature of at least 40°F (4°C) for 24 hours after laying units.
 5. Do not heat water for mortar and grout to above 160°F (71°C).
- J. Protect completed masonry and masonry not being worked on in the following manner. Temperature ranges indicated apply to mean daily air temperatures except for grouted masonry. For grouted masonry, temperatures ranges apply to anticipated minimum night temperatures.
1. 40°F (4°C) to 32°F (0°C):
 - a. Protect masonry from rain or snow for at least 24 hours by covering with weather-resistive membrane.
 2. 32°F (0°C) to 25°F (-4°C):
 - a. Completely cover masonry with weather-resistive membrane for at least 24 hours.

3. 25°F (-4°C) to 20°F (-7°C):
 - a. Completely cover masonry with weather-resistive insulating blankets or similar protection for at least 24 hours, 48 hours for grouted masonry.
4. 20°F (-7°C) and below:
 - a. Except as otherwise indicated, maintain masonry temperature above 32°F (0°C) for 24 hours using enclosures and supplementary heat, electric heating blankets, infrared lamps or other methods proven to be satisfactory. For grouted masonry maintain heated enclosure to 40°F (4°C) for 48 hours.

PART 2 - PRODUCTS

2.01 CONCRETE MASONRY UNITS: (Light weight Concrete Block – see Struct. Dwgs.)

- A. General: Comply with referenced standards and other requirements indicated below applicable to each form of concrete masonry unit required.
- B. Provide special shapes where required for lintels, corners, jambs, sash, control joints, headers, bonding and other special conditions.
 1. Provide square-edged units for outside corners, except where indicated as bullnose.
- C. Concrete Block: Provide units complying with characteristics indicated below for Grade, Type, face size, exposed face and, under each form of block included, for weight classification.
 1. Grade N.
 2. Size: Manufacturer's standard units with nominal face dimensions of 16" long x 8" high (15-5/8" x 7-5/8" actual) x thicknesses indicated.
 3. Strength: f'm = 1500 psi
- D. Type I, moisture-controlled units.
- E. Exposed Faces: Manufacturer's standard color and texture. Refer to Exterior Building Elevations for specific style and color locations.
- F. Hollow Load-Bearing Block: ASTM C 90 and as follows:
 1. Weight Classification: Normal weight.
- G. Solid Load bearing Block: ASTM C 145 and as follows:
 1. Weight Classification: Normal weight.

2.02 MORTAR AND GROUT MATERIALS:

- A. Portland Cement: ASTM C 150, Type I, except Type III may be used for cold weather construction. Provide natural color mortar.

- B. Hydrated Lime: ASTM C 207, Type S.
- C. Aggregate for Mortar: ASTM C 144, except for joints less than 1/4" use aggregate graded with 100% passing the No. 16 sieve.
- D. Aggregate for Grout: ASTM C 404.
- E. Water: Clean and potable.
- F. Pre-mixed mortar: Spec mix reblended materials will be accepted in lieu of site mixed materials.

2.03 JOINT REINFORCEMENT, TIES AND ANCHORING DEVICES:

- A. Materials: Comply with requirements indicated below for basic materials and with requirements indicated under each form of joint reinforcement, tie and anchor for size and other characteristics:
 - 1. Hot-Dip Galvanized Steel Wire: ASTM A 82 for uncoated wire and with ASTM A 123, Class B-2 (1.5 oz. per sq. ft. of wire surface) for zinc coating applied after prefabrication into units.
 - 2. Zinc-Coated (Galvanized) Steel Sheet: Carbon steel with zinc coating complying with ASTM A 525, Coating Designation G90.
- B. Joint Reinforcement: Provide welded-wire units prefabricated with deformed continuous side rods and plain cross rods into straight lengths of not less than 10', with prefabricated corner and tee units, and complying with requirements indicated below:
 - 1. Width: Fabricate joint reinforcement in units with widths of approximately 2" less than nominal width of walls and partitions as required to provide mortar coverage of not less than 5/8" on joint faces exposed to exterior and 1/2" elsewhere.
 - 2. Wire Size for Cross Rods: 0.1875" diameter.
 - 3. For Single-wythe masonry provide type as follows with single pair of side rods:
 - a. Ladder design with perpendicular cross rods spaced not more than 16" o.c.
- C. Anchor Bolts: Provide steel bolts with hex nuts and flat washers complying with ASTM A 307, Grade A, hot-dip galvanized to comply with ASTM C 153, Class C, in sizes and configurations indicated.

2.04 MISCELLANEOUS MASONRY ACCESSORIES:

- A. Loose Fill Insulation: Perlite or Vermiculite-poured type for ungrouted cells of masonry units, ASTM C516, Type II, Grade 3 in cold climates.

- B. Non-Metallic control Joint Strips: Premolded, flexible cellular neoprene rubber or polyvinyl chloride filler strips complying with ASTM D 1056.
- C. Bond Breaker Strips: Asphalt-saturated organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).
- D. Weepholes: Polyethylene plastic tubes, 1/4" round, 4" long.

2.05 MASONRY CLEANERS:

- A. Products: Subject to compliance with requirements, provide the following:
 - 1. "Sure Klean" No. 600 Detergent; ProSoCo, Inc.

2.06 MORTAR AND GROUT MIXES:

- A. General: Do not add admixtures including coloring pigments, air-entraining agents, accelerators, retarders, water repellent agents, anti-freeze compounds or other admixtures, unless otherwise indicated.
 - 1. Do not use calcium chloride in mortar or grout.
- B. Mixing: Combine and thoroughly mix cementitious, water and aggregates in a mechanical batch mixer; comply with referenced ASTM standards for mixing time and water content.
- C. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification, for types of mortar required, unless otherwise indicated.
- D. Limit cementitious materials in mortar to Portland cement-lime.
- E. Use Type M mortar for masonry below grade and in contact with earth, and where indicated.
- F. Use Type S mortar for reinforced masonry and where indicated.
- G. Use Type N mortar for exterior, above grade loadbearing and non-loadbearing walls; for interior loadbearing walls; and for other applications where another type is not indicated.
- H. Grout for Unit Masonry: Comply with ASTM C 476 for grout for use in construction of reinforced and nonreinforced unit masonry. Use grout of consistency indicated or if not otherwise indicated, of consistency (fine or coarse) at time of placement which will completely fill all spaces intended to receive grout. Provide grout with a minimum 28 day compressive strength of 2000 psi.
 - 1. Use fine grout in grout spaces less than 2" in horizontal direction, unless otherwise indicated.

2. Use coarse grout in grout spaces 2" or more in least horizontal dimension, unless otherwise indicated.

2.07 MASONRY SEALERS:

- A. Products: Subject to compliance with requirements, provide the following:
 1. Provide Clear Sealer: ALKYLALKOXY Silane 40%, Tamms Industries "Baracade Silane 40," Hydrozo, Inc. "Hydrozo 40," or L&M Construction Chemicals "Aquapel

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL:

- A. Use dry cutting saws to cut concrete masonry units.

3.02 CONSTRUCTION TOLERANCES:

- A. Variation from Plumb: For vertical lines and surfaces of columns, walls and arises do not exceed 1/4" in 10', or 3/8" in a story height not to exceed 20', nor 1/2" in 40' or more. For external corners, expansion joints, control joints and other conspicuous lines, do not exceed 1/4" in any story or 20' maximum, nor 1/2" in 40' or more. For vertical alignment of head joints do not exceed plus or minus 1/4" in 10', 1/2" maximum.
- 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" in any bay or 20' maximum, nor 1/2" in 40' or more. For top surface of bearing walls do not exceed 1/8" between adjacent floor elements in 10' or 1/16" within width of a single unit.
- C. Variation of Linear Building Line: For position shown in plan and related portion of columns, walls and partitions, do not exceed 1/2" in any bay or 20' maximum, nor 3/4" in 40' or more.
- D. Variation in Cross-Sectional Dimensions: For columns and thickness of walls, from dimensions shown, do not exceed minus 1/4" nor plus 1/2".
- E. Variation in Mortar Joint Thickness: Do not exceed bed joint thickness indicated by more than plus or minus 1/8", with a maximum thickness limited to 1/2". Do not exceed head joint thickness indicated by more than plus or minus 1/8".

3.03 LAYING MASONRY WALLS:

- A. Layout walls in advance for accurate spacing of surface bond patterns with

uniform joint widths and to accurately locate openings, movement-type joints, returns and offsets. Avoid the use of less-than-half-size units at corners, jambs and wherever possible at other locations.

- B. Lay-up walls to comply with specified construction tolerances, with courses accurately spaced and coordinated with other work.
- C. Pattern Bond; Lay exposed masonry in running bond with vertical joint in each course centered on units in courses above and below. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 2". Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4" horizontal face dimensions at corners or jambs.
- D. Stopping and Resuming Work: Rack back $\frac{1}{2}$ -unit length in each course. Do not tooth. Clean exposed surfaces of set masonry, wet units lightly (if required) and remove loose masonry units and mortar prior to laying fresh masonry.
- E. Built-in Work: As the work progresses, build-in items specified under this and other sections of these specifications. Fill in solidly with masonry around built-in items.
 - 1. Fill space between hollow metal frames and masonry solidly with mortar, unless otherwise indicated.
 - 2. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath in the joint below and rod mortar or grout into core.
 - 3. Fill cores in hollow concrete masonry units with grout 3 courses (24") under bearing plates, beams, lintels, posts and similar items, unless otherwise indicated.

3.04 MORTAR BEDDING AND JOINTING:

- A. Lay hollow concrete masonry units with full mortar coverage on horizontal and vertical face shells. Bed webs in mortar in starting course on footings and in all courses of piers, columns and pilasters, and where adjacent to cells or cavities to be reinforced or filled with concrete or grout. For starting course on footings where cells are not grouted, spread out full mortar bed including areas under cells.
- B. Tool exposed joints slightly concave using a jointer larger than joint thickness, unless otherwise indicated.
- C. Remove masonry units disturbed after laying; clean and reset in fresh mortar. Do not pound corners or jambs to shift adjacent stretcher units which have

been set in position. If adjustments are required, remove units, clean off mortar and reset in fresh mortar.

- D. Collar Joints: After each course is laid, fill the vertical longitudinal joint between wythes solidly and with mortar for the following masonry work:
 - 1. All exterior walls, except cavity walls, and interior walls and partitions.

3.05 HORIZONTAL JOINT REINFORCEMENT:

- A. General: Provide continuous horizontal joint reinforcement as indicated. Install longitudinal side rods in mortar for their entire length with a minimum cover of 5/8" on exterior side of walls, 1/2" elsewhere. Lap reinforcing a minimum of 6".
- B. Cut or interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.
- C. Reinforce walls with continuous horizontal joint reinforcing unless specifically noted to be omitted.
- D. Reinforce the following walls with continuous horizontal joint reinforcement:
 - 1. Single wythe walls.
 - 2. Hollow concrete masonry walls.
- E. Provide continuity at corners and wall intersections by use of prefabricated "L" and "T" sections. Cut and bend reinforcement units as directed by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures and other special conditions.
- F. Space continuous horizontal reinforcement as follows:
 - 1. For single-wythe walls, space reinforcement at 16" o.c. vertically, unless otherwise indicated.
 - 2. For parapets, space reinforcement at 8" o.c. vertically, unless otherwise indicated.
- G. In addition to wall reinforcement, provide additional reinforcement at openings as required to comply with the above.

3.06 ANCHORING MASONRY WORK:

- A. General: Provide anchor devices of type indicated.
- B. 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" in width between masonry and structural member, unless otherwise indicated. Keep open space free of mortar or other rigid materials.
 - 2. Anchor masonry to structural members with flexible anchors embedded in masonry joints and attached to structure.

3. Space anchors as indicated but not more than 16" o.c. vertically and 24" o.c. horizontally. Install additional anchors within 1'-0" of openings and at intervals around perimeter not exceeding 3'-0".

3.07 CONTROL AND EXPANSION JOINTS:

- A. General: Provide vertical and horizontal expansion, control and isolation joints in masonry where shown, but no further than 25'-0" maximum apart. Build-in related items as the masonry work progresses.
- B. Build flanges of metal expansion strips into masonry. Lap each joint 4" in direction of water flow. Seal joints below grade and at junctures with horizontal expansion joints, if any.
- C. Build flanges of factory-fabricated expansion joint units into masonry. See Division-7 section "Elastic Expansion Joints".
- D. Build-in non-metallic joint fillers where indicated.
- E. Build in horizontal pressure relieving joints where indicated; construct joints by either leaving an air space or inserting non-metallic compressible joint filler of width required to permit installation of sealant and backer rod.
- F. Locate horizontal pressure relieving joints beneath shelf angles supporting masonry veneer and attached to structure behind masonry veneer.

3.08 BOND BEAMS:

- A. Install bond where indicated on the drawings.
- B. Provide continuous bond beams over adjacent openings. Place control joints above and below bond beams as indicated.

3.09 INSULATION

- A. Insulate exterior masonry walls. Pour loose fill insulation into ungrouted voids in lifts not to exceed 16 inches vertically. Rod well to assure complete filling before laying subsequent course.

3.10 FIELD QUALITY CONTROL:

- A. Grout Tests: For each type indicated, test grout for compressive strength as it is placed.
- B. Report test results in writing and in form specified under each test method, to Architect and Contractor, on same day tests are made.

- C. Evaluation of Quality Control Tests: Masonry work, in absence of other indications of noncompliance with requirements, will be considered satisfactory if results from construction quality control tests comply with minimum requirements indicated.

3.11 REPAIR, POINTING AND CLEANING:

- A. Remove and replace masonry units which are loose, chipped, broken, stained or otherwise damaged, or if units do not match adjoining units as intended. Provide new units to match adjoining units and install in fresh mortar or grout, pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge any voids or holes, except weepholes, and completely fill with mortar. Point- up all joints including corners, openings and adjacent work to provide a neat, uniform appearance, prepared for application of sealants.
- C. Final Cleaning: After mortar is thoroughly set and cured, clean masonry as follows:
 - 1. Remove large mortar particles by hand with wooden paddles and non-metallic scrape hoes or chisels.
 - 2. Protect adjacent non-masonry surfaces from contact with cleaner by covering them with liquid strippable masking agent, polyethylene film or waterproof masking tape.
 - 3. Saturate wall surfaces with water prior to application of cleaners; remove cleaners promptly by rinsing thoroughly with clear water.
 - 4. Use bucket and brush hand cleaning method to clean masonry surfaces:
 - a. Pre-manufactured cleaner; apply in compliance with directions of cleaner manufacturer.
 - 5. Clean concrete unit masonry to comply with masonry manufacturer's directions and applicable NCMA "Tek" bulletins.
- D. Protection: Provide final protection and maintain conditions in a manner acceptable to Installer, which ensures unit masonry work being without damage and deterioration at time of substantial completion.

3.12 SEALING:

- A. After exterior masonry surfaces have been thoroughly cleaned and pointed, apply a minimum of two (2) coats of waterproofing agent in accordance with the manufacturer's instructions and recommendations. Manufacturer's local representatives shall be present at the beginning of sealing application, and shall report to the Architect to record his observations promptly after the startup.
- B. Comply with manufacturer's instructions and recommendations, using airless

spraying procedure unless otherwise indicated.

- C. The intent of these specifications is for a complete weathertight and waterproof wall. If after the specified number of coats are applied, adequate weather-resistant and waterproofing have not been achieved, it shall be this subcontractor's responsibility to apply additional coats until acceptable performance has been obtained.

END OF SECTION

SECTION 04230

REINFORCED UNIT MASONRY

PART 1 - GENERAL

1.02 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. Requirements of Section "Unit Masonry" apply to work of this section.

1.02 DESCRIPTION OF WORK:

- A. Extent of each type of reinforced unit masonry work is indicated on drawings and in schedules.

1.03 SUBMITTALS:

- A. Shop Drawings: Submit shop drawings for fabrication, bending, and placement of reinforcement bars. Comply with ACI 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures". Show bar schedules, diagrams of bent bars, stirrup spacing, lateral ties and other arrangements and assemblies as required for fabrication and placement of reinforcement for unit masonry work.

PART 2 - PRODUCTS

2.01 MATERIALS:

- A. General: Refer to Section "Unit Masonry" for masonry materials and accessories not included in this section.
- B. Reinforcement Bars: Provide deformed bars of following grades complying with ASTM A 615, except as otherwise indicated.
- C. Provide Grade 40 for bars No. 3, Grade 60 for No. 4 to No. 18, except as otherwise indicated.
- D. Shop-fabricate reinforcement bars which are shown to be bent or hooked.

PART 3 - EXECUTION

3.01 PLACING REINFORCEMENT:

- A. General: Clean reinforcement of loose rust, mill scale, earth, ice or other materials which will reduce bond to mortar or grout. Do not use reinforcement bars with kinks or bends not shown on drawings or final shop drawings, or bars with reduced cross- section due to excessive rusting or other causes.
- B. Position reinforcement accurately at the spacing indicated. Support and secure vertical bars against displacement. Horizontal reinforcement may be placed as the masonry work progresses. Where vertical bars are shown in close proximity, provide a clear distance between bars of not less than the nominal bar diameter or 1" (whichever is greater).
- C. Splice reinforcement bars where shown; do not splice at other points unless acceptable to the Architect. Provide lapped splices, unless otherwise indicated. In splicing vertical bars or attaching to dowels, lap ends, place in contact and wire tie.
 - 1. Provide not less than minimum lap shown, or if not indicated, as required by governing code.
- D. Weld splices where indicated. Comply with the requirements of AWS D1.4 for welding materials and procedures.
- E. Embed prefabricated horizontal joint reinforcement as the work progresses, with a minimum cover of 5/8" on exterior face of walls and 1/2" at other locations. Lap units not less than 6" at ends. Use prefabricated "L" and "T" units to provide continuity at corners and intersections. Cut and bend units as recommended by manufacturer for continuity at returns, offsets, column fire- proofing, pipe enclosures and other special conditions.
- F. Anchoring: Anchor reinforced masonry work to supporting structure as indicated.
 - 1. Anchor reinforced masonry walls to non-reinforced masonry where they intersect.

3.02 INSTALLATION, GENERAL:

- A. Temporary Formwork: Provide formwork and shores as required for temporary support of reinforced masonry elements.
 - 1. Construct formwork to conform to shape, line and dimensions shown. Make sufficiently tight to prevent leakage of mortar grout, or concrete (if any). Brace, tie and support as required to maintain position and shape during construction and curing of reinforced masonry.

- B. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and all other reasonable temporary loads that may be placed on them during construction.

3.03 INSTALLATION OF REINFORCED CONCRETE UNIT MASONRY:

A. General:

1. Do not wet concrete masonry units (CMU).
2. Lay CMU units with full-face shell mortar beds. Fill vertical head joints (end joints between units) solidly with mortar from face of unit to a distance behind face equal to not less than the thickness of longitudinal face shells. Solidly bed cross-webs of starting courses in mortar. Maintain head and bed joint widths shown, or if not shown, provide 3/8" joints.
 - a. Where solid CMU units are shown, lay with full mortar head and bed joints.

B. Walls:

1. Pattern Bond: Lay CMU wall units in ½-running bond with vertical joints in each course centered on units in courses above and below, unless otherwise indicated. Bond and interlock each course at corners and intersections. Use special-shaped units where shown, and as required for corners, jambs, sash, control joints, lintels, bond beams and other special conditions.
2. Maintain vertical continuity of core or cell cavities, which are to be reinforced and grouted, to provide minimum clear dimensions indicated and to provide minimum clearance and grout coverage for vertical reinforcement bars. Keep cavities free of mortar. Solidly bed webs in mortar where adjacent to reinforced cores or cells.
3. Where horizontal reinforced beams (bond beams) are shown, use special units or modify regular units to allow for placement of continuous horizontal reinforcement bars. Place small mesh expanded metal lath or wire screening in mortar joints under bond beam courses over cores or cells of non-reinforced vertical cells, or provide units with solid bottoms.

C. Grouting:

1. Use "Fine Grout" per ASTM C 476 for filling spaces less than 4" in one or both horizontal directions.
2. Use "Coarse Grout" per ASTM C 476 for filling 4" spaces or larger in both horizontal directions.
3. Grouting Technique: At the Contractor's option, use either low- lift or high-lift grouting techniques subject to requirements which follow.

- D. Low-Lift Grouting:
1. Provide minimum clear dimension of 2" and clear area of 8 sq. in. in vertical cores to be grouted.
 2. Place vertical reinforcement prior to laying of CMU. Extend above elevation of maximum pour height as required for splicing. Support in position at vertical intervals not exceeding 192 bar diameters nor 10 ft.
 3. Lay CMU to maximum pour height. Do not exceed 4' height, or if bond beam occurs below 4' height stop pour at course below bond beam.
 4. Pour grout using chute or container with spout. Rod or vibrate grout during placing. Place grout continuously; do not interrupt pouring of grout for more than one hour. Terminate grout pours 1-1/2" below top course of pour.
 5. Bond Beams: Stop grout in vertical cells 1-1/2 " below bond beam course. Place horizontal reinforcement in bond beams; lap at corners and intersections as shown. Place grout in bond beam course before filling vertical cores above bond beam.
- E. High-Lift Grouting:
1. Do not use high-lift grouting technique for grouting of CMU unless minimum cavity dimension and area is 3" and 10 sq. in., respectively.
 2. Provide cleanout holes in first course at all vertical cells which are to be filled with grout.
 - a. Use units with one face shell removed and provide temporary supports for units above, or use header units with concrete brick supports, or cut openings in one face shell.
 3. Construct masonry to full height of maximum grout pour specified, prior to placing grout.
 - a. Limit grout lifts to a maximum height of 8', for single wythe hollow concrete masonry walls, unless otherwise indicated.
- F. Place vertical reinforcement before grouting. Place before or after laying masonry units, as required by job conditions. Tie vertical reinforcement to dowels at base of masonry where shown and thread CMU over or around reinforcement. Support vertical reinforcement at intervals not exceeding 192 bar diameters nor 10'.
1. Where individual bars are placed after laying masonry, place wire loops extending into cells as masonry is laid and loosen before mortar sets. After insertion of reinforcement bar, pull loops and bar to proper position and tie free ends.
- G. Where reinforcement is prefabricated into cage units before placing, fabricate units with vertical reinforcement bars and lateral ties of the size and spacing indicated.

- H. Place horizontal beam reinforcement as the masonry units are laid.
- I. Embed lateral tie reinforcement in mortar joints where indicated. Place as masonry units are laid, at vertical spacing shown.
 - 1. Where lateral ties are shown in contact with vertical reinforcement bars, embed additional lateral tie reinforcement in mortar joints. Place as shown, or if not shown, provide as required to prevent grout blowout or rupture of CMU face shells, but provide not less than No. 2 bars or 8-gage wire ties spaced 16" o.c. for members with 20" or less side dimensions, and 8" o.c. for members with side dimensions exceeding 20".
- J. Preparation of Grout Spaces: Prior to grouting, inspect and clean grout spaces. Remove dust, dirt, mortar droppings, loose pieces of masonry and other foreign materials from grout spaces via clean out holes. Clean reinforcing and adjust to proper position. Clean top surface of structural members supporting masonry to ensure bond. After final cleaning and inspection, close cleanout holes and brace closures to resist grout pressures.
- K. Do not place grout until entire height of masonry to be grouted has attained sufficient strength to resist displacement of masonry units and breaking of mortar bond. Install shores and bracing, if required, before starting grouting operations.
- L. Place grout by pumping into grout spaces unless alternate methods are acceptable to the Architect.
- M. Limit grout pours to sections which can be completed in one working day with not more than one hour interruption of pouring operation. Place grout in lifts which do not exceed 4'. Allow not less than 30 minutes, nor more than one hour between lifts of a given pour. Vibrate each grout lift during pouring operation.
 - 1. Place grout in lintels or beams over openings in one continuous pour.
- N. Where bond beam occurs more than one course below top of pour, fill bond beam course to within 1" of vertically reinforced cavities, during construction of masonry.
- O. When more than one pour is required to complete a given section of masonry, extend reinforcement beyond masonry as required for splicing. Pour grout to within 1-1/2" of top course of first pour. After grouted masonry is cured, lay masonry units and place reinforcement for second pour section before grouting. Repeat sequence if more pours are required.

3.04 FIELD QUALITY CONTROL:

- A. Test grout for compressive strength minimum (6) tests per long building walls, minimum (4) tests per short building walls.

END OF SECTION

SECTION 04700

MANUFACTURED MASONRY

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes: Manufactured stone veneer, manufactured stone trim and application materials.
- B. Related Sections:
 - 1. **Division 05, or 06 Section specifying weather resistant barrier over framed walls.**
 - 2. **Division 07 Section specifying flashing materials.**
 - 3. **Division 09 Section specifying portland cement plastering.**

1.02 REFERENCES

- A. American Concrete Institute (ACI).
- B. American Society for Testing and Materials (ASTM):
 - 1. ASTM C 39, Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
 - 2. ASTM C 67, Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile.
 - 3. ASTM C 177, Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.
 - 4. ASTM C 192, Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory.
 - 5. ASTM C 270, Standard Specification for Mortar for Unit Masonry.
 - 6. ASTM C 482, Standard Test Method for Bond Strength of Ceramic Tile to Portland Cement.
 - 7. ASTM D 226, Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.
- C. International Code Council (ICC):
 - 1. ES Report.
 - 2. UBC Standard No. 14-1, Kraft Waterproof Building Paper.
- D. Masonry Standards Joint Committee (MSJC) of The Masonry Society.
- E. Underwriters Laboratories (UL):
 - 1. Listing in Material Approval Guide.
 - 2. UL 723, Standard for Safety for Surface Burning Characteristics of Building Materials.

1.03 SUBMITTALS

- A. Reference Section 01300–Submittal Procedures; submit following items:
 - 1. Product Data: Manufactured masonry and application materials **including mortar color charts, and weather resistant barrier.**
 - 2. Samples: Panel containing full-size samples of specified manufactured masonry showing full range of colors and textures **complete with specified mortar.**
 - a. Actual size of masonry sample approximately 12 by 12 inches (300 by 300 mm).
 - 3. Quality Assurance/Control Submittals:
 - a. Qualifications:
 - 1) Proof of manufacturer qualifications.
 - 2) Proof of installer qualifications.
 - b. Certificates: ICC-ES Report.
 - c. **Test Reports for physical properties.**
 - d. Manufacturer’s Installation Instructions.
- B. Closeout Submittals: Reference Section 01700–Closeout Submittals; submit following items:
 - 1. Maintenance Instructions.
 - 2. Special Warranties.

1.04 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Manufacturer Qualifications:
 - a. Minimum five years experience in producing manufactured masonry.
 - b. Member of following organizations:
 - 1) MSJC.
 - 2) ACI.
 - 3) ASTM.
 - 2. Installer Qualifications: Company with documented experience in installation of manufactured masonry including minimum 5 projects within 400 mile radius of this Project.
- B. Certifications:
 - 1. Current ICC-ES Report.
 - 2. UL: Listing in Material Approval Guide.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Reference Section 01600–Product Storage and Handling Requirements.
- B. Follow manufacturer’s instructions.
- C. Store moisture-sensitive materials in weather protected enclosures.

1.06 PROJECT/SITE CONDITIONS

- A. Environmental Requirements: Maintain materials and ambient temperature in area of installation at minimum 40 degrees F (4 degrees C) prior to, during, and for 48 hours following installation.

1.07 WARRANTY

- A. Special Warranty: Provide manufacturer's standard limited warranty against defects in manufacturing for a period of 50 years following date of Substantial Completion.

1.08 MAINTENANCE

- A. Extra Materials: Furnish extra manufactured stone material in a variety of shapes and sizes in quantity equal to three percent of the installed stone.

PART 2 - PRODUCTS

2.01 MANUFACTURER

- A. As shown on the drawings.
- B. Substitutions: None permitted.

2.02 MANUFACTURED MASONRY MATERIALS

- A. Stone: As specified on drawings.
- B. Architectural Trim: As specified on drawings.
- C. Manufactured Masonry Physical Properties:
 - 1. Compressive Strength: ASTM C 192 and ASTM C39, 1800 psi (12.4 MPa), 5 specimen average, 1500 psi (10.3 MPa) minimum for individual unit.
 - 2. Bond Between Stone Unit, Type S Mortar, and Backing: ASTM C 482, 50 psi (345 kPa).
 - 3. Thermal Resistance: ASTM C 177, R-factor, 0.355 per inch (25.4 mm) of thickness.
 - 4. Freeze/Thaw: ASTM C 67, no disintegration and less than 3 percent weight loss.
 - 5. Fire Hazard Test, UL 723:
 - a. Flame spread: 0.
 - b. Smoke Development: 0.
 - 6. Maximum Veneer Unit Weight: 15 psf (73 kg/m²).

2.03 RELATED MATERIALS

- A. Weather Resistant Barrier: Kraft waterproof building paper, UBC Standard No. 14-1.
- B. Metal Lath: 2.5 lb (1.4 kg/m²) galvanized expanded metal lath.
- C. Fasteners:
 - 1. **Into Wood Studs: Minimum 0.120 inch (3 mm) shank diameter galvanized nails or staples of sufficient length to penetrate 1-3/8 inches (35 mm) minimum into the stud.**
 - 2. **Into Metal Studs: Minimum 7/16 inch (11.1 mm) head diameter, corrosion-resistant, self-drilling, self tapping, pancake head screws of sufficient length to penetrate 3/8 inch (10 mm) minimum into the stud.**

- D. Mortar: Premixed Type N or mortar mixed using components and proportions following manufactured masonry manufacturer's installation instructions. Comply with ASTM C 270.
 - 1. **Mortar Color: Iron oxide pigments.**

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates upon which manufactured masonry will be installed.
- B. Coordinate with responsible entity to correct unsatisfactory conditions.
- C. Commencement of work by installer is acceptance of substrate conditions.

3.02 PREPARATION

- A. Protection: Prevent work from occurring on the opposite of walls to which manufactured masonry is applied during and for 48 hours following installation of the manufactured masonry.
- B. Surface Preparation: Follow manufacturer's instructions designated below for the appropriate type of manufactured masonry and substrate.

3.03 INSTALLATION

- A. **Install faux stone products in accordance with manufacturer's installation instructions using grouted joints.**
- B. **Install architectural trim products in accordance with manufacturer's installation instructions.**
- C. **Install/Apply Related Materials specified above in accordance with type of substrate and manufactured masonry manufacturer's installation instructions.**

3.04 CLEANING

- A. Reference Section 01 74 00—Cleaning and Waste Management.
- B. Clean manufactured masonry in accordance with manufacturer's installation instructions.

3.05 PROTECTION

- A. Protect finished work from rain during and for 48 hours following installation.
- B. Protect finished work from damage during remainder of construction period.

END OF SECTION

DIVISION 5

METALS

SECTION 05120
STRUCTURAL STEEL

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.02 SUMMARY:

- A. Extent of structural steel work is shown on drawings, including schedules, notes and details to show size and location of members, typical connections, and type of steel required.
- B. Structural steel is that work defined in American Institute of Steel Construction (AISC) "Code of Standard Practice" and as otherwise shown on drawings.
- C. Miscellaneous Metal Fabrications are specified elsewhere in Division 5. Refer to Division 3 for anchor bolt installation in concrete; Division 4 for masonry.
- D. Source Quality Control: Materials and fabrication procedures are subject to inspection in mill, shop, and field, conducted by a qualified inspection agency. Such inspections, if performed, will not relieve Contractor of responsibility for providing materials and fabrication procedures in compliance with specified requirements.
 - 1. Promptly remove and replace materials or fabricated components which do not comply.
- E. Design of Members and Connections: Details shown are typical; similar details apply to similar conditions, unless otherwise indicated. Verify dimensions at site whenever possible without causing delay in the work.
 - 1. Promptly notify Architect whenever design of members and connections for any portion of structure are not clearly indicated.

1.03 SUBMITTALS:

- A. Shop Drawings: Submit shop drawings including complete details and schedules for fabrication and assembly of structural steel members, procedures and diagrams.

1. Include details of cuts, connections, camber, holes, and other pertinent data. Indicate welds by standard AWS A2.1 and A2.4 symbols, and show size, length, and type of each weld.
 - a. Provide setting drawings, templates, and directions for installation of anchor bolts and other anchorages to be installed as work of others sections.

1.04 QUALITY ASSURANCE:

- A. Codes and Standards: Comply with provisions of following, except as otherwise indicated:
 1. AISC "Code of Standard Practice for Steel Buildings and Bridges".
 2. AISC "Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings", including "Commentary" and Supplements thereto as issued.
 3. AISC "Specifications for Architecturally Exposed Structural Steel".
 4. AISC "Specifications for Structural Joints using ASTM A 325 or A 490 Bolts" approved by the Research Council on Riveted and Bolted Structural Joints of the Engineering Foundation.
 5. American Welding Society (AWS) D1.1 "Structural Welding Code - Steel".
 6. ASTM A 6 "General Requirements for Delivery of Rolled Steel Plates, Shapes, Sheet Piling and Bars for Structural Use".
- B. Qualifications for Welding Work: Qualify welding processes and welding operators in accordance with AWS "Standard Qualification Procedure".
 1. Provide certification that welders to be employed in work have satisfactorily passed AWS qualification tests.
 - a. If recertification of welders is required, retesting will be Contractor's responsibility.

1.05 DELIVERY, STORAGE AND HANDLING:

- A. Deliver materials to site at such intervals to insure uninterrupted progress of work.
- B. Deliver anchor bolts and anchorage devices, which are to be embedded in cast-in-place concrete or masonry, in ample time to not to delay work.
- C. Store materials to permit easy access for inspection and identification. Keep steel members off ground, using pallets, platforms, or other supports. Protect steel members and packaged materials from erosion and deterioration.
 1. Do not store materials on structure in a manner that might cause distortion or damage to members or supporting structures. Repair or replace damaged materials or structures as directed.

PART 2 - PRODUCTS

2.01 MATERIALS:

- A. Metal Surfaces, General: For fabrication of work which will be exposed to view, use only materials which are smooth and free of surface blemishes including pitting, rust and scale seam marks, roller marks, rolled trade names and roughness. Remove such blemishes by grinding, or by welding and grinding, prior to cleaning, treating and application of surface finishes.
- B. Structural Steel Shapes, Plates and Bars: See Struct Dwgs. for Specifications.
- C. Cold-Formed Steel Tubing: ASTM A 500, Grade B.
- D. Hot-Formed Steel Tubing: ASTM A 501.
- E. Steel Pipe: ASTM A 53, Type E or S, Grade B; or ASTM A 501.
- F. Anchor Bolts: ASTM A 307, headed type unless otherwise indicated.
ASTM A325-N, headed type at moment frame columns.
- G. Unfinished Threaded Fasteners: ASTM A 325N, Grade A,
 - 1. Provide either hexagonal or square, heads and nuts, except use only hexagonal units for exposed connections.
- H. Electrodes for Welding: Comply with AWS Code.
- I. Structural Steel Primer Paint: Free of lead and zinc chromate, V.O.C. compliant, FS-TT-P636, Red.
- J. Non-metallic Shrinkage-Resistant Grout: Pre-mixed, non-metallic, non-corrosive, non-staining product containing selected silica sands, Portland cement, shrinkage compensating agents, plasticizing and water reducing agents.
 - 1. Products: Subject to compliance with requirements, provide one of the following or accepted equivalent product:
 - a. Euco N.S.; Euclid Chemical Co.
 - b. Crystex; L&M Construction Chemicals
 - c. Masterflow 713, Master Builders

2.02 FABRICATION:

- A. Shop Fabrication and Assembly: Fabricate and assemble structural assemblies in shop to greatest extent possible. Fabricate items of structural steel in accordance with AISC Specifications and as indicated on final shop drawings. Provide camber in structural members where indicated.
 - 1. Properly mark and match-mark materials for field assembly. Fabricate for delivery sequence which will expedite erection and minimize field handling of materials.
 - 2. Where finishing is required, complete assembly, including welding of units, before start of finishing operations. Provide finish surfaces of members exposed in final structure free of markings, burrs, and other defects.
- B. Connections: Weld or bolt shop connections, as indicated. Bolt field connections, except where welded connections or other connections are indicated.
- C. Welded Construction: Comply with AWS Code for procedures, appearance and quality of welds, and methods used in correcting welding work. All welding shall be performed in an approved fabricator's shop.
- D. Holes for Other Work: Provide holes required for securing other work to structural steel framing, and for passage of other work through steel framing members, as shown on final shop drawings.
 - 1. Provide threaded nuts welded to framing, and other specialty items as indicated to receive other work.
 - 2. Cut, drill, or punch holes perpendicular to metal surfaces. Do not flame cut holes or enlarge holes by burning. Drill holes in bearing plates.

2.03 SHOP PAINTING:

- A. General: Shop paint structural steel, except those members or portions of members to be embedded in concrete or mortar. Paint embedded steel which is partially exposed on exposed portions and initial 2" of embedded areas only.
 - 1. Do not paint surfaces which are to be welded or high-strength bolted with friction-type connections.
 - 2. Do not paint surfaces which are scheduled to receive sprayed-on fireproofing.
- B. Surface Preparation: After inspection and before shipping, clean steelwork to be painted. Remove loose rust, loose mill scale, and spatter, slag or flux deposits. Clean steel in accordance with Steel Structures Painting Council (SSPC) as follows:
 - 1. SP-1 "Solvent Cleaning".
- C. Painting: Provide a one-coat shop applied paint system complying with Steel

PART 3 - EXECUTION

3.01 ERECTION:

- A. Surveys: Check elevations of concrete and masonry bearing surfaces, and locations of anchor bolts and similar devices, before erection work proceeds, and report discrepancies to Architect. Do not proceed with erection until corrections have been made, or until compensating adjustments to structural steel work have been agreed upon with Architect.
- B. Temporary Shoring and Bracing: Provide temporary shoring and bracing members with connections of sufficient strength to bear imposed loads. Remove temporary members and connections when permanent members are in place and final connections are made. Provide temporary guy lines to achieve proper alignment of structures as erection proceeds.
- C. Temporary Planking: Provide temporary planking and working platforms as necessary to effectively complete work.
- D. Setting Bases and Bearing Plates: Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen to improve bond to surfaces. Clean bottom surface of base and bearing plates.
 - 1. Set loose and attached base plates and bearing plates for structural members on wedges or other adjusting devices.
- E. Tighten anchor bolts after supported members have been positioned and plumbed. Do not remove wedges or shims, but if protruding, cut off flush with edge of base or bearing plate prior to packing with grout.
- F. Pack grout solidly between bearing surfaces and bases or plates to ensure that no voids remain. Finish exposed surfaces, protect installed materials, and allow to cure.
 - 1. For proprietary grout materials, comply with manufacturer's instructions.
- G. Field Assembly: Set structural frames accurately to lines and elevations indicated. Align and adjust various members forming part of complete frame or structure before permanently fastening. Clean bearing surfaces and other surfaces which will be in permanent contact before assembly. Perform necessary adjustments to compensate for discrepancies in elevations and

alignment.

1. Level and plumb individual members of structure within specified AISC tolerances.
 2. Establish required leveling and plumbing measurements on mean operating temperature of structure. Make allowances for difference between temperature at time of erection and mean temperature at which structure will be when completed and in service.
 3. Splice members only where indicated and accepted on shop drawings.
- H. Erection Bolts: On exposed welded construction, remove erection bolts, fill holes with plug welds and grind smooth at exposed surfaces.
- I. Comply with AISC Specifications for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.
1. Do not enlarge unfair holes in members by burning or by use of drift pins, except in secondary bracing members. Ream holes that must be enlarged to admit bolts.
- J. Gas Cutting: Do not use gas cutting torches in field for correcting fabrication errors in primary structural framing. Cutting will be permitted only on secondary members which are not under stress, as acceptable to Architect. Finish gas-cut sections equal to a sheared appearance when permitted.
- K. Touch-Up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint. Apply paint to exposed areas using same material as used for shop painting.
1. Apply by brush or spray to provide minimum dry film thickness of 1.5 mils.

3.02 QUALITY CONTROL:

- A. Engage an independent testing and inspection agency to inspect welded connections and to perform tests and prepare test reports, only if not covered by Bldg. Dept. or others. See Section 1400 of this specifications book for additional information.
- B. Testing agency shall conduct and interpret tests and state in each report whether test specimens comply with requirements, and specifically state any deviations therefrom.
- C. Provide access for testing agency to places where structural steel work is being fabricated or produced so that required inspection and testing can be accomplished.
- D. Testing agency may inspect structural steel at plant before shipment; however, Architect reserves right, at any time before final acceptance, to

reject material not complying with specified requirements.

- E. Correct deficiencies in structural steel work which inspections and laboratory test reports have indicated to be not in compliance with requirements. Perform additional tests, at Contractor's expense, as may be necessary to reconfirm any non-compliance of original work, and as may be necessary to show compliance of corrected work.
- F. Shop Bolted Connections: Inspect or test in accordance with AISC specifications.
- G. Field Welding: Inspect and test during erection of structural steel as follows:
 - 1. Certify welders and conduct inspections and tests as required. Record types and locations of defects found in work. Record work required and performed to correct deficiencies.
 - 2. Perform visual inspection of all field welds.
- H. Special inspections are required for the following:
 - 1. Full penetration welds.
 - 2. High strength bolted connections.

END OF SECTION

SECTION 05500

METAL FABRICATIONS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This section includes the following metal fabrications:
 - 1. Rough hardware.
 - 2. Ladders.
 - 3. Nosings.
 - 4. Loose bearing and leveling plates.
 - 5. Miscellaneous framing and supports for the following:
 - a. Overhead doors.
 - b. Applications where framing and supports are not specified in other sections.
 - 6. Miscellaneous steel trim.
 - 7. Shelf and relieving angles.
 - 8. Structural steel door frames for overhead doors.
 - 9. Pipe bollards.
- B. Related Sections: The following sections contain requirements that relate to this section:
 - 1. Division 5 Section "Structural Steel" for structural steel framing system components.

1.03 DEFINITIONS

- A. Definitions in ASTM E 985 for railing-related terms apply to this section.

1.04 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
- B. Product data for products used in miscellaneous metal fabrications, including paint products and grout.
- C. Shop drawings detailing fabrication and erection of each metal fabrication

indicated. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide templates for anchors and bolts specified for installation under other sections.

1.05 QUALITY ASSURANCE

- A. Fabricator Qualifications: Firm experienced in successfully producing metal fabrications similar to that indicated for this Project, with sufficient production capacity to produce required units without causing delay in the Work.
- B. Installer Qualifications: Arrange for installation of metal fabrications specified in this section by same firm that fabricated them.
- C. Qualify welding processes and welding operators in accordance with AWS D1.1 "Structural Welding Code - Steel," D1.3 "Structural Welding Code - Sheet Steel", and D1.2 "Structural Welding Code - Aluminum."
 - 1. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

1.06 PROJECT CONDITIONS

- A. Field Measurements: Check actual locations of walls and other construction to which metal fabrications must fit, by accurate field measurements before fabrication; show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delay of Work.

PART 2 - PRODUCTS

2.01 FERROUS METALS

- A. Metal Surfaces, General: For metal fabrications exposed to view upon completion of the Work, provide materials selected for their surface flatness, smoothness, and freedom from surface blemishes. Do not use materials whose exposed surfaces exhibit pitting, seam marks, roller marks, rolled trade names, roughness, and, for steel sheet, variations in flatness exceeding those permitted by reference standards for stretcher-leveled sheet.
- B. Steel Plates, Shapes, and Bars: ASTM A 36.
- C. Rolled Steel Floor Plates: ASTM A 786.
- D. Wide Flange Beams and Columns: ASTM A992.

- E. Steel Bars for Gratings: ASTM A 569 or ASTM A 36.
- F. Wire Rod for Grating Cross Bars: ASTM A 510.
- G. Steel Tubing: Product type (manufacturing method) and as follows:
 - 1. Hot-Formed Steel Tubing: ASTM A 501.
- H. Uncoated Structural Steel Sheet: Product type (manufacturing method), quality, and grade, as follows:
 - 1. Cold-Rolled Structural Steel Sheet: ASTM A 611, grade as follows:
 - a. Grade A, unless otherwise indicated or required by design loading.
- I. Steel Pipe: ASTM A 53; finish, type, and weight class as follows:
 - 1. Black finish, unless otherwise indicated.
 - 2. Galvanized finish for exterior installations and where indicated.
 - 3. Standard weight, unless otherwise indicated, or another weight, type, and grade required by structural loads.
- J. Gray Iron Castings: ASTM A 48, Class 30.
- K. Malleable Iron Castings: ASTM A 47, grade 32510.
- L. Brackets, Flanges and Anchors: Cast or formed metal of the same type material and finish as supported rails, unless otherwise indicated.
- M. Concrete Inserts: Threaded or wedge type; galvanized ferrous castings, either malleable iron, ASTM A 47, or cast steel, ASTM A 27. Provide bolts, washers, and shims as required, hot-dip galvanized per ASTM A 153.
- N. Welding Rods and Bare Electrodes: Select in accordance with AWS specifications for the metal alloy to be welded.

2.02 GROUT AND ANCHORING CEMENT

- A. Nonshrink Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with CE CRD-C 621. Provide grout specifically recommended by manufacturer for interior and exterior applications of type specified in this Section 05120.
- B. Products: Subject to compliance with requirements, provide one of the following:

2.03 FASTENERS

- A. General: Provide zinc-coated fasteners for exterior use or where built into exterior walls. Select fasteners for the type, grade, and class required.

- B. Bolts and Nuts: Regular hexagon head type, ASTM A 307, Grade A, ASTM A325N.
- C. Lag Bolts: Square head type, FS FF-B-561.
- D. Machine Screws: Cadmium plated steel, FS FF-S-92.
- E. Wood Screws: Flat head carbon steel, FS FF-S-111.
- F. Plain Washers: Round, carbon steel, FS FF-W-92.
- G. Drilled-In Expansion Anchors: Expansion anchors complying with FS FF-S-325, Group VIII (anchors, expansion), Type I (internally threaded tubular expansion anchor); and machine bolts complying with FS FF- B-575, Grade 5.
- H. Toggle Bolts: Tumble-wing type, FS FF-B-588, type, class, and style as required.
- I. Lock Washers: Helical spring type carbon steel, FS FF-W-84.

2.04 PAINT

- A. Shop Primer for Ferrous Metal: Lead free, V.O.C. compliance, FS-TT-P636,
- B. Galvanizing Repair Paint: FS-TT-P-641.
- C. Bituminous Paint: Cold-applied asphalt mastic complying with SSPC-Paint 12 except containing no asbestos fibers.

2.05 CONCRETE FILL AND REINFORCING MATERIALS

- A. Concrete Materials and Properties: Comply with requirements of Division 3 section "Concrete Work" for normal weight, ready-mix concrete with minimum 28-day compressive strength of 2,500 psi, 440 lb cement per cu. ft. minimum, and W/C ratio of 0.65 maximum, unless higher strengths indicated.
- B. Reinforcing Bars: ASTM A 615, Grade 60, unless otherwise indicated.

2.06 FABRICATION, GENERAL

- A. Form metal fabrications from materials of size, thickness, and shapes indicated but not less than that needed to comply with performance requirements

indicated. Work to dimensions indicated or accepted on shop drawings, using proven details of fabrication and support. Use type of materials indicated or specified for various components of each metal fabrication.

- B. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges.
- C. Allow for thermal movement resulting from the following maximum change (range) in ambient temperature in the design, fabrication, and installation of installed metal assemblies to prevent buckling, opening up of joints, and overstressing of welds and fasteners. Base design calculations on actual surface temperatures of metals due to both solar heat gain and nighttime sky heat loss.
 - 1. Temperature Change (Range): 100°F (55.5°C).
- D. Shear and punch metals cleanly and accurately. Remove burrs.
- E. Ease exposed edges to a radius of approximately 1/32 inch, unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- F. Remove sharp or rough areas on exposed traffic surfaces.
- G. Weld corners and seams continuously to 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.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing and contour of welded surface matches those adjacent.
- H. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of type indicated or, if not indicated, Phillips flat-head (countersunk) screws or bolts. Locate joints where least conspicuous.
- I. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space anchoring devices to provide adequate support for intended use.
- J. Shop Assembly: Preassemble items 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.

- K. Cut, reinforce, drill and tap miscellaneous metal work as indicated to receive finish hardware, screws, and similar items.
- L. Fabricate joints that will be exposed to weather in a manner to exclude water, or provide weep holes where water may accumulate.

2.07 ROUGH HARDWARE

- A. Furnish bent or otherwise custom fabricated bolts, plates, anchors, hangers, dowels, and other miscellaneous steel and iron shapes as required for framing and supporting woodwork, and for anchoring or securing woodwork to concrete or other structures. Straight bolts and other stock rough hardware items are specified in Division 6 sections.
- B. Fabricate items to sizes, shapes, and dimensions required. Furnish malleable-iron washers for heads and nuts which bear on wood structural connections; elsewhere, furnish steel washers.

2.08 STEEL LADDERS

- A. General: Fabricate ladders for the locations shown, with dimensions, spacings, details and anchorages as indicated. Comply with requirements of ANSI A14.3. Provide galvanized members in ladder assembly.
- B. Siderails: Continuous steel flat bars, ½ inch x 2-1/2 inches, with eased edges, spaced 18 inches apart.
- C. Bar Rungs: Round steel bars, 3/4 inch diameter, spaced 12 inches o.c.
- D. Fit rungs in centerline of side rails, plug weld and grind smooth on outer rail faces.
- E. Support each ladder at top and bottom and at intermediate points spaced not more than 5'-0" o.c. by means of welded or bolted steel brackets.
 - 1. Size brackets to support design dead and live loads indicated and to hold centerline of ladder rungs clear of the wall surface by not less than 7 inches.
 - 2. Extend side rails 42 inches above top rung, and return rails to wall or structure unless other secure handholds are provided. If the adjacent structure does not extend above the top rung, goose-neck the extended rails back to the structure to provide secure ladder access.

2.09 LOOSE BEARING AND LEVELING PLATES

- A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction, made flat, free from warps or twists, and of required

thickness and bearing area. Drill plates to receive anchor bolts and for grouting as required. Galvanize after fabrication.

2.10 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports for applications indicated or which are not a part of structural steel framework, as required to complete work.
- B. Fabricate units to sizes, shapes, and profiles indicated and required to receive adjacent other construction retained by framing and supports. Fabricate from structural steel shapes, plates, and steel bars of welded construction using mitered joints for field connection. Cut, drill, and tap units to receive hardware, hangers, and similar items.
 - 1. Equip units with integrally welded anchors for casting into concrete or building into masonry. Furnish inserts if units must be installed after concrete is placed.
 - a. Except as otherwise indicated, space anchors 24 inches o.c. and provide minimum anchor units in the form of steel straps 1-1/4 inches wide x 1/4 inch x 8 inches long.

2.11 MISCELLANEOUS STEEL TRIM

- A. Provide shapes and sizes indicated for profiles shown. Unless otherwise indicated, fabricate units from structural steel shapes, plates, and steel bars, with continuously welded joints and smooth exposed edges. Use concealed field splices wherever possible. Provide cutouts, fittings, and anchorages as required for coordination of assembly and installation with other work.

2.12 SHELF AND RELIEVING ANGLES

- A. Fabricate shelf and relieving angles from steel angles of sizes indicated and for attachment to concrete framing. Provide slotted holes to receive 3/4 inch bolts, spaced not more than 6 inches from ends and not more than 24 inches o.c., unless otherwise indicated.
- B. For cavity walls, provide vertical channel brackets to support shelf/relieving angles from back-up masonry and concrete. Align expansion joints in angles with indicated expansion joints in cavity wall exterior wythe.
- C. Galvanize shelf angles to be installed on exterior concrete framing.
- D. Furnish wedge-type concrete inserts, complete with fasteners, for attachment of shelf angles to cast-in-place concrete.

2.13 STRUCTURAL STEEL DOOR FRAMES FOR OVERHEAD DOORS

- A. Fabricate steel door frames from structural shapes and bars of size and to dimensions indicated, fully welded together, with 5/8 inch x 1-1/2 inch steel bar stops, unless otherwise indicated. Plug weld built-up members and continuously weld exposed joints. Secure removable stops to frame with countersunk machine screws, uniformly spaced at not more than 10 inches o.c. Reinforce frames and drill and tap as required to accept finish hardware.
- B. Provide steel strap anchors for securing door frames into adjoining concrete or masonry, using 1/8 inch x 2 inch straps of the length required for a minimum 8 inch embedment, unless otherwise indicated. Weld anchors to frame jambs no more than 12 inches from both bottom and head of frame and space anchors not more than 30 inches apart.
- C. Extend bottom of frames to floor elevation indicated with steel angle clips welded to frames for anchoring frame to floor with expansion shields and bolts.
- D. Galvanize frames and anchors in the following locations:
 - 1. Exterior locations.
 - 2. Interior locations where indicated.

2.14 PIPE BOLLARDS

- A. Fabricate pipe bollards from Schedule 80 steel pipe. Cap bollards with 1/4 inch minimum thickness steel base plate.
- B. Fabricate sleeves for bollard anchorage from steel pipe with 1/4 inch thick steel plate welded to bottom of sleeve.

2.15 FINISHES, GENERAL

- A. Comply with NAAMM "Metal Finishes Manual" for recommendations relative to application and designations of finishes.
- B. Finish metal fabrications after assembly.

2.16 STEEL AND IRON FINISHES

- A. Galvanizing: For those items indicated for galvanizing, apply zinc-coating by the hot-dip process compliance with the following requirements:
 - 1. ASTM A 153 for galvanizing iron and steel hardware.
 - 2. ASTM A 123 for galvanizing both fabricated and unfabricated iron and steel products made of uncoated rolled, pressed, and forged shapes, plates, bars, and strip 0.0299 inch thick and heavier.
- B. Preparation for Shop Priming: Prepare uncoated ferrous metal surfaces to comply with minimum requirements indicated below for SSPC surface

preparation specifications and environmental exposure conditions of installed metal fabrications:

1. Exteriors (SSPC Zone 1B): SSPC-SP6 "Commercial Blast Cleaning."
- C. Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finish or to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated. Comply with requirements of SSPC-PA1 "Paint Application Specification No. 1" for shop painting.
1. Stripe paint all edges, corners, crevices, bolts, welds, and sharp edges.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions, and directions for installation of anchorages, including concrete inserts, sleeves, anchor bolts, and miscellaneous items having integral anchors that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to project site.
- B. Center nosings on tread widths with noses flush with riser faces and tread surfaces.
- C. Set sleeves in concrete with tops flush with finish surface elevations; protect sleeves from water and concrete entry.

3.02 INSTALLATION, GENERAL

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous metal fabrications to in-place construction; include threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws, and other connectors as required.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installation of miscellaneous metal fabrications. Set metal fabrication accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete masonry or similar construction.
- D. Fit exposed connections accurately together to form hairline joints. Weld

connections that are not to be left as exposed joints, but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade the surfaces of exterior units which have been hot-dip galvanized after fabrication, and are intended for bolted or screwed field connections.

- E. Field Welding: Comply with AWS Code for procedures of manual shielded metal-arc welding, appearance and quality of welds made, methods used in correcting welding work, 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.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing and contour of welded surface matches those adjacent.

3.03 SETTING LOOSE PLATES

- A. Clean concrete and masonry bearing surfaces of any bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of bearing plates.
- B. Set loose leveling and bearing plates on wedges, or other adjustable devices. After the bearing members have been positioned and plumbed, tighten the anchor bolts. Do not remove wedges or shims, but if protruding, cut off flush with the edge of the bearing plate before packing with grout.
 - 1. Use metallic nonshrink grout in concealed locations where not exposed to moisture; use nonmetallic nonshrink grout in exposed locations, unless otherwise indicated.
 - 2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.04 INSTALLATION OF BOLLARDS

- A. Anchor bollards in concrete by means of pipe sleeves preset and anchored into concrete. After bollards have been inserted into sleeves, fill annular space between bollard and sleeve solid with nonshrink, nonmetallic grout, mixed and placed to comply with grout manufacturer's directions.

3.05 ADJUSTING AND CLEANING

- A. Touch-Up 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 touch-up of field painted surfaces.

1. Apply by brush or spray to provide a minimum dry film thickness of 2.0 mils.
2. Touch-Up Painting: Cleaning and touch-up painting of field welds, bolted connections, and abraded areas of the shop paint on miscellaneous metal is specified in Division 9 Section "Painting" of these specifications.
3. For galvanized surfaces clean welds, bolted connections and abraded areas and apply galvanizing repair paint to comply with ASTM A 780.

END OF SECTION

DIVISION 6

WOOD AND PLASTICS

SECTION 06100
ROUGH CARPENTRY

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.02 SUMMARY:

- A. Types of work in this section include rough carpentry for:
 - 1. Rooftop equipment bases and support curbs.
 - 2. Wood grounds, nailers and blocking.
 - 3. Wood ledgers.
 - 4. Sheathing.
 - 5. Wall framing.
 - 6. Roof framing.

1.03 DEFINITIONS:

- A. Rough carpentry includes carpentry work not specified as part of other sections and which is generally not exposed, except as otherwise indicated.

1.04 PRODUCT HANDLING:

- A. Delivery and Storage: Keep materials under cover and dry. Protect against exposure to weather and contact with damp or wet surfaces. Stack lumber as well as plywood and other panels; provide for air circulation within and around stacks and under temporary coverings including polyethylene and similar materials.
 - 1. For lumber and plywood pressure treated with waterborne chemicals, sticker between each course to provide air circulation.

1.05 PROJECT CONDITIONS:

- A. Coordination: Fit carpentry work to other work; scribe and cope as required for accurate fit. Correlate location of furring, nailers, blocking, grounds and similar supports to allow attachment of other work.

PART 2 - PRODUCTS

2.01 LUMBER, GENERAL:

- A. Lumber Standards: Manufacture lumber to comply with PS 20 "American Softwood Lumber Standard" and with applicable grading rules of inspection agencies certified by American Lumber Standards Committee's (ALSC) Board of Review.
- B. Grade Stamps: Factory-mark each piece of lumber with grade stamp of inspection agency evidencing compliance with grading rule requirements and identifying grading agency, grade, species, moisture content at time of surfacing, and mill.
- C. Nominal sizes are indicated, except as shown by detail dimensions. Provide actual sizes as required by PS 20, for moisture content specified for each use.
 - 1. Provide dressed lumber, S4S, unless otherwise indicated.
 - 2. Provide seasoned lumber with 19 percent maximum moisture content at time of dressing and shipment for sizes 2" or less in nominal thickness, unless otherwise indicated.

2.02 BOARDS:

- A. Concealed Boards: Where boards will be concealed by other work, provide lumber of 19 percent maximum moisture content (S-Dry) and of following species and grade.
 - 1. Douglas Fir species, PS20, Standard grade for framing utility grade for furring and blocking, S4S.

2.03 MISCELLANEOUS LUMBER:

- A. Provide wood for support or attachment of other work including rooftop equipment curbs and support bases, cant strips, bucks, nailers, blocking, furring, grounds, stripping and similar members. Provide lumber of sizes indicated, worked into shapes shown, and as follows:
 - 1. Moisture content: 19 percent maximum for lumber items not specified to receive wood preservative treatment.
 - 2. Grade: Standard Grade light framing size lumber of any species or board size lumber as required. No. 3 Common or Standard grade boards per WCLIB or WWPA rules or No. 3 boards per SPIB rules.

- B. Plywood Backing Panels: For mounting electrical or telephone equipment, provide fire-retardant treated plywood panels with grade designation, APA C-D PLUGGED INT with exterior glue, in thickness indicated, or, if not otherwise indicated, not less than 15/32".
- 3. Plywood Sheathing/Structural Wood Sheathing: Provide as detailed in structural drawings. Coordinate use as roof decking with roofing manufacturers.

2.04 MISCELLANEOUS MATERIALS:

- A. Fasteners and Anchorages: Provide size, type, material and finish as indicated and as recommended by applicable standards, complying with applicable Federal Specifications for nails, staples, screws, bolts, nuts, washers and anchoring devices. Provide metal hangers and framing anchors of the size and type recommended by the manufacturer for each use including recommended nails.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL:

- A. Discard units of material with defects which might impair quality of work, and units which are too small to use in fabricating work with minimum joints or optimum joint arrangement.
- B. Set carpentry work to required levels and lines, with members plumb and true to line and cut and fitted.
- C. Securely attach carpentry work to substrate by anchoring and fastening as shown and as required by recognized standards.
 - 1. Countersink nail heads on exposed carpentry work and fill holes.
- D. Use common wire nails. Use finishing nails for finish work. Select fasteners of size that will not penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting of wood; predrill as required.

3.02 WOOD GROUNDS, NAILERS, BLOCKING AND SLEEPERS:

- A. Provide wherever shown and where required for screeding or attachment of other work. Form to shapes as shown and cut as required for true line and level of work to be attached. Coordinate location with other work involved.
- B. Attach to substrates as required to support applied loading. Countersink bolts and nuts flush with surfaces, unless otherwise indicated. Build into masonry during installation of masonry work. Where possible, anchor to formwork before concrete placement.

END OF SECTION

SECTION 06129

PREFABRICATED WOOD JOISTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawing and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.02 SUMMARY:

- A. Extent and configuration of prefabricated wood joists as indicated on drawings.

1.03 SUBMITTALS

- A. Provide calculations which have been signed and stamped by a structural engineer licensed to practice in the jurisdiction where joists will be installed.

1.04 QUALITY ASSURANCE:

- A. Fabricator's Qualifications: Provide joists by a firm which has a minimum 5 year record of successfully fabricating units similar to type indicated.

1.05 DELIVERY, STORAGE AND HANDLING:

- A. Handle and store joists with care, and in accordance with manufacturer's instructions to avoid damage from bending, overturning or other cause for which truss is not designed to resist or endure.
- B. Time delivery and erection of joists to avoid extended on-site storage and to avoid delaying work of other trades whose work must follow erection of joists.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Provide joists by Trus-Joist Corporation or approved equal.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. General: Erect and brace joists to comply with recommendations of manufacturer.
- B. Erect joists with plane of webs vertical (plumb) and parallel to each other, located accurately at design spacings indicated.
- C. Hoist units in place by means of lifting equipment suited to sizes and types of joists required, applied at designated lift points as recommended by fabricator, exercising care not to damage joist members or joints by out-of-plane bending or other causes.
- D. Provide temporary bracing as required to maintain trusses plumb, parallel and in location indicated, until permanent bracing is installed.
- E. Anchor joists securely at all bearing points to comply with methods and details indicated. See structural drawings for joist hangers on wall ledgers. Tie roof diaphragm to concrete wall as shown on structural drawings.
- F. Install permanent blocking, bridging, and related components to enable joists to maintain design spacing, withstand live and dead loads including lateral loads, and to comply with other indicated requirements. See structural plans for special connection requirements under HVAC Units.
- G. Do not place holes for piping or electrical conduit in joists except as noted in structural plans or as approved in manufacturer's literature.

END OF SECTION

SECTION 06194

PRE-ENGINEERED WOOD TRUSSES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.02 SUMMARY:

- A. Types of work in this section include rough carpentry for:
 - 1. Wood trusses
 - 2. Bridging
 - 3. Temporary and permanent bracing
 - 4. Related hardware including metal hangers, anchors, and metal shapes

1.03 DEFINITIONS:

- A. Furnish labor, material, services, equipment and appliances required for prefabricated wood truss work indicated on the Drawings and specified herein.

1.04 ENGINEERING DESIGN:

- A. Trusses shall be custom designed to fit dimensions and loads indicated on the Drawings. Design shall be in accord with allowable values assigned by the most restrictive governing code. Complete structural calculations showing internal layout member forces and stress control points are to be submitted to the Architect for each design. Design shall be under the supervision of a registered professional engineer.

1.05 REFERENCE PUBLICATIONS AND STANDARDS:

- A. National Forest Products Association (NFPA):
 - a. "National Design Specifications for Stress Grade Lumber and Its Fastenings.
- B. American Institute of Timber Construction (AITC):
 - a. "Timber Construction Standards"
- C. Truss Plate Institute (TPI):
 - a. "Design Specifications for Light Metal Plate Connected Wood Trusses"

D. American Society for Testing Materials (ASTM):

1.06 SHOP DRAWINGS:

A. Submit to Architect for acceptance prior to the start of fabrication. Drawings shall show pitch, span, dimensions and spacing of truss. Truss bearing sizes and locations. Design loading of truss and allowable stress increase. Axial forces in each truss member. Nominal sizes and location of connector plates at all joints. Size, species and stress of grade of lumber for all truss members. Camber. Permanent lateral bracing as required by design to reduce buckling length of individual truss members only. Handling and erection recommendations. Drawings and structural shall bear the seal of a professional engineer licensed in the State of California.

1.07 APPROVAL OF MANUFACTURER:

A. Trusses shall be manufactured in a plant approved for fabrication by the Owner.

PART 2 - PRODUCTS

2.01 FABRICATION:

A. General:

a. Components shall be fabricated in a properly equipped manufacturing facility of a permanent nature. They shall be manufactured by experienced workmen, using precision cutting and truss fabricating equipment, under the direct supervision of a qualified foreman. All trusses shall be fabricated under strict rules of inspection and quality control required by governing authority.

B. Cutting Members:

a. Accurately cut to length, angle and true to line to assure tight joints for finished truss.

C. Connections:

a. Properly place members and connectors in special jigs and tightly clamp members in place until the connector plates have been pressed into the lumber simultaneously on both sides of the joints.

D. Camber:

a. As noted on accepted shop drawings by properly positioning the members in the fabricating jig.

2.02 MATERIALS:

A. Lumber:

- a. Conform to the published stress ratings for the species and grades set out in the official grading rules of the appropriate lumber association or as listed in the reference specifications. Wherever this Specification, or notes on the plans or truss engineering design calls for lumber which exceed the minimum set forth therein, the Specifications, plans, and/or truss engineering designs shall be applicable, and information stated or shown in one shall be applicable the same as if in all of them. All lumber shall conform to the species and fully recognized nominal sizes shown on the plans or truss engineering designs. All members shall be cut from lumber which bear the proper grade mark stamps of a recognized grading association or licensed lumber inspection agency. No lumber shall be used which does not appear to conform to the proper dimensions and/or grades. At the time of fabrication, the moisture content of all lumber shall be within limits stated in reference specifications.

B. Connectors:

a. General:

- i. ASTM A446-72 Grade A prime commercial quality galvanized sheet steel of no less than 20 gauge thickness which has a minimum yield of 33,000 psi and a minimum ultimate tensile strength of 45,000 psi. Connectors shall have a series of nail-like projections which are designed to separate the fibers of the wood into which they are pressed, in accordance with accepted nailing practices. All connector plated truss joints shall be designed using the net area plating method as set forth in TPI Standards.

b. Field Connectors:

- i. Where field assembly of truss sub-components is necessary, connections shall be in accord with details shown on accepted shop drawings.

C. Bracing:

- a. As required by accepted shop drawings.

D. Hardware:

- a. As required by accepted shop drawings.

PART 3 - EXECUTION

3.01 HANDLING:

- A. Perform in a manner to prevent bending, warping, twisting or other damage.

3.02 STORAGE:

- A. Store in vertical position above ground on suitable supports and braced to prevent bending and/or tipping over.

3.03 PROTECTION OF MATERIALS:

- A. Protect from damage when stored at the job site. Finished members shall be free of bends, twists or open joints. Replace warped, bowed or damaged trusses at no additional cost to the Owner.

3.04 WORKMANSHIP:

- A. Use only skilled and experienced personnel.

3.05 ERECTION:

- A. Erect in complete accord with the plans and accepted shop drawings. Provide erection bracing in addition to specified bridging to keep trusses straight and plumb and to assure adequate lateral support for the individual trusses and entire system until decking material has been applied.

3.06 PROTECTION OF WORK IN PROGRESS:

- A. Apply no construction loads before trusses and bridging have been anchored. Install and secure permanent decking before applying full design loads.

3.07 CLEAN UP:

- A. Upon completion of work of this Section, remove related debris from premises.

END OF SECTION

SECTION 06200

FINISH CARPENTRY

PART 1 – GENERAL

1.01 DESCRIPTION:

A. Work included:

Installation of all wood trim and other items not specifically described as being installed under other Sections of these Specifications.

B. Related work described elsewhere:

1. Lumber: Section 06010
2. Rough Carpentry: Section 06100
3. Architectural Woodwork: Section 06220
4. Installation of Wood Doors and Frames: Section 08200
5. Wood Windows: Section 08160

1.02 QUALITY ASSURANCE

A. Qualifications of workmen:

For actual cutting and fitting of trim and finish material, use only journeymen carpenters who are thoroughly trained and experienced in the skills required, who are completely familiar with the materials involved and the manufacturer's recommended methods of installation, and who are thoroughly familiar with the requirements of this work.

B. Rejection:

In the acceptance or rejection of finish carpentry, no allowance will be made for lack of skill on the part of the workmen.

1.03 PRODUCT HANDLING:

A. Protection:

Use all means necessary to protect the materials of this Section before, during and after installation, and to protect the installed work and materials of other trades.

B. Replacements:

In the even of damage, immediately make all repairs and replacements necessary to the approval of the Architect and at no additional cost to the Owner.

PART 2 PRODUCTS

(No products are required in this Section)

PART 3 EXECUTION

3.01 SURFACE CONDITIONS:

A. Inspection:

1. Prior to all work of this Section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.
2. Verify that finish carpentry may be completed in strict accordance with the original design and all pertinent codes and regulations.

B. Discrepancies:

1. In the event of discrepancy or sit conditions, which affect millwork installation, immediately notify the Architect.
2. Do no proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.02 WORKMANSHIP:

A. General:

All finish carpentry shall produce joints true, tight, and well nailed with all members assembled in accordance with the drawings.

B. Jointing:

1. Make all joints to conceal shrinkage. Miter all exterior corners, cope all interior corners, and miter or scarf all end-to-end joints.
2. Install all trim in pieces as long as possible jointing only where solid support is obtained.

C. Fastening:

1. Install all items straight, true, level, plumb, and firmly anchored in place. Where blocking or backing is required, coordinate as necessary with other trades to ensure placement of all required backing and blocking in a timely manner.
2. Nail trim with finish nails of proper dimensions to hold the member firmly in place without splitting the wood.
3. Nail all exterior trim with galvanized nails, making all joints to exclude water and setting in waterproof glue or the caulking described in Section 07900 of these Specifications.
4. On exposed finish work, set all nails for putty.
5. Screw, do not drive, all wood screws, except that screws may be started by driving and then screwed home.

3.03 INSTALLATION OF OTHER ITEMS:

Install all other items in strict accordance with the drawings and the published recommendations of the manufacturer of the item, anchoring firmly in place at the prescribed locations, straight, plumb, level, and anchored for long life under hard use.

3.04 FINISHING:

Sandpaper all finished wood surfaces thoroughly as required to produce a uniformly smooth surface, always sanding in the direction of the grain. No coarse-grained sandpaper mark, mill mark, hammer mark, or other imperfection will be accepted.

3.05 CLEANING-UP:

A. General:

Keep the premises in a neat, safe, and orderly condition at all times during execution of this portion of the work, free from accumulation of sawdust, cut-ends, and debris.

B. Sweeping:

1. At the end of each working day, or more often if necessary, thoroughly sweep all surfaces where refuse from this portion of the work has settled.
2. Remove the refuse to the area of the job site set aside for its storage.
3. Upon completion of this portion of the work, thoroughly broom clean all surfaces.

END OF SECTION

SECTION 06400 - INTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

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

1.02 SUMMARY:

- A. This Section includes the following:
 - 1. Wood cabinets (casework).
 - 2. Laminate clad cabinets (plastic-covered casework).
 - 3. Cabinet tops (countertops).
 - 4. Flush wood paneling.
 - 5. Closet and shelf assemblies.
- B. Related Sections:
 - 1. Division 6 Section "Rough Carpentry."
 - 2. Division 8 Section "Flush Wood Doors."
 - 3. Division 9 Section "Painting."

1.03 SUBMITTALS:

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
- B. Product data for each type of product and process specified in this section and incorporated into items of architectural woodwork during fabrication, finishing, and installation.
- C. Fire-retardant treatment data for material impregnated by pressure process to reduce combustibility. Include certification by treating plant that treated materials comply with requirements.
- D. Shop drawings showing location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
- E. Samples for initial selection purposes of the following in form of

manufacturer's color charts consisting of actual units or sections of units showing full range of colors, textures, and patterns available for each type of material indicated.

1. Plastic laminate.

F. Samples for verification purposes of the following:

1. Lumber with or for transparent finish, 2' long, for each species and cut, finished on one side and one edge.
2. Wood veneer faced panel products; with or for transparent finish, 8½ inches by 11 inches, for each species and cut with one half of exposed surface finished, with separate samples of unfaced panel product used for core.
3. Laminate clad panel products, 8½ inches by 11 inches for each type, color, pattern, and surface finish, with separate samples of unfaced panel product used for core.
4. Corner pieces as follows:
 - a. Cabinet front frame joints between stiles and rail as well as exposed end pieces, 18 inches high by 18 inches wide by 6 inches deep.
 - b. Miter joints for standing trim.
5. Exposed cabinet hardware, one unit of each type and finish.

1.04 DELIVERY, STORAGE, AND HANDLING:

- A. Protect woodwork during transit, delivery, storage, and handling to prevent damage, soilage, and deterioration.
- B. Do not deliver woodwork until painting, wet work, grinding, and similar operations that could damage, soil, or deteriorate woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas whose environmental conditions meet requirements specified in "Project Conditions."

1.05 PROJECT CONDITIONS:

- A. Environmental Conditions: Obtain and comply with Woodwork Manufacturer's and Installer's coordinated advice for optimum temperature and humidity conditions for woodwork during its storage and installation. Do not install woodwork until these conditions have been attained and stabilized so that woodwork is within plus or minus 1.0 percent of optimum moisture content from date of installation through remainder of construction period.
- B. Field Measurements: Where woodwork is indicated to be fitted to other construction, verify field measurements before manufacturing woodwork.

PART 2 - PRODUCTS

2.01 HIGH PRESSURE DECORATIVE LAMINATE MANUFACTURERS:

- A. Manufacturers:
 - 1. Formica Corp.
 - 2. Micarta Div., Westinghouse Electric Corp.
 - 3. Nevamar Corp.

2.02 MATERIALS:

- A. General: Provide materials that comply with requirements of the AWI woodworking standard for each type of woodwork and quality grade indicated and, where the following products are part of woodwork, with requirements of the referenced product standards, that apply to product characteristics indicated:
 - 1. Hardboard: ANSI/AHA A135.4
 - 2. High Pressure Laminate: NEMA LD 3.
 - 3. Particleboard: ANSI A208.1.
 - 4. Softwood Plywood: PS 1.
 - 5. Formaldehyde Emission Levels: Comply with formaldehyde emission requirements of each voluntary standard referenced below:
 - a. Particleboard: NPA 8.
 - b. Hardwood Plywood: HPM A FE.

2.03 FABRICATION, GENERAL

- A. Wood Moisture Content: Comply with requirements of referenced quality standard for moisture content of lumber in relation to relative humidity conditions existing during time of fabrication and in installation areas.

- B. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:
 - 1. Corners of cabinets and edges of solid wood (lumber) members less than 1 inch in nominal thickness: 1/16 inch.
 - 2. Edges of rails and similar members more than 1 inch in nominal thickness: 1/8 inch.
- C. Complete fabrication, including assembly, finishing, and hardware application, before shipment to project site to maximum extent possible. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
- D. Factory-cut openings, to maximum extent possible, to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Smooth edges of cutouts and, where located in countertops and similar exposures, seal edges of cutouts with a water-resistant coating.

2.04 WOOD CABINETS (CASEWORK) FOR TRANSPARENT FINISH

- A. Quality Standard: Comply with AWI Section 400 and its Division 400A "Wood Cabinets."
- B. Grade: Premium
- C. AWI Type of Cabinet Construction: Flush overlay.
 - 1. Grain Matching: Run and match grain vertically for drawer fronts, doors, and fixed panels.
 - 2. Matching of Veneer Leaves: Book match.
 - 3. Veneer Matching Within Panel Face: Running match.
- D. Wood Species for Semi-exposed Surfaces: Match species and cut indicated for exposed surfaces.

2.05 LAMINATE CLAD CABINETS (PLASTIC-COVERED CASEWORK)

- A. Quality Standard: Comply with AWI Section 400 and its Division 400B "Laminate Clad Cabinets."
- B. Grade: Custom.

- C. Laminate Cladding: High pressure decorative laminate complying with the following requirements:
 - 1. Colors, Patterns, and Finishes: Provide materials and products that results in colors and textures of exposed laminate surfaces comply with the following requirements:
 - a. Match color, pattern, and finish indicated by reference to laminate manufacturer's standard designations for these characteristics.
 - 2. Laminate Grade for Exposed Surfaces: Provide laminate cladding complying with the following requirements for type of surface and grade.
 - a. Horizontal Surfaces Other Than Tops: GP-50 (0.50-inch nominal thickness).
 - b. Vertical Surfaces: GP-50 (0.050-inch nominal thickness).
 - c. Edges: GP-50 (0.050-inch nominal thickness)
 - 3. Semi-exposed Surfaces: Provide surface materials indicated below:
 - a. Woodwork manufacturer's standard low pressure laminate.

2.06 CABINET HARDWARE AND ACCESSORY MATERIALS

- A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets, except for items specified in Division 8 Section "Finish Hardware."
- B. Cabinet Hardware Schedule: Refer to schedule at end of this section for cabinet hardware required for architectural cabinets.
- C. Hardware Standard: Comply with ANSI/BHMA A156.9 "American National Standard for Cabinet Hardware" for items indicated by reference to BHMA numbers or referenced to this standard.
- D. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with ANSI/BHMA A156.18 for BHMA code number indicated.
 - 1. Satin Stainless Steel, Stainless Steel Base: BHMA 630.
- E. For concealed hardware provide manufacturer's standard finish that complies with product class requirements of ANSI/BHMA A156.9.

2.07 ARCHITECTURAL CABINETS TOPS (COUNTERTOPS)

- A. Quality Standard: Comply with AWI Section 400 and its Division 400C.
- B. Type of Top: Panel product for transparent finish (wood veneer laminated over various cores) as follows:
 - 1. Grade: Premium
 - 2. Veneer Species: Red Oak, plain sliced.
 - 3. Matching of Adjacent Veneer Leaves: Book match.
 - 4. Veneer Matching Within Panel Face: Running match.
 - 5. Edge Treatment: Lumber matching wood veneer face for species and cut.
- C. Type of Top: High pressure decorative laminate complying with the following:
 - 1. Grade: Custom.
 - 2. Laminate Cladding for Horizontal Surface: High pressure decorative laminate as follows:
 - a. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
 - 1) Match color, pattern, and finish indicated by reference to manufacturer's standard designations for these characteristics.
 - a) Patterns.
 - 3. Edge Treatment: Same as laminate cladding on horizontal surfaces.

2.08 FASTENERS AND ANCHORS

- A. Screws: Select material, type, size, and finish required for each use. Comply with FS FF-S-111 for applicable requirements.
 - 1. For metal framing supports, provide screws as recommended by metal framing manufacturer.
- B. Nails: Select material, type, size, and finish required for each use. Comply with FS FF-N-105 for applicable requirements.
- C. Anchors: Select material, type, size, and finish required by 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 bolt devices for drilled-in-place anchors. Furnish inserts and anchors, as required, to be set into concrete or masonry work for subsequent woodwork anchorage.

2.09 FACTORY FINISHING OF INTERIOR ARCHITECTURAL WOODWORK

- A. Quality Standard: Comply with AWI Section 1500 unless otherwise indicated.
- B. General: The entire finish of interior architectural woodwork is specified in this section, regardless of whether factory applied or applied after installation.
 - 1. Factory Finishing: To the greatest extent possible, finish architectural woodwork at factory. Defer only final touch-up, cleaning, and polishing until after installation.
 - 2. Factory Finishing: The extent to which the final finish is applied to architectural woodwork other than cabinets and panels, and countertops at factory is Contractor's option, except factory apply at least prime/base coat to the great extent possible before delivery.
- C. General: The primary and prefinishing (if any) of interior architectural woodwork required to be performed at factory is specified in this section. Refer to Division 9 Section "Painting" for final finishing of installed architectural woodwork and for material and application requirements of prime coats for woodwork not specified to receive final finish in this section.
- D. Preparations for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces and similar preparations for finishing of architectural woodwork, as applicable to each unit of work.
- E. Transparent Finish for Open-Grain Woods: Comply with requirements indicated below for grade, finish system, staining, effect, and sheen, with sheen measured on 60 deg gloss meter per ASTM D 523.
 - 1. Grade: Premium
 - 2. AWI Finish System #1: Standard lacquer typical.
 - 3. AWI Finish System #5: Catalyzed polyurethane at countertops.
 - 4. Staining: Match Architect's sample.
 - 5. Effect: Open grain.
 - 6. Sheen: Dull satin 15-20 deg.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Condition woodwork to average prevailing humidity conditions in installation areas before installing.
- B. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including back priming and removal of packing.

3.02 INSTALLATION

- A. Quality Standard: Install woodwork to comply with AWI Section 1700 for same grade specified in Part 2 of this section for type of woodwork involved.
- B. Install woodwork plumb, level, true, and straight with no distortions. Shim as required with concealed shims. Install to a tolerance of 1/8 inch in 8'-0" for plumb and level (including tops) and with no variations in flushness of adjoining surfaces.
- C. Scribe and cut woodwork to fit adjoining work and refinish cut surfaces or repair damaged finish at cuts.
- D. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure to grounds, stripping and blocking with countersunk, concealed fasteners and blind nailing as required for a complete installation. Except where prefinished matching fastener heads are required, use fine finishing nails for exposed nailing, countersunk and filled flush with woodwork and matching final finish where transparent finish is indicated.
- E. Cabinets: Install without distortion so that doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete the installation of hardware and accessory items as indicated. Maintain veneer sequence matching (if any) of cabinets with transparent finish.
- F. Tops: Anchor securely to base units and other support systems as indicated.

3.03 ADJUSTMENT AND CLEANING

- A. Repair damaged and defective woodwork where possible to eliminate defects functionally and visually; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.
- B. Clean, lubricate, and adjust hardware.
- C. Clean woodwork on exposed and semi-exposed surfaces. Touch up factory-applied finishes to restore damaged or soiled areas.

3.04 PROTECTION

- A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensures that woodwork is being without damage or deterioration at time of Substantial Completion.

3.05 HARDWARE SCHEDULE

- A. Pulls: Alno, Inc. - A701-35 3-3/4" pull/polished chrome.
- B. Door Hinges: Blum Module 90.
- C. Drawer Slides: Blum BS 220E.
- D. Closet Rod and Shelf Support: Stanley 19-2999.
- E. Shelf Standards: Knap and Vogt 255 WH with matching supports.

END OF SECTION 06400

DIVISION 7

THERMAL AND MOISTURE PROTECTION

SECTION 07170

BENTONITE WATERPROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

The general provision of the Contract, including General and Supplementary Conditions and General Requirements, apply to the work specified in this section.

1.2 DESCRIPTION OF WORK

The extent of Geotextile/Bentonite Clay waterproofing membrane is shown on the drawing and/or as specified herein.

1.3 RELATED WORK

- A. Concrete
- B. Masonry
- C. Backfill
- D. Expansion Joints

1.4 QUALITY ASSURANCE

- A. Manufacturer: Provide Geotextile/Bentonite Clay waterproofing membrane produced by a manufacturer with a minimum of 5 years experience in the waterproofing industry.
- B. Installer: A firm with a minimum of 2 years experience in installing bentonite clay or other related waterproofing products.
- C. The formation or presence of mold or fungi in a building is dependent upon a broad range of factors including, but not limited to, the presence of spores and nutrient sources, moisture, temperatures, climatic conditions, relative humidity, and heating/ventilating systems and their maintenance and operating capabilities. These factors are beyond the control of Carlisle and Carlisle shall not be responsible for any claims, repairs, restoration, or damages relating to the presence of any irritants, contaminants, vapors, fumes, molds, fungi, bacteria, spores, mycotoxins, or the like in any building or in the air, land, or water serving the building.
- D. Shotcrete installations should have an independent inspector to record and monitor the shotcrete installation.

1.5 SUBMITTALS

- A. Manufacturer: Submit six copies of product data sheets, specifications, installation instructions and general recommendations for each type of product specified.
- B. Installer: Submit detail drawings for installation of product specified.
- C. Water Sample Test Result: A water sample (2 liters) is required on projects that have ground water and should be submitted to the waterproofing manufacturer to test for contamination and compatibility with waterproofing membrane. Submit to architect a letter of compatibility recommending which formulation to use.
- D. Warranty: Submit specimen of manufacturers' standard warranty.

1.6 WARRANTY

- A. Upon completion and acceptance of the work required by this section, the manufacturer will issue a warranty agreeing to promptly replace defective materials for a period of 5 years.
- B. The formation or presence of mold or fungi in a building is dependent upon a broad range of factors including, but not limited to, the presence of spores and nutrient sources, moisture, temperatures, climatic conditions, relative humidity, and heating/ventilating systems and their maintenance and operating capabilities. These factors are beyond the control of Carlisle and Carlisle shall not be responsible for any claims, repairs, restoration, or damages relating to the presence of any irritants, contaminants, vapors, fumes, molds, fungi, bacteria, spores, mycotoxins, or the like in any building or in the air, land, or water serving the building.

1.7 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver materials in original manufacturer's packaging and store materials in strict accordance with manufacturer's instructions.
- B. Remove and replace products that have been prematurely exposed to moisture.

1.8 PROJECT CONDITIONS

- A. Install materials in accordance with all safety and weather conditions required by the manufacturer.
- B. Install materials only after work on the applicable substrate is complete.
- C. Complete cast-in-place reinforced columns prior to membrane installation.

PART 2 - PRODUCTS

2.1 WATERPROOFING SYSTEM

- A. The Geotextile/Bentonite clay waterproofing membrane shall be CCW MiraCLAY supplied by Carlisle Coatings & Waterproofing Incorporated, 900 Hensley Lane, Wylie, Texas 75098, Phone (800) 527-7092 Fax: (972) 442-0076.
- B. Physical Properties for Geotextile/Bentonite Clay Waterproofing Membrane:

CCW MiraCLAY Physical Properties:

Property	Test Method	Value
Bentonite Content	—	1.0 lb./ft ² (.488 kg/m ²)*
Nominal Dry Thickness	—	0.25 in. (6.4 mm)
Weight	—	75 lb. (34.05 kg)
Permeability	ASTM D 5084	5 x 10 ⁻⁹ cm/sec
Grab Tensile Strength	ASTM D 4632	95 lb. (422 N)
Grab Elongation	ASTM D 4632	150%
Puncture Resistance	ASTM D 4833	120 psi (828 kPa)
Hydrated Internal Shear	ASTM D 5321	500 psf (24 kPa)
Swell Index	ASTM D 5890	2g (24 ml) min.
Fluid Loss	ASTM D 5891	18 ml max

*@ 12% moisture content

- C. Waterproofing system accessories supplied by waterproofing membrane manufacturer:
Mastic: CCW MiraCLAY Mastic is used for detailing at terminations and penetrations. Also used to fill minor voids in concrete and as a fillet in angle changes.
Granules: CCW MiraCLAY Granules used for horizontal to vertical transitions and for detailing at seams and slab penetrations.

- Waterstop: CCW MiraSTOP used as a waterstop at cold concrete pours, shotcrete cold joints and between pre-cast concrete panels.
- D. Membrane to Substrate Fasteners: Fasteners, of the type and length suitable for the substrate, shall be used in conjunction with washers, of at least 1" diameter, to attach the geotextile/bentonite clay waterproofing membrane to the substrate.
 - E. Membrane to Membrane Fasteners: Mechanically fasten membrane sheets together with a box-stapler or similar device for horizontal applications.
 - F. The Geotextile/Bentonite membrane shall consist of geotextile panels of sodium bentonite clay sandwiched between two layers of needle-punched woven and non-woven polypropylene fabrics.
 - G. Drainage Composite: Shall be CCW MiraDRAIN® as recommended by the manufacturer for each condition.
 - H. Perimeter Drainage System: Where required shall be CCW QuickDRAIN™.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine substrate and condition under which waterproofing will be installed. Do not proceed with the work until unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

- A. Lagging, Concrete Closures, Shotcrete or Guniting Applications:
 - 1. Fill all spaces that are over 1" (25mm) in width with grout or concrete to a smooth and uniform surface. Cover large gaps with 1/2" (12mm) plywood or CCW MiraDRAIN 6000 or 6000XL.
 - 2. Trowel CCW MiraCLAY Mastic around all tieback plates and soldier beams a minimum of 1 1/2" (39mm) thick and extend a minimum of 4" (10cm) beyond the flange.
 - 3. Remove projections from the wall surface in excess of 3/4" (20mm).
- B. Grade Substrates: Shall be level and uniform that is compacted to a minimum of 85% modified proctor.
- C. Concrete Application:
 - 1. Apply CCW MiraCLAY Mastic to all construction joints at a minimum of 1/4" (7mm) thickness and a 3" (8cm) minimum width.
 - 2. Remove projections from the wall surface in excess of 3/4" (20mm).
- D. Honeycombing, voids and aggregate pockets exceeding 1 inch in diameter or have a depth greater than 3/4 inch should be filled with a non-shrink cementitious grout. Fill tie-rod holes with a non-shrink cementitious grout.

3.3 INSTALLATION

- A. Prevent geotextile/bentonite clay waterproofing membrane from hydrating before being covered with overburden. When threat of rain is imminent or backfill is not immediate, geotextile/bentonite clay waterproofing membrane should be covered with polyethylene sheeting.
- B. Lagging Application
 - 1. Install a stripping piece of CCW MiraCLAY over each soldier beam that extends a minimum of 8" (20cm) beyond either side of the beam. Each soldier beam shall have a double layer of CCW MiraCLAY Membrane.
 - 2. Install CCW MiraCLAY with the white non-woven side out, facing the installer.
 - 3. Starting at the bottom of the wall, unroll CCW MiraCLAY and nail across top of panel one nail per 12" (31cm) on center. Allow sheet to hang down nailing only as required to stabilize.
 - 4. Install adjacent membrane by overlapping edges a minimum of 4" (10cm).

5. Fasten membrane once every 18" (45cm) on seams or as required to prevent blousing.
 6. Extend waterproofing membrane to or above grade and fasten membrane once every 12" to 15" (31cm to 39cm).
 7. Install CCW MiraSTOP at all pour joints and exterior perimeter of tie-back box outs.
- C. Underslab Application: (Concrete slab shall have a minimum thickness of 4" if reinforced or 5" if not reinforced).
1. Install CCW MiraCLAY with the white non-woven side up, facing the installer.
 2. Overlap edges a minimum of 4" (10cm).
 3. Protect CCW MiraCLAY from damage caused by chairs with sharp edges or points by placing a patch of CCW MiraCLAY under the chair.
 4. Staple joints often enough to prevent excessive movement.
 5. Pour CCW MiraCLAY Granules or trowel CCW MiraCLAY Mastic around all penetrations and press in "cut to fit" collars of CCW MiraCLAY.
 6. Extend the installation of CCW MiraCLAY 12" (31cm) up or beyond the perimeter slab forms.
 7. Inspect and repair any damaged material before concrete pour.
- D. Concrete Wall Application:
1. Install CCW MiraCLAY with the white non-woven side out, facing the installer.
 2. Starting at the bottom of the wall, unroll CCW MiraCLAY and nail across top of panel one nail per 12" (31cm) on center. Allow sheet to hang down nailing only as required to stabilize.
 3. Install adjacent membrane by overlapping edges a minimum of 4" (10cm).
 4. Fasten membrane once every 18" (45cm) on seams or as required to prevent blousing with 3/4" (20mm) to 1" (25mm) concrete nails with washers.
 5. Extend waterproofing membrane to 6-inches below grade and fasten membrane to the substrate to maintain constant compression using a 1/8" X 1" (3 X 25 mm) minimum termination bar. Trowel a 1/2" (12mm) thick and 2" (5cm) wide bead of CCW MiraCLAY Mastic at top edge of membrane and cover termination bar.
 6. Create a cant at any vertical to horizontal transition by applying a 1.5" to 2" (4cm to 5cm) cant of CCW MiraCLAY Granules or CCW MiraCLAY Mastic.
 7. Strip in all corners and transitions with a 12" to 15" (31cm to 39cm) piece of CCW MiraCLAY membrane to double cover these areas.
 8. Backfill must be compactable soils free of construction debris and must be uniformly compacted to a minimum 85% Modified Proctor on each lift.
- E. Concrete Caissons, Shotcrete or Guniting Application
1. Conform CCW MiraCLAY to the change in planes.
 2. Install CCW MiraCLAY with the white non-woven side out, facing the installer.
 3. Starting at the bottom of the wall, unroll CCW MiraCLAY and nail across top of panel one nail per 12" (31cm) on center. Allow sheet to hang down nailing only as required to stabilize.
 4. Install adjacent membrane by overlapping edges a minimum of 4" (10cm).
 5. Fasten membrane once every 12" (30 cm) on seams or as required to prevent blousing with 3/4" (19mm) to 1" (25mm) concrete nails with 1" (25 mm) washers.

3.4 SHOTCRETE PLACEMENT

1. Apply shotcrete in strict accordance with ACI 506.2-95 Specification for Shotcrete.
2. Moisten the MiraCLAY non-woven surface to improve adhesion.
3. Commence spraying from the bottom to the top at a pressure not to vibrate or move the CCW MiraCLAY.
4. Install to the designed thickness in lifts not to exceed 4 feet (1.2m).
5. Protect adjacent CCW MiraCLAY from overspray and remove rebound and sand pockets.

3.5 PROTECTION AND DRAINAGE

1. Protect the geotextile/bentonite clay waterproofing membrane with CCW MiraDRAIN Drainage Composite.
2. Install the CCW MiraDRAIN Drainage Composite according to the detailed drawings for the specific installation requirements of the project.

3.6 BACKFILL

Backfill with smooth and uniform material with no sharp projections or stones larger than $\frac{3}{4}$ -inch. Compact backfill to an 85% Modified Proctor. Insure backfill material is not contaminated with salt or other materials that could prevent the CCW MiraCLAY from hydrating.

END OF SECTION

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SECTION 07200

BUILDING INSULATION

PART 1 – GENERAL

Provide all work and materials for insulation of the buildings as shown.

1.0 RELATED DOCUMENTS

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

1.01 SECTION INCLUDES

- A. Insulation work required on unexcavated exterior on foundation walls and similar locations as shown on the drawings.
- B. Insulation work required on exterior perimeter, interior partition walls and similar locations as shown on the drawings.

1.02 QUALITY STANDARDS

- A. Provide experienced, well-trained workers competent to complete the work as specified.
- B. Unless approved by the Architect, provide all related products and accessories from one manufacturer.
- C. Thermal Conductivity: The thickness shown are for the thermal conductivity (k-value at 75 F.) specified for each material.
- D. Provide adjusted thicknesses as directed for the use of material having a different thermal conductivity. Where insulation is specified to have a specified "R" value, furnish manufacturer's standard thickness required to equal or exceed the specified value.

1.03 REFERENCES

- A. American Society for Testing and Materials (ASTM).
 - 1. C 665 Specification for Mineral Fiber Blanket Thermal insulation for Light Frame Construction and Manufactured Housing.
 - 2. E 84 Test Method for Surface Burning Characteristics of Building Materials.

3. E 119 Test Method for Fire Tests of Building Construction Materials.
4. E 136 Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C.
5. C 518 Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter.

1.04 SUBMITTALS

- A. Submit the following within 10 calendar days after receiving the Notice to Proceed.

Submit list of materials to be provided for this work; manufacturer's data required to prove compliance with these Specifications, manufacturer's installation instructions; shop drawings as required with complete details and assembly instructions.

Submit samples as required for approval by the Architect.

1.05 MATERIALS, DELIVERY, STORAGE, AND HANDLING

- A. Provide all materials required to complete the work as shown on drawings and specified herein.
- B. Protect insulation from physical damage and from becoming wet, soiled, or covered with ice or snow. Comply with manufacturer's recommendations for handling, storage and protection during installation.
- C. Label insulation packages to include material name, production date and/or product code.
- D. Have on hand and ready for installation in coordination with roofing, all accessories such as skylights, hatches, relief vents, expansion joints, etc.
- E. Protect plastic insulation from exposure to sunlight.
- F. Fire Hazard: Do not deliver plastic insulation materials to the project site ahead of time for installation. Protect at all times against ignition. Complete the installation and concealment of plastic materials as rapidly as possible in each area of work.

- G. Deliver and store material under provision of Section 01600.

1.06 PRECONSTRUCTION, PREPARATION, AND LIMITATIONS

- A. Examine and verify that job conditions are satisfactory for speedy and acceptable work.
- B. Do not use unfaced insulation in exposed applications where there is potential for skin contact and irritation.
- C. Do not proceed with the installation of insulation on walls or under slabs until the work which follows (and which conceals the insulation) is ready to be performed.

PART 2 – MATERIALS

2.01 INSULATION MATERIALS:

- A. Extruded Polystyrene Board Insulation:

Rigid, closed-cell, extruded polystyrene board complying with ASTM C578, Type IV (1.6 pcf density), thermal conductivity, aged value, (k – value at 75° F.) of 0.20; manufacturer's standard sizes, 2" thickness for R = 10.

Provide "Styrofoam SM" by Dow Chemical, "Foamular 250" by U.C. Industries, "Amocor" by Amoco Foam Products or approved equal.

- B. Mineral/Glass Fiber Batt Insulation:

1. MINIMUM COMPLIANCE STANDARDS: The following Documents govern the work except where more restrictive items are specified:
 - a. Federal Specification HH-I-521F, Type III.
 - b. American Society of Heating, Refrigeration, and Air Conditioning Engineers.
 - c. National Environmental Systems Contractors Association.
2. INSULATION: Mineral wool or glass fiber batts or blanket conforming to E.P.A. energy conservation requirements and F.S. HH-I-521F, Type III.
 - a. UL RATING: Maximum flame spread of 25, fuel contribute of 50, and smoke developed of 50 when tested per ASTM E 84.

- b. THERMAL RESISTANCE: "R" values are listed in the ASHRA Guide for batt and blanket insulation. Provide 6 inch R-19 for walls with 6-inch stud cavity and 3½ inch R-11 for walls with 4" stud cavity. Provide craft paper backing to one side with flanges for stapling application.
- c. Provide products from Owens Corning or approved equal.

2.02 ACCESSORY MATERIALS:

Miscellaneous Materials:

Adhesive for Bonding Insulation: The type recommended by the insulation manufacturer, and complying with fire-resistance requirements.

Mechanical Anchors: Type and size as recommended by the insulation manufacturer for the type of application shown and condition of substrate.

PART 3 – CONSTRUCTION AND INSTALLATION

3.1.1 INSTALLATION:

General:

Comply with manufacturer's instructions for the particular conditions of installation in each case. If printed instructions are not available or do not apply to the project conditions, consult the manufacturer's technical representative for specific recommendations before proceeding with the work.

Extend insulation full thickness as shown over entire surface to be insulated. Cut and fit tightly around obstructions, and fill voids with insulation and mastic. Do not install batt insulation on top of or within 3" of recessed light fixtures unless light fixtures are approved for such insulation.

Perimeter Insulation:

Apply a single layer of insulation of the required thickness.

On vertical surfaces and where temporary support is required before backfilling, set units in adhesive applied in accordance with manufacturer's instructions. Use type adhesive recommended by manufacturer.

Apply to exterior face of exterior foundations walls where ongrade building slabs are below adjacent grades. Extend from 2" below grade down 24". Apply in final coat of dampproofing while still wet.

Unit-Type Building Insulation:

Apply insulation units of the type shown to the substrate by the method indicated, complying with the manufacturer's recommendations.

Attach units to substrate and to sides of framing member with staples or other approved mechanical fasteners.

Friction fit batt insulation at metal stud framing to completely fill spaces. Minimize cross joints and seal with adhesive tape.

Set vapor barrier faced units with vapor barrier to inside of construction, except as otherwise shown. Do not obstruct ventilation spaces.

Tape joints and ruptures in vapor barriers, using adhesive tape of type recommended by insulation manufacturer, and seal each continuous area of insulation to surrounding construction so as to ensure vapor-tight installation of the units.

In wood or metal frame construction spaces too small for batt insulation or inaccessible for its installation, fill spaces with pressurized container foamed in place insulation of acceptable type and having equivalent thermal performance to batt insulation required.

Do not cover insulation until the installation has been inspected and approved.

END OF SECTION

SECTION 07220

ROOF SCUTTLE

I. PART ONE – GENERAL

1.01 SUMMARY

A. Work included:

- 1.** Furnishing and installing factory fabricated roof scuttles
- 2.** Furnishing and installing factory fabricated automatic roof fire vents.

1.02 REFERENCES

- A.** American Society for Testing and Materials (ASTM), 1916 Race Street, Philadelphia, PA 19103; (215) 299-5400, fax (215) 977-9679
- 1.** ASTM A 36-93a: Standard Specification for Structural Steel
- B.** Factory Mutual Research Corporation (FMRC), P.O. Box 9102, Norwood, MA 02082 (617) 762-4300
- C.** Underwriters Laboratories (UL), 333 Pfingsten Road, Northbrook, IL, 60062, (847) 272-8800, FAX (847) 272-8129

1.03 SUBMITTALS

- A.** Product Data: Provide manufacturer's product data for all materials in this specification.
- B.** Shop Drawings: Show profiles, accessories, location, and dimensions.
- C.** Samples: Manufacturer to provide upon request; sized to represent material adequately.
- D.** Contract Closeout: Roof scuttle manufacturer shall provide the manufacturer's Warranty prior to the contract closeout.

1.04 PRODUCT HANDLING

- A.** All materials shall be delivered in manufacturer's original packaging.
- B.** Store materials in a dry, protected, well-vented area. The contractor shall thoroughly inspect product upon receipt and report damaged material immediately to delivering carrier and note such damage on the carrier's freight bill of lading.
- C.** Remove protective wrapping immediately after installation.

1.05 SUBSTITUTIONS

- A.** Proposals for substitution products shall be accepted only from bidding contractors and not less than (10) working days before bid due date. Contractor guarantees that proposed substitution shall meet the performance and quality standards of this specification.

1.06 JOB CONDITIONS

- A. Verify that other trades with related work are complete before installing roof scuttle(s) and fire vents.
- B. Mounting surfaces shall be straight and secure; substrates shall be of proper width.
- C. Refer to the construction documents, shop drawings, and manufacturer's installation instructions.
- D. Coordinate installation with roof membrane and roof insulation manufacturer's instructions before starting.
- E. Observe all appropriate OSHA safety guidelines for this work.

1.07 WARRANTY/GUARANTEE

- A. Manufacturer's standard warranty: Materials shall be free of defects in material and workmanship for a period of five years from the date of purchase. Should a part fail to function in normal use within this period, manufacturer shall furnish a new part at no charge. Electrical motors, special finishes, and other special equipment (if applicable) shall be warranted separately by the manufacturers of those products.

II. PART TWO - PRODUCTS

2.01 MANUFACTURER

- A. The BILCO Company, P.O. Box 1203, New Haven, CT 06505, 1-203-934-6363, Fax: 1-203-933-8478, Web: www.bilco.com

2.02 ROOF SCUTTLE

- A. Furnish and install where indicated on plans metal roof scuttle Type S, size width: 4'0" (914mm) x length: 4'0" (762mm). Length denotes hinge side. The roof scuttle shall be single leaf. The roof scuttle shall be pre-assembled from the manufacturer.
- B. Performance characteristics:
 - 1. Cover shall be reinforced to support a minimum live load of 40 psf (195kg/m²) with a maximum deflection of 1/150th of the span or 20 psf wind uplift.
 - 2. Operation of the cover shall be smooth and easy with controlled operation throughout the entire arc of opening and closing.
 - 3. Operation of the cover shall not be affected by temperature.
 - 4. Entire scuttle shall be weathertight with fully welded corner joints on cover and curb.
- C. Cover: Shall be 14 gauge paint bond G-90 galvanized steel with a 3" (76mm) beaded flange with formed reinforcing members. Cover shall have a heavy extruded thermoplastic rubber gasket fitted into a retainer that is mechanically fastened to the cover interior to assure a continuous seal when compressed to the top surface of the curb.

- D. Cover insulation: Shall be fiberglass of 1" (25.4mm) thickness, fully covered and protected by a metal liner **22 gauge paint bond G-90 galvanized steel**.
- E. Curb: Shall be 12" (305mm) in height and of **14 gauge paint bond G-90 galvanized steel**. The curb shall be formed with a 3-1/2" (89mm) flange with 7/16" (11.1mm) holes provided for securing to the roof deck. The curb shall be equipped with an integral metal cap flashing of the same gauge and material as the curb, fully welded at the corners, that features the Posi-Flash™ flashing system, including stamped tabs, 6" (153mm) on center, to be bent inward to hold single ply roofing membrane securely in place.
- F. Curb insulation: Shall be rigid, high-density fiberboard of 1" (25.4mm) thickness on outside of curb.
- G. Lifting mechanisms: Manufacturer shall provide compression spring operators enclosed in telescopic tubes to provide, smooth, easy, and controlled cover operation throughout the entire arc of opening and closing. The upper tube shall be the outer tube to prevent accumulation of moisture, grit, and debris inside the lower tube assembly. The lower tube shall interlock with a flanged support shoe **through bolted to the curb assembly**.
- H. Hardware
 - 1. Heavy pintle hinges shall be provided
 - 2. Cover shall be equipped with a spring latch with interior and exterior turn handles
 - 3. Roof scuttle shall be equipped with interior and exterior padlock hasps.
 - 4. The latch strike shall be a stamped component bolted to the curb assembly.
 - 5. Cover shall automatically lock in the open position with a rigid hold open arm equipped with a 1" (25.4mm) diameter red vinyl grip handle to permit easy release for closing.
 - 6. Compression spring tubes shall be an anti-corrosive material and all other hardware shall be zinc plated and chromate sealed. Springs shall have an electro-coated acrylic finish for corrosion resistance.
 - 7. Cover hardware shall be bolted into heavy gauge channel reinforcing welded to the underside of the cover and concealed within the insulation space.
- I. Finishes: Factory finish shall be **alkyd based red oxide primed steel**.

2.03 AUTOMATIC ROOF FIRE VENT

- A. Furnish and install where indicated on plans metal fire vent **Type SV**, size **width (3'-0") x length (2'-6")**. Length denotes hinge side. The roof fire vent shall be single leaf. The roof fire vent shall be pre-assembled from the manufacturer.
- B. Performance characteristics:
 - 1. Cover shall be reinforced to support a minimum live load of 40 psf (195kg/m²) with a maximum deflection of 1/150th of the span or 20 psf wind uplift.

2. Lifting mechanism assemblies shall open the vent covers simultaneously when latch is manually released or when heat breaks the UL listed fusible link. Opening shall be in a controlled manner to avoid damage to surrounding roof surfaces.
 3. Entire roof fire vent shall be weather-tight with fully welded corner joints on cover and curb.
 4. Latch mechanisms shall hold the covers in the closed position without overstressing the fusible link and withstand 30 psf (146 kg/m²) wind uplift forces acting on the cover.
 5. Latch operation: When heat parts the UL listed fusible link, the latch shall release instantaneously, allowing vent cover to open. The latch shall be designed for easy resetting, after a fire or test, so that the cover cannot be latched closed unless the mechanism has been reset properly. Manufacturer shall provide instructions for resetting the latch with each unit.
- C. Cover: Shall be 14 gauge paint bond G-90 galvanized steel with a 3" (76mm) beaded flange with formed reinforcing members. Covers shall have a heavy extruded EPDM rubber gasket that is bonded to the cover interior to assure a continuous seal when compressed to the top surface of the curb.
- D. Cover insulation: Shall be fiberglass of 1" (25.4mm) thickness, fully covered and protected by a metal liner 22 gauge paint bond G-90 galvanized steel.
- E. Curb: Shall be 12" (305mm) in height and of 14 gauge paint bond G-90 galvanized steel. Curb shall be formed with a 3-1/2" (89mm) flange with 7/16" (11.1mm) holes provided for securing to roof deck. Curb shall be equipped with integral metal capflashing of the same gauge and material as the curb and feature the Posi-Flash™ flashing system, including stamped tabs, 6" (153mm) on center, to be bent inward to hold single-ply roofing membrane securely in place.
- F. Curb insulation: Shall be rigid, high density fiberboard of 1" (25.4mm) thickness on the outside of curb.
- G. Lifting mechanisms: Manufacturer shall provide compression spring operators enclosed in telescopic tubes to open the covers against a snow/wind load. Upper tube shall be the outer tube to prevent accumulation of moisture, grit, and debris inside lower tube assembly. Lower tube shall interlock with a flanged support shoe.
- H. Latch mechanism: Shall be the BILCO Thermolatch ® II positive hold/release mechanism with a separate latching point for each cover controlled by a single UL listed 165° fusible link. Fusible link shall be curb mounted on a non-hinged end to allow the latching mechanism to be easily reset from the roof level.
- I. Hardware
1. Heavy pintle hinges shall be provided.

2. Cover shall automatically lock in the open position with a rigid hold open arm equipped with a 1" (25.4mm) diameter red vinyl grip handle to permit easy release for closing.
 3. Compression spring tubes shall be an anti-corrosive material and all other hardware shall be zinc plated and chromate sealed. [For installation in corrosive environments, specify Type 316 stainless steel hardware.
 4. Cover hardware shall be bolted into heavy gauge channel reinforcing welded to the underside of the cover and concealed within the insulation space.
- J. Heavy duty shock absorbers: Shall be provided to assure controlled opening of the covers.
- K. Manual pull release cables: Interior and exterior cables with red vinyl grips shall be provided and allow the unit to be opened without disturbing the fusible link.
- L. Finishes: Factory finish shall be [select: alkyd based red oxide primed steel or mill finish aluminum].

III. PART THREE - EXECUTION

3.01 INSPECTION

- A. Verify that roof scuttle and roof fire vent installation will not disrupt other trades. Verify that the substrate is dry, clean, and free of foreign matter. Report and correct defects prior to any installation.

3.02 INSTALLATION

- A. Submit product design drawings for review and approval to the architect or specifier before fabrication.
- B. The installer shall check as-built conditions and verify the manufacturer's roof scuttle details for accuracy to fit the application prior to fabrication. The installer shall comply with the roof scuttle Manufacturer's installation instructions.
- C. The installer shall furnish mechanical fasteners consistent with the roof requirements.
- D. The manufacturer shall provide instructions for resetting the latching device with each unit.
- E. The installer shall test the vent(s) for proper operation after installation fusing the link. A replacement fusible link shall be supplied with vent by the manufacturer.

END OF SECTION



Senerflex® Channeled Adhesive Design – Section 072419

*Water-drainage polymer-based EIFS incorporating vertical drainage channels
and an air/water-resistive barrier*

INTRODUCTION

This specification has been assembled to enable the design professional to select or delete sections to suit the project requirements and is intended to be used in conjunction with Senergy® typical details, product bulletins, technical bulletins, etc.

DESIGN RESPONSIBILITY

It is the responsibility of both the specifier and the purchaser to determine if a product is suitable for its intended use. The designer selected by the purchaser shall be responsible for all decisions pertaining to design, detail, structural capability, attachment details, shop drawings and the like. The Wall Systems business of BASF Corporation (herein referred to as “BASF Wall Systems”) has prepared guidelines in the form of specifications, typical application details, and product bulletins to facilitate the design process only. BASF Wall Systems is not liable for any errors or omissions in design, detail, structural capability, attachment details, shop drawings or the like, whether based upon the information provided by BASF Wall Systems or otherwise, or for any changes which the purchasers, specifiers, designers or their appointed representatives may make to BASF Wall Systems published comments.

DESIGNING AND DETAILING A SENERFLEX CHanneled ADHESIVE WALL SYSTEM

General: The system shall be installed in strict accordance with current recommended published details and product specifications from the system's manufacturer.

- A. Wind Load
 - 1. Maximum deflection not to exceed L/240 under positive or negative design loads.
 - 2. Design for wind load in conformance with local code requirements.
- B. Substrate Systems
 - 1. Acceptable substrates are: PermaBase® Cement Board and other cement-boards conforming with ASTM C1325 (Type A-exterior); poured concrete/unit masonry; ASTM C1177 type sheathings, including, Weather Defense™ Platinum sheathing, GreenGlass® sheathing, e²XP™ sheathing, GlasRoc® sheathing, Securock™ glass-mat sheathing, and DensGlass® exterior sheathing; gypsum sheathing (ASTM C79/C1396); Exposure I or exterior plywood (Grade C/D or better); or Exposure I OSB.
 - 2. Painted and otherwise coated surfaces of brick, unit masonry, stucco and concrete shall be inspected and prepared as approved by BASF Wall Systems before application. The applicator shall verify that the proposed substrate is acceptable prior to the Senerflex Channeled Adhesive Wall System installation.
 - 3. The substrate systems shall be engineered with regard to structural performance by others.
- C. Moisture Control
 - 1. Prevent the accumulation of water behind the EIF system, either by condensation or leakage through the wall construction, in the design and detailing of the wall assembly.
 - a. Provide flashing to direct water to the exterior where it is likely to penetrate components in the wall assembly, including, above window and door heads, beneath window and door sills, at roof/wall intersections, decks, abutments of lower walls with higher walls, above projecting features, and at the base of the wall and anywhere else required by local code.
 - [b. Air Leakage Prevention: provide continuity of air barrier system at foundation, roof, windows, doors and other penetrations through the system with connecting and compatible air barrier components to minimize condensation and leakage caused by

air movement.

- c. Vapor Diffusion and Condensation: perform a dew point analysis of the wall assembly to determine the potential for accumulation of moisture in the wall assembly as a result of water vapor diffusion and condensation. Adjust insulation thickness and/or other wall assembly components accordingly to minimize the risk of condensation. Avoid the use of vapor retarders on the interior side of the wall in warm, humid climates.

D. Impact Resistance

1. Provide Ultra-High impact resistance to a minimum height of 6' – 0" (1.8m) above finished grade at all areas accessible to pedestrian traffic and other areas exposed to abnormal stress or potential impact. Indicate the areas with impact resistance requirements other than "Standard" on contract drawings.

E. Color Selection

1. The use of dark colors must be considered in relation to wall surface temperature as a function of local climate conditions. Select Finish Coat color with a light reflectance value (LRV) of 20% or higher. The use of dark colors (LRV less than 20%) is not recommended with EIF Systems that incorporate expanded polystyrene (EPS). EPS has a sustained service temperature limitation of approximately 71°C (160°F).

F. System Joints

1. Minimum ¾" (19 mm) expansion joints in the system are required at building expansion joints, at prefabricated panel joints, floor lines of wood frame construction, where substrates change and where structural movement is anticipated. It is the sole responsibility of the project design team, including the architect, engineer, etc., to ultimately determine specific expansion joint placement, width and design. Detail specific locations in construction drawings.
2. Minimum ½" (13 mm) wide sealant joints are required at all penetrations through the Senerflex Channeled Adhesive Design (windows, doors, etc.)
3. Specify compatible closed cell backer rod and acceptable sealant that has been evaluated in accordance with ASTM C 1382, "Test Method for Determining Tensile Adhesion Properties of Sealants When Used in Exterior Insulation and Finish System (EIFS) Joints," and that meets minimum 50% elongation after conditioning.
4. The system must be properly terminated (back-wrapped a min. of 2", properly sealed, flashed) at all penetrations, lighting fixtures, electrical outlets, hose bibs, dryer vents, etc.

G. Grade Condition

1. The Senerflex Channeled Adhesive Design is not intended for use below grade or on surfaces subject to continuous or intermittent immersion in water or hydrostatic pressure. Ensure a minimum 8" (203.2 mm) clearance above grade or as required by code, a minimum 1" (25.4 mm) clearance above finished grade (sidewalk/concrete flatwork).

H. Trim, Projecting Architectural Features

(NOTE TO SPECIFIER: Installation of the Senergy Wall System outside the slope guidelines referenced in this specification may still qualify for a standard warranty; however, increased maintenance and premature deterioration of the system shall be expected and any deleterious affects caused by the lack of slope will not be the responsibility of BASF Corporation. The design professional has the option to build according to his/her project needs. The design professional must also consider geography, climate, building orientation, wall orientation and adjacent building components when designing with EIFS. The slope guidelines referenced below are provided to offer assistance to the owner and/or design professional. Final design of any building is the responsibility of the design professional.)

1. Minimum slope for all projections shall be 1:2 (27°) with a maximum length of 30.5 cm (12") [e.g. 15 cm in 30.5 cm (6" in 12")]. Increase slope for northern climates to prevent accumulation of ice/snow on the surface.
2. Senergy Wall Systems were designed and tested to be applied to vertical surfaces. As the slope of the wall system application decreases, the chance for premature

- deterioration of any wall system increases.
3. Low sloping EIFS conditions are subject to more extreme heat. Low sloped areas are known to produce an increase in wall surface temperature. This design can lead to accelerated weathering of the low sloped surface.
- I. Coordination with other trades
1. Evaluate adjacent materials such as windows, doors, etc. for conformance to manufacturer's details. Adjacent trades shall provide scaled shop drawings for review.
 2. Air Seals at any joints/gaps between adjoining components (penetrations, etc.) are of primary importance to maintain continuity of an air barrier system and must be considered by the design professional in the overall wall assembly design. Install air seals between the primary Air/Water Resistive barrier and other wall components (penetrations, etc.) in order to maintain continuity of an air barrier system.
 3. Provide site grading such that Senerflex Channeled Adhesive Design terminates a minimum of 8" (203 mm) above finished grade or as required by code.
 4. Provide protection of rough openings in accordance with Senergy® Moisture Protection Guidelines for Senerflex Wall Systems before installing windows, doors, and other penetrations through the wall.
 5. Install copings and sealant immediately after installation of the Senerflex Channeled Adhesive Design and when Senergy coatings are completely dry.

TECHNICAL INFORMATION

Consult BASF Wall Systems' Technical Services Department for specific recommendations concerning all other applications. Consult the Senergy website, www.senergy.basf.com, for additional information about products and systems and for updated literature.

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Refer to all drawings and other sections of this specification to determine the type and extent of work therein affecting the work of this section, whether or not such work is specifically mentioned herein.
- B. Senerflex Channeled Adhesive Design: Composite wall Exterior Insulation and Finish System consisting of Air/Water Resistive Barrier, Adhesive, rigid insulation, Base Coat, Reinforcing Mesh, and Finish Coat.
- C. Senergy products are listed in this specification to establish a standard of quality. Any substitutions to this specification shall be submitted to and receive approval from the Architect at least 10 days before bidding. Proof of equality shall be borne by the submitter.
- D. The system type shall be Senergy Senerflex Channeled Adhesive Design as manufactured by BASF Corp. - Wall Systems, Jacksonville, Florida (herein referred to as BASF Wall Systems).

1.02 RELATED SECTIONS

- A. Section 03 00 00 Concrete substrate
- B. Section 04 00 00 Masonry substrate
- C. Section 05 40 00 Cold-formed metal framing
- D. Section 06 16 00 Sheathing
- E. Section 06 11 00 Wood framing
- F. Section 07 27 00 Air barriers
- G. Section 07 62 00 Sheet Metal Flashing and Trim
- H. Section 07 65 00 Flexible flashing
- I. Section 07 90 00 Joint protection
- J. Section 08 00 00 Openings
- K. Section 09 22 00 Supports for plaster and gypsum board
- L. Section 09 22 16 Non-structural metal framing
- M. Section 09 29 00 Gypsum board

1.03 DEFINITIONS

- A. Exterior Insulation and Finish System: Exterior assembly comprised of Adhesive, rigid insulation, Base Coat, Reinforcing Mesh, and Finish Coat.
- B. Class PB Systems: A class of EIFS where the Base Coat varies in thickness depending upon the number of layers or thickness of Reinforcing Mesh. The reinforcing material is glass fiber mesh, which is embedded into the Base Coat at the time of installation. The Base Coat shall be applied so as to achieve Reinforcing Mesh embedment with no Reinforcing Mesh color visible, nominal thickness of 1.6 mm (1/16"). Protective Finish Coats, of various thicknesses, in a variety of textures and colors, are applied over the Base Coat.
- C. Water-Drainage EIFS: A wall cladding design with an exterior surface for primary weather protection and aesthetics, which incorporates an inner secondary Air/Water Resistive barrier to accommodate incidental moisture and direct it to the exterior.

1.04 SUBMITTALS

- A. Submit under provisions of Section [01 33 00]
- B. Product Data: Provide data on Senerflex Channeled Adhesive Design materials, product characteristics, performance criteria, limitations and durability.
- C. Code Compliance: Provide manufacturer's applicable code compliance report.
- D. Samples: Submit [two] [x] [millimeter] [inch] size samples of Senerflex Channeled Adhesive Design illustrating Finish Coat color and texture range.
- E. Certificate: System manufacturer's approval of applicator.
- F. Sealant: Sealant manufacturer's certificate of compliance with ASTM C1382.
- G. System manufacturer's current specifications, typical details, system design guide and related product literature which indicate preparation required, storage, installation techniques, jointing requirements and finishing techniques.

1.05 QUALITY ASSURANCE

- A. Manufacturer: More than 10 years in the EIFS industry, with more than 1000 completed EIFS projects.
- B. Applicator: Approved by BASF Wall Systems in performing work of this section.
- C. Regulatory Requirements: Conform to applicable code requirements for exterior insulation and finish system.
- D. Field Samples
 - 1. Provide under provisions of Section [01 43 36] [01 43 39].
 - 2. Construct one field sample panel for each color and texture, [x] [meters] [feet] in size of system materials illustrating method of attachment, surface Finish color and texture.
 - 3. Prepare each sample panel using the same tools and techniques to be used for the actual application.
 - 4. Locate sample panel where directed.
 - 5. Accepted sample panel [may] [may not] remain as part of the work.
 - 6. Field samples shall be comprised of all wall assembly components including substrate, Air/Water Resistive barrier, insulation board, Base Coat, Reinforcing Mesh, primer (if specified), Finish Coat, and typical sealant/flashing conditions.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Deliver, store and handle products under provisions of Section [01 65 00] [01 66 00] [].
- B. Deliver Senerflex Channeled Adhesive Design materials in original unopened packages with manufacturer's labels intact.
- C. Protect Senerflex Channeled Adhesive Design materials during transportation and installation to avoid physical damage.
- D. Store Senerflex Channeled Adhesive Design materials in cool, dry place protected from freezing. Store at no less than 4°C/40°F (10°C/50°F for BASF Wall Systems' AURORA STONE, AURORA TC-100, ALUMINA™ and BOREALIS Finish).
- E. Store insulation boards flat and protected from direct sunlight and extreme heat.

- F. Store Senerflex Channeled Adhesive Design Reinforcing Mesh, SHEATHING FABRIC and SENERFLASH™/SENERWRAP flexible flashing in cool, dry place protected from exposure to moisture.

1.07 PROJECT/SITE CONDITIONS

- A. Do not apply Senerflex Channeled Adhesive Design in ambient temperatures below 4°C/40°F (10°C/50°F for BASF Wall Systems' AURORA STONE, AURORA TC-100, ALUMINA™ and BOREALIS Finish). Provide properly vented, supplementary heat during installation and drying period when temperatures less than 4°C/40°F (10°C/50°F for BASF Wall Systems' AURORA STONE, AURORA TC-100, ALUMINA™ and BOREALIS Finish) prevail.
- B. Do not apply Senerflex Channeled Adhesive Design materials to frozen surfaces.
- C. Maintain ambient temperature at or above 4°C/40°F (10°C/50°F for BASF Wall Systems' AURORA STONE, AURORA TC-100, ALUMINA™ and BOREALIS Finish) during and at least 24 hours after Senerflex Channeled Adhesive Design installation and until dry.

1.08 SEQUENCING AND SCHEDULING

- A. Coordinate and schedule installation of Senerflex Channeled Adhesive Design with related work of other sections.
- B. Coordinate and schedule installation of trim, flashing, and joint sealers to prevent water infiltration behind the system.

1.09 WARRANTY

- A. Provide BASF Wall Systems ten-year limited materials warranty and ten-year materials and labor moisture drainage warranty for Senerflex Channeled Adhesive Design installations under provisions of Section [01 70 00].
1. Comply with BASF Wall Systems project review requirements and notification procedures to assure qualification for warranty.

PART 2 PRODUCTS

2.01 MANUFACTURERS

Senerflex® Channeled Adhesive Design (Class PB System) manufactured by BASF Corporation.

(NOTE TO SPECIFIER: Items in brackets indicate a system option or choice of options. Throughout the specification, delete those which are not required or utilized. Contact BASF Wall Systems Technical Service Department for further assistance.)

2.02 MATERIALS

- A. Air/Water-Resistive Barrier:

NOTE TO SPECIFIER: Select SENERSHIELD® and/or SENERSHIELD-R® (most typically one or the other) in section 1 and one or more of the corresponding components listed in section 2. Delete those not utilized.

1. [SENERSHIELD®: 100% acrylic-based, fiber-reinforced Air/Water Resistive Barrier that is field mixed with Type I or Type II Portland cement.]

- OR -

[SENERSHIELD-R®: ready-mixed, flexible Air/Water Resistive Barrier.]

2. [a. FLASHING PRIMER: water-based primer for use prior to application of SENERFLASH™ on all acceptable surfaces.
- b. SENERFLASH™: 30-mil thick, self-sealing, self-healing composite membrane of polyester fabric and rubberized asphalt. Compatible with SENERSHIELD or SENERSHIELD-R Air/Water Resistive Barrier.]
- [c. Senergy® SELF-ADHERING MESH TAPE 4: 100 mm (4") balanced, open weave glass fiber reinforcing mesh with adhesive; twisted multi-end strands treated for compatibility with system components for use with SENERSHIELD]

- [d. FLEXGUARD 4 Mesh: 100 mm (4") balanced, open weave glass fiber Reinforcing Mesh; twisted multi-end strands treated for compatibility with system components for use with SENERSHIELD]
- [e. 4" SHEATHING FABRIC: 100 mm (4") spunbonded non-woven reinforced polyester web for use with SENERSHIELD-R.]

B. Adhesives/Base Coats

NOTE TO SPECIFIER: Select one or more of the following base coat materials. Delete those not utilized.

- [1. [STANDARD] [ALPHA] Base Coat: 100% acrylic base coat, field-mixed with Portland cement; manufactured by BASF Corp.]
- [2. ALPHA DRY Base Coat: Dry-mix base coat containing Portland cement; manufactured by BASF Corp.]
- [3. XTRA-STOP Base Coat: 100% acrylic-based, water-resistant base coat, field-mixed with Portland cement; manufactured by BASF Corp.]
- [4. ALPHA GENIE Base Coat: Fiber-reinforced, 100% acrylic base coat, field-mixed with Portland cement; manufactured by BASF Corp.]

NOTE TO SPECIFIER: Portland cement is not used with Senershield-R or Alpha Dry Base Coat.

- [C. Portland cement: Conform to ASTM C150, Type I, II, or I/II, grey or white; fresh and free of lumps.]
- D. Water: Clean and potable without foreign matter.
- E. Insulation Board: Expanded polystyrene; ASTM C578, Type I; Flame spread less than 25, smoke developed less than 450 per ASTM E84, UL 723; minimum density 15.22 kg/m³ (0.95 lb/ft³; K=6.09 per mm (0.24 per inch); minimum thickness as indicated on drawings [minimum 19 mm (3/4")]; meeting the following:
 - 1. Air-dried (aged) six weeks, or equivalent, prior to installation.
 - 2. Edges: square within 0.8 mm per meter (1/32" per foot).
 - 3. Thickness: tolerance of plus or minus 1.6 mm (1/16").
 - 4. Size: 0.6 m x 1.22 m (2' x 4').
 - 5. Length and width: tolerance of plus or minus 1.6 mm (1/16").
- F. Senergy Reinforcing Mesh: Balanced, open weave glass fiber reinforcing mesh; twisted multi-end strands treated for compatibility with Senerflex Channeled Adhesive Design components.

NOTE TO SPECIFIER: Select required mesh; delete those that are not to be utilized.

- [1. FLEXGUARD 4: standard weight, 4 oz.]
- [2. INTERMEDIATE 6: standard/medium weight, 6 oz.]
- [3. INTERMEDIATE 12: intermediate weight, 12 oz.]
- [4. STRONG 15: heavy weight, 15 oz. used only in combination with Flexguard 4 or Intermediate 6.]
- [5. HI-IMPACT 20: heavy weight, 20 oz. used only in combination with Flexguard 4 or Intermediate 6.]]
- [6. CORNER MESH: Intermediate weight, pre-marked for easy bending, for reinforcing at exterior corners.]
- [G. [ASAP]: 100% acrylic-based coating; as manufactured by BASF Corp.]
- [H. [COLOR COAT]: 100% acrylic-based coating; as manufactured by BASF Corp.]
- [I. TINTED PRIMER: 100% acrylic-based primer; color to closely match the selected Senergy® Finish Coat color; manufactured by BASF Corp.]

J. Senergy Finish Coat:

NOTE TO SPECIFIER: Select one of the following finish types and textures. Delete those that are not to be utilized.

- 1. [SENERFLEX 100% acrylic polymer based finish; air cured, compatible with Base Coat; Finish color; color [] as selected; Finish texture [CLASSIC] [FINE] [TEXTURE] [COARSE] [SAHARA] [BELGIAN LACE] [ENCAUSTO VERONA] [METALLIC] as scheduled; as manufactured by BASF Corp.]
- OR -
- 2. [BASF Wall Systems' 100% acrylic polymer based finish; air cured, compatible with

Base Coat; Finish color; color [] as selected; Finish texture [BOREALIS] [AURORA TC-100] [AURORA STONE] [ALUMINA™] as scheduled; as manufactured by BASF Corp.]

- OR -

3. [SILCOAT®] Finish: Siliconized acrylic emulsion finish coat; air cured, Finish color factory-mixed; color [] selected; Finish texture [CLASSIC] [FINE] [TEXTURE] [SAHARA] [BELGIAN LACE] as scheduled; as manufactured by BASF Corp.]

[K. BASF Wall System's AnticoGlaze™: 100% acrylic stain, manufactured by BASF Corp.]

2.03 ACCESSORIES

Window/Door Drip Edge: Rigid polyvinyl chloride (PVC), UV resistant for exterior use, with a drip edge, as furnished by Plastic Components, Inc. or equal. Accessories shall conform to ASTM D1784-97, C1063-99 and D4216-99.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify project site conditions under provisions of Section [01 00 00].

B. Walls

1. Substrates

- a. Trowel applied Air/Water Resistive barrier acceptable substrates: PermaBase® Cement Board and other cement-boards conforming with ASTM C1325 (Type A-exterior); poured concrete/unit masonry; ASTM C1177 type sheathings, including, Weather Defense™ Platinum sheathing, GreenGlass® sheathing, e²XP™ sheathing, GlasRoc® sheathing, Securock™ glass-mat sheathing, and DensGlass® exterior sheathing; gypsum sheathing (ASTM C79/C1396). Consult the BASF Wall Systems Technical Services Department for all other applications.
- b. Roller applied Air/Water Resistive barrier acceptable substrates: Acceptable substrates are: PermaBase® Cement Board and other cement-boards conforming with ASTM C1325 (Type A-exterior); poured concrete/unit masonry; ASTM C1177 type sheathings, including, Weather Defense™ Platinum sheathing, GreenGlass® sheathing, e²XP™ sheathing, GlasRoc® sheathing, Securock™ glass-mat sheathing, and DensGlass® exterior sheathing; gypsum sheathing (ASTM C79/C1396); Exposure I or exterior plywood (Grade C/D or better); or Exposure I OSB. Consult the BASF Wall Systems Technical Services Department for all other applications.
- c. Wall sheathing must be securely fastened per applicable building code and sheathing manufacturer's requirements.
- d. Examine surfaces to receive Senerflex Channeled Adhesive Design and verify that substrate and adjacent materials are dry, clean, sound, and free of releasing agents, paint, or other residue or coatings. Verify substrate is flat, free of fins or planar irregularities greater than 6.4 mm in 3 m (1/4" in 10').

2. Flashings

- a. All flashings are by others and must be installed in accordance with specific manufacturer's requirements. Where appropriate, end-dams must be provided.
- b. Openings must be flashed prior to window/door, HVAC, etc. installation. Refer to SENERFLASH™ product bulletin and *Senergy® Moisture Protection Guidelines for Senerflex Wall Systems Bulletin* for further information.
- c. Windows and openings shall be flashed according to design and Building Code Requirements.
- d. Individual windows that are ganged to make multiple units require continuous head flashing and the joints between the units must be fully sealed.

3. Roof

Verify that all roof flashings have been installed in accordance with the guidelines set by the Asphalt Roofing Manufacturers Association (ARMA).

4. Kick-out flashing

Kick-out flashing must be installed leak-proof and angled (min 100°) to allow for

- proper drainage and water diversion.
- C. Do not proceed until all unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Protect all surrounding areas and surfaces from damage and staining during application of Senerflex® Channeled Adhesive Design.
- B. Protect finished work at end of each day to prevent water penetration.
- C. Substrate preparation: Prepare substrates in accordance with Senergy instructions.

3.03 MIXING

General: No additives are permitted unless specified in product mixing instructions. Close containers when not in use. Prepare in a container that is clean and free of foreign substances. Do not use a container which has contained or been cleaned with a petroleum-based product. Clean tools and equipment with water immediately after use. Dried material can only be removed mechanically.

NOTE TO SPECIFIER: Keep only the products in this section which will be incorporated in the Senerflex Channeled Adhesive Design. Delete those not to be utilized.

- A. Air/Water Resistive Barrier
1. [SENERSHIELD]
 - a. Mix SENERSHIELD with a clean, rust-free paddle and drill until thoroughly blended before adding Portland cement.
 - b. Mix one part (by weight) Portland cement with one part SENERSHIELD. Add Portland cement in small increments, mixing until thoroughly blended after each additional increment.
 - c. A small amount of clean, potable water per mixed pail (30 lbs of SENERSHIELD) may be added to adjust workability. **Do not overwater.**
 2. [SENERSHIELD-R]
 - a. Mix SENERSHIELD-R with a clean, rust-free paddle and drill until thoroughly blended. Do not add water.
- B. Senergy Base Coat
1. [STANDARD], [ALPHA], [XTRA-STOP], and [ALPHA GENIE] Base Coat
 - a. Mix Base Coat with a clean, rust-free paddle and drill until thoroughly blended, before adding Portland cement.
 - b. Mix one part (by weight) Portland cement with one part Base Coat. Add Portland cement in small increments, mixing until thoroughly blended after each additional increment.
 - c. Clean, potable water may be added to adjust workability.
 2. [ALPHA DRY] Base Coat
 - a. Mix and prepare each bag in a 19-liter (5-gallon) pail.
 - b. Fill the container with approximately 5.6-liters (1.5-gallons) of clean, potable water.
 - c. Add ALPHA DRY Base Coat in small increments, mixing after each additional increment.
 - d. Mix ALPHA DRY Base Coat and water with a clean, rust-free paddle and drill until thoroughly blended.
 - e. Additional ALPHA DRY Base Coat or water may be added to adjust workability.
- C. Senergy [ASAP], [TINTED PRIMER], [COLOR COAT], [ANTICOGLAZE™] and [SENERFLEX], [SILCOAT®], [ENCAUSTA VERONA] Finish Coats
1. Mix the factory-prepared material with a clean, rust-free paddle and drill until thoroughly blended.
 2. A small amount of clean, potable water may be added to adjust workability. **Do not overwater.**
 3. Additives are not permitted.
 4. Close container when not in use.

5. Clean tools and equipment with water immediately after use. Dried material can only be removed mechanically
- D. BASF Wall Systems [AURORA TC-100], [BOREALIS], [AURORA STONE] and [ALUMINA] Specialty Finish Coats
 1. Gently mix the contents of the pail for 1 minute using a low RPM 1/2 inch drill equipped with a mixing paddle such as a Demand Twister or a Windlock B-MEW, B-M1 or B-M9.
 2. Additives are not permitted.
 3. Close container when not in use.
 4. Clean tools and equipment with water immediately after use. Dried material can only be removed mechanically.

3.04 APPLICATION

General: Apply Senerflex® Channeled Adhesive Design materials in accordance with Senerflex Channeled Adhesive Design Specifications.

A. Accessories:

1. Attach Window/Door Drip Edge level and per manufacturer's instructions.

B. Air/Water Resistive Barrier

1. All sheathing joints and windows/openings must be protected and the Air/Water Resistive barrier applied in accordance with *Senergy® Moisture Protection Guidelines* bulletin.
2. Substrate shall be dry, clean, sound, and free of releasing agents, paint, or other residue or coatings. Verify substrate is flat, free of fins or planar irregularities greater than 6.4 mm in 3 m (1/4" in 10').
3. Unsatisfactory conditions shall be corrected before application of the SENERSHIELD/ SENERSHIELD-R.
4. [Apply the [FLASHING PRIMER/SENERFLASH 4 / 9] [SELF-ADHERING MESH TAPE/SENERSHIELD] [FLEXGUARD 4 Reinforcing Mesh/SENERSHIELD] in accordance with SENERSHIELD product bulletin.]
-OR -
[Apply the [4" SHEATHING FABRIC/SENERSHIELD-R] in accordance with the SENERSHIELD-R product bulletin.]
5. Installed materials should be checked before continuing system application.
6. Ensure [FLEXGUARD 4 Reinforcing Mesh/SENERSHIELD] [FLASHING PRIMER/SENERFLASH/SENERSHIELD] [SELF-ADHERING MESH TAPE/SENERSHIELD] [4" SHEATHING FABRIC/SENERSHIELD-R] overlaps the top flange of the starter track.

C. Insulation Board:

1. Vertical surfaces: begin at base of wall with firm, temporary support or spacer.
2. Apply horizontally in a running bond pattern.
3. Pre-cut insulation board to fit openings and projections. Insulation board must be a single piece around corners of openings. Stagger vertical joints and corners. Stagger insulation and sheathing board joints.
4. Apply mixed [ALPHA] [STANDARD] [ALPHA DRY] [XTRA STOP] [ALPHA GENIE] Base Coat to entire surface of insulation board using a stainless steel trowel with 13 mm x 13 mm (1/2"x 1/2") notches spaced 50 mm (2") apart. Ribbons of adhesive must be applied parallel to the 2' dimension of the EPS insulation board to ensure they are vertical when the EPS insulation board is applied to the substrate.
5. Immediately set board into place and apply pressure over entire surface of board to ensure positive uniform contact and high initial grab. **Do not slide board into place.** Do not allow Base Coat to dry prior to installing.
6. Abut all joints tightly and ensure overall flush level surface.
7. Check adhesion periodically by removing a board prior to set. Properly installed insulation board will be difficult to remove and Senerflex Adhesive/Base Coat will be adhered to both the SENERSHIELD/SENERSHIELD-R and the insulation board.

8. Fill 1/16" and larger gaps between insulation boards with slivers of insulation board.
 9. Allow application of insulation board to dry (normally 8 to 10 hours) prior to application of Base Coat/Reinforcing Mesh.
 10. Rasp flush any irregularities of the insulation board greater than 1.6 mm (1/16").
 11. Install expansion joints and aesthetic grooves as indicated on drawings. Do not align aesthetic grooves with insulation board joints.
- D. Senergy® Base Coat/Reinforcing Mesh: Base Coat shall be applied so as to achieve Reinforcing Mesh embedment with no Reinforcing Mesh color visible.

NOTE TO SPECIFIER: Indicate on drawings the required locations of standard, medium and high or ultra high impact reinforcing mesh.

- [1. Senergy CORNER MESH
 - a. Install CORNER MESH at corners.
 - b. Apply CORNER MESH prior to application of Reinforcing Mesh.
 - c. Cut CORNER MESH to workable lengths.
 - d. Apply mixed [ALPHA] [STANDARD] [ALPHA DRY] [XTRA-STOP] [ALPHA GENIE] Base Coat to insulation board at outside corners using a stainless steel trowel.
 - e. Immediately place CORNER MESH against the wet Base Coat and embed the CORNER MESH into the Base Coat by troweling from the corner; butt edges and avoid wrinkles.
 - f. After Base Coat is dry and hard, apply a layer of FLEXGUARD 4, INTERMEDIATE 6 or 12 Reinforcing Mesh over the entire surface of the CORNER MESH in accordance with 3.04 C.2.]
2. Standard Impact or Medium Impact Resistance Reinforcing Mesh.
 - a. Install [FLEXGUARD 4] [INTERMEDIATE 6] [INTERMEDIATE 12] where indicated on drawings.
 - b. Apply mixed [STANDARD] [ALPHA] [ALPHA DRY] [XTRA-STOP] [ALPHA GENIE] Base Coat to entire surface of insulation board with a stainless steel trowel to embed the Reinforcing Mesh.
 - c. Immediately place [FLEXGUARD 4] [INTERMEDIATE 6] [INTERMEDIATE 12] Reinforcing Mesh against wet Base Coat and embed the Reinforcing Mesh into the Base Coat by troweling from the center to the edges.
 - d. Lap Reinforcing Mesh 64 mm (2 1/2") minimum at edges.
 - e. Ensure Reinforcing Mesh is continuous at corners, void of wrinkles and embedded in Base Coat so that no Reinforcing Mesh color is visible.
 - f. If required, apply a second layer of Base Coat to achieve total nominal Base Coat/Reinforcing Mesh thickness of 1.6 mm (1/16").
 - g. Allow Base Coat with embedded Reinforcing Mesh to dry hard (normally 8 to 10 hours).
- [3. High Impact or Ultra High Impact Resistance Reinforcing Mesh

NOTE TO SPECIFIER: Where High Impact or Ultra High Impact is specified, Flexguard 4 or Intermediate 6 must be specified also.

- a. Install [INTERMEDIATE 12 & FLEXGUARD 4] [INTERMEDIATE 12 & INTERMEDIATE 6] [STRONG 15 & FLEXGUARD 4] [STRONG 15 & INTERMEDIATE 6] [HI-IMPACT 20 & FLEXGUARD 4] [HIIMPACT 20 & INTERMEDIATE 6] Reinforcing Mesh where indicated on drawings.
- b. Apply mixed [STANDARD] [ALPHA] [ALPHA DRY] [XTRA-STOP] [ALPHA GENIE] Base Coat to entire surface of insulation board with a stainless steel trowel to embed the Reinforcing Mesh.
- c. Immediately place [INTERMEDIATE 12] [STRONG 15] [HI-IMPACT 20] Reinforcing Mesh against wet Base Coat and embed the Reinforcing Mesh into the Base Coat by troweling from the center to the edges.
- d. Butt [INTERMEDIATE 12] [STRONG 15] [HI-IMPACT 20] Reinforcing Mesh at all adjoining edges; do not use to backwrap or bend around corners.
- e. Butt [INTERMEDIATE 12] [STRONG 15] [HI-IMPACT 20] Reinforcing Mesh at adjoining edges of CORNER MESH.

- f. Ensure Reinforcing Mesh is free of wrinkles and embedded in Base Coat so that no Reinforcing Mesh color is visible.
- g. After Base Coat with embedded Reinforcing Mesh is dry and hard (normally 8 to 10 hours), apply a layer of [FLEXGUARD 4] [INTERMEDIATE 6] Reinforcing Mesh over the entire surface in accordance with 3.04 C.2 to achieve total nominal Base Coat/ Reinforcing Mesh thickness of 2.4 mm (3/32").]

[E. Senergy [ASAP] [COLOR COAT]

1. Apply material to the Base Coat/Reinforcing Mesh in sealant joints with a high-quality, latex-type paintbrush.
2. Work material continuously until a uniform appearance is obtained.
3. Allow to dry thoroughly (approximately 24 hours) prior to application of sealant primer and sealant.]

[F. Senergy TINTED PRIMER

1. Apply TINTED PRIMER to the Base Coat/Reinforcing Mesh with a sprayer, 10 mm (3/8") nap roller, or good quality latex paint brush at a rate of approximately 3.6–6.1m² per liter (150–250 ft² per gallon).
2. TINTED PRIMER shall be dry to the touch before proceeding to the Senergy Finish Coat application.]

G. Senergy Finish Coat

- [1. SENERFLEX® FINISH: [CLASSIC] [FINE] [TEXTURE] [COARSE] [SAHARA] [BELGIAN LACE] [ENCAUSTO VERONA] [METALLIC].

- OR -

SILCOAT® Finish: [CLASSIC] [FINE] [TEXTURE] [SAHARA] [BELGIAN LACE]

- a. Apply Finish directly to the Base Coat with a clean, stainless steel trowel.
 - b. Apply and level Finish during the same operation to minimum obtainable thickness consistent with uniform coverage.
 - c. Maintain a wet edge on Finish by applying and texturing continually over the wall surface.
 - d. Work Finish to corners, joints or other natural breaks and do not allow material to set up within an uninterrupted wall area.
 - e. Float Finish to achieve final texture.
- [2. [AURORA TC-100] [BOREALIS] Finish Coat
 - a. Apply TINTED PRIMER to substrate in accordance with current Senergy TINTED PRIMER product bulletin.
 - b. TINTED PRIMER shall be of corresponding color for selected [AURORA TC-100] [BOREALIS] Finish color. Allow TINTED PRIMER to dry to the touch before proceeding to [AURORA TC-100] [BOREALIS] Finish application.
 - c. Apply a tight coat of Finish with a clean, stainless steel trowel.
 - d. Maintain a wet edge on Finish by applying and leveling continually over the wall surface.
 - e. Work Finish to corners, joints or other natural breaks and do not allow material to set up within an uninterrupted wall area. Allow first coat to set until surface is completely dry prior to applying a second coat of Finish.
 - f. For a smooth appearance, use a stainless steel trowel and apply the second coat of Finish. Achieve final texture using circular motions.
 - g. For a textured appearance, apply the second coat of Finish using a spray gun and hopper. Double-back to achieve final texture.
 - h. Total thickness of Finish shall be approximately 1.6 mm (1/16").

[3. AURORA STONE Finish

- a. Apply TINTED PRIMER to substrate in accordance with current Senergy® TINTED PRIMER product bulletin.
- b. TINTED PRIMER shall be of corresponding color for selected AURORA STONE Finish color. Allow TINTED PRIMER to dry to the touch before proceeding to AURORA STONE Finish application.
- c. Apply a coat of AURORA STONE Finish using a spray gun and hopper, maintaining a wet edge. Work to corners, joints or other natural breaks and do not

- allow material to set up within an uninterrupted wall area.
- d. Allow first coat of AURORA STONE Finish to set until surface is completely dry prior to applying a second coat of AURORA STONE Finish.
- e. Apply a second coat of AURORA STONE Finish using a spray gun and hopper; double back to achieve final texture.
- f. Thickness of AURORA STONE Finish may vary between 1.6 mm (1/16") and 3.2 mm (1/8"), depending upon texture.

Note: Spraying of AURORA STONE Finish should be in the same manner and direction and by the same mechanic on a particular elevation or project whenever possible, to maintain a uniform appearance. Maintain consistent air pressure to minimize texture variations. Stator or rotor design pumps are not recommended.]

[4. ALUMINA™ Finish Coat

- a. Apply TINTED PRIMER to substrate in accordance with current Senergy® TINTED PRIMER product bulletin. TINTED PRIMER shall be of corresponding color for selected [ALUMINA™] Finish color. Allow TINTED PRIMER to dry to the touch before proceeding to [ALUMINA™] Finish application.
- b. Apply a tight coat of Finish with a clean, stainless steel trowel.
- c. Maintain a wet edge on Finish by applying and leveling continually over the wall surface.
- d. Work Finish to corners, joints or other natural breaks and do not allow material to set up within an uninterrupted wall area. Allow first coat to set until surface is completely dry prior to applying a second coat of Finish.
- e. Use a stainless steel trowel and apply the second coat of Finish. Achieve final texture using circular motions.
- f. Total thickness of Finish may be between 1.6 mm (1/16") and 3.2 mm (1/8").]

[H. BASF Wall System's ANTICOGLAZE™:

- 1. Apply BASF Wall System's ANTICOGLAZE™ in accordance with recommendations contained in current product literature.]

3.05 CLEANING

- A. Clean work under provisions of Section [01 74 00] [].
- B. Clean adjacent surfaces and remove excess material, droppings, and debris.

3.06 PROTECTION

- A. Protect base coat from rain, snow and frost for 48–72 hours following application.
- B. Protect installed construction under provisions of Section [01 76 00] [].

END OF SECTION

Note

The Wall Systems business or BASF Corporation is referred to herein as "BASF Wall Systems."

Residential Policy

Apply wall systems in accordance with local building codes in force at the time of construction. On one and two-family residential framed construction; BASF Wall Systems requires that the wall system selected be one that includes provisions for moisture drainage. Please view the Senergy Residential Policy Bulletin on the Senergy website for a more detailed discussion of this topic.

Disclaimer

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07530 Single Membrane Roofing

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes
 - 1. Thermoplastic Polyolefin Single-Ply Roofing Membrane
 - 2. Thermoplastic Polyolefin Flashings
 - 3. Thermoplastic Polyolefin Accessories
 - 4. Insulation
- B. Related Sections
 - 1. Section 06100: Rough Carpentry
 - 2. Section 07620: Sheet Metal Flashing and Trim
 - 3. Section 15430: Plumbing Specialties

1.02 REFERENCES

- A. American Society for Testing and Materials (ASTM) - *Annual Book of ASTM Standards*
 - 1. ASTM D-751 – Standard Test Methods for Coated Fabrics
 - 2. ASTM D-2137 - Standard Test Methods for Rubber Property—Brittleness Point of Flexible Polymers and Coated Fabrics
 - 3. ASTM E-96 - Standard Test Methods for Water Vapor Transmission of Materials
 - 4. ASTM D1204 - Standard Test Method for Linear Dimensional Changes of Nonrigid Thermoplastic Sheeting or Film at Elevated Temperature
 - 5. ASTM D-471 - Standard Test Method for Rubber Property—Effect of Liquids
 - 6. ASTM D-1149 - Standard Test Methods for Rubber Deterioration—Cracking in an Ozone Controlled Environment
 - 7. ASTM C-1549 - Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer
 - 8. ASTM C-1371 - Standard Test Method for Determination of Emittance of Materials Near Room Temperature Using Portable Emissometers
 - 9. ASTM E 903 – Standard Test Method for Solar Absorptance, Reflectance, and Transmission of Materials Using Integrating Spheres
 - 10. ASTM G155 - Standard Practice For Operating Xenon Arc Light Apparatus For Exposure Of Non-Metallic Materials
 - 11. ASTM D573 - Standard Test Method For Rubber - Deterioration In An Air Oven
- B. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA) - *Architectural Sheet Metal Manual*
- C. National Roofing Contractors Association (NRCA)
- D. American Society of Civil Engineers (ASCE)
- E. U.S. Green Building Council (USGBC)
 - 1. Leadership in Energy and Environmental Design (LEED)
- F. Factory Mutual (FM Global) - *Approval Guide*
- G. Underwriters Laboratories (UL) - *Roofing Systems and Materials Guide* (TGFU R1306)

H. California Title 24 Energy Efficient Standards

I. ENERGY STAR

J. Cool Roofing Rating Council (CRRC)

K. Miami-Dade County

1.03 DEFINITIONS

A. Roofing Terminology: Refer to ASTM D1079 and the glossary of the National Roofing Contractors Association (NRCA) *Roofing and Waterproofing Manual* for definitions of roofing terms related to this section.

1.04 SUBMITTALS

A. Product Data: Provide product data sheets for each type of product indicated in this section.

B. Shop Drawings: Provide manufacturers standard details and approved shop drawings for the roof system specified.

C. Samples: Provide samples of insulations, fasteners, membrane materials and accessories for verification of quality.

D. Certificates: Installer shall provide written documentation from the manufacturer of their authorization to install the roof system, and eligibility to obtain the warranty specified in this section.

1.05 QUALITY ASSURANCE

A. Manufacturer's Qualifications: GAF shall provide a roofing system that meets or exceeds all criteria listed in this section.

B. Installer's Qualifications:

1. Installer shall be classified as a ***Master or Master Select™*** contractor as defined and certified by GAF.

C. Source Limitations: All components listed in this section shall be provided by a single manufacturer or approved by the primary roofing manufacturer.

D. Final Inspection

Manufacturer's representative shall provide a comprehensive final inspection after completion of the roof system. All application errors must be addressed and final punch list completed.

1.06 PRE-INSTALLATION CONFERENCE

A. Prior to scheduled commencement of the roofing installation and associated work, conduct a meeting at the project site with the installer, architect, owner, GAF representative and any other persons directly involved with the performance of the work. The installer shall record conference discussions to include decisions and agreements reached (or disagreements), and furnish copies of recorded discussions to each attending party. The main purpose of this meeting is to review foreseeable methods and procedures related to roofing work.

1.07 PERFORMANCE REQUIREMENTS

A. Provide an installed roofing membrane and base flashing system that does not permit the passage of water, and will withstand the design pressures calculated in accordance with the most current revision of ASCE 7.

- B. GAF shall provide all primary roofing materials that are physically and chemically compatible when installed in accordance with manufacturers current application requirements.

1.08 REGULATORY REQUIREMENTS

- A. All work shall be performed in a safe, professional manner, conforming to all federal, state and local codes.
- B. Exterior Fire Test Exposure: Provide a roofing system achieving a UL Class A rating for roof slopes indicated.

1.09 DELIVERY, STORAGE AND HANDLING

- A. Deliver all roofing materials to the site in original containers, with factory seals intact. All products are to carry a GAF® label.
- B. Store all pail goods in their original undamaged containers in a clean, dry location within their specified temperature range.
- C. Do not expose materials to moisture in any form before, during, or after delivery to the site. Reject delivery of materials that show evidence of contact with moisture.
- D. Remove manufacturer supplied plastic covers from materials provided with such. Use “breathable” type covers such as canvas tarpaulins to allow venting and protection from weather and moisture. Cover and protect materials at the end of each work day. Do not remove any protective tarpaulins until immediately before the material will be installed.
- E. Materials shall be stored above 55°F (12.6°C) a minimum of 24 hours prior to application.

1.10 PROJECT CONDITIONS

- A. Weather
 - 1. Proceed with roofing only when existing and forecasted weather conditions permit.
 - 2. Ambient temperatures must be above 45°F (7.2°C) when applying hot asphalt or water based adhesives.

1.11 WARRANTY

- A. Provide Manufacturers standard EverGuard® Diamond Pledge™ Guarantee with single source coverage and no monetary limitation where the manufacturer agrees to repair or replace components in the roofing system, which cause a leak due to a failure in materials or workmanship.
 - 1. Duration: Twenty (20) years from the date of completion.

*Materials and workmanship of listed products within this section when installed in accordance with current GAF application and specification requirements. Contact GAF Contractor Services for the full terms and conditions of the guarantee.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURER

- A. GAF® - 1 Campus Drive, Parsippany, NJ 07054

2.02 INSULATION

- A. Rigid polyisocyanurate board, with a strong white or black fibrous glass facer conforming to or exceeding the requirements of ASTM C 1289 / FS HH-I-1972. **EnergyGuard™ Polyiso Insulation**, with the following characteristics:
 - 1. Board Thickness: to meet R40 insulation value.
 - 2. Thermal Resistance (LTTR value) of: Each layer 15.0

2.03 ROOF BOARD

- A. Fiber-reinforced gypsum panel with an integral water-resistant core. Securock® Gypsum Fiber Roof Board by US Gypsum.
 - 1. Board Thickness: ¼”
 - 2. Thermal Resistance (R value) of: .20

2.04 MEMBRANE MATERIALS

- A. A smooth type, polyester scrim reinforced thermoplastic polyolefin membrane with a nominal 0.060 inch (60 mil) thickness, for use as a single ply roofing membrane. Meets or exceeds the minimum requirements of ASTM D-6878. UL Listed, FM Approved, Dade County Product Approval, Florida Building Code Approved. White membrane is Energy Star Listed, CRRC Listed and Title 24 Compliant. Each full roll contains approximately 1000 sq.ft. of roofing material, 10’ X 100’, weighing 322 lbs. Each half sheet roll contains approximately 500 sq.ft. of roofing material, 5’ X 100’, weighing 162 lbs. **EverGuard® TPO 60 mil** thermoplastic single-ply roofing membrane by GAF.

2.05 FLASHING MATERIALS

- A. A smooth type, polyester scrim reinforced thermoplastic polyolefin membrane with a nominal 0.060 inch (60 mil) thickness, for use as a single ply roofing membrane. Meets or exceeds the minimum requirements of ASTM D-6878. UL Listed, FM Approved, Dade County Product Approval, Florida Building Code Approved. White membrane is Energy Star Listed, CRRC Listed and Title 24 Compliant. Each full roll contains approximately 1000 sq.ft. of roofing material, 10’ X 100’, weighing 322 lbs. Each half sheet roll contains approximately 500 sq.ft. of roofing material, 5’ X 100’, weighing 162 lbs. **EverGuard® TPO 60 mil** thermoplastic single-ply roofing membrane by GAF.

2.06 ADHESIVES, SEALANTS and PRIMERS

- A. Solvent-based Bonding Adhesive: Solvent based rubberized adhesive for use with EverGuard TPO membranes, **EverGuard® 1121 Bonding Adhesive**, by GAF.
- B. Solvent based liquid, required to protect field cut edges of EverGuard TPO membranes. Applied directly from a squeeze bottle, **EverGuard® TPO Cut Edge Sealant**, by GAF.
- C. Solvent based primer for preparing surfaces to receive butyl based adhesive tapes, **EverGuard® TPO Primer**, by GAF.
- D. Solvent based seam cleaner used to clean exposed or contaminated seam prior to heat welding, **EverGuard® TPO Seam Cleaner**, by GAF.
- E. Solvent based, trowel grade synthetic elastomeric sealant. Durable and UV resistant suitable for use where caulk is typically used. Available in 10 oz. tubes, **FlexSeal™ Caulk Grade Roof Sealant** by GAF.
- F. Commercial grade roofing sealant suitable for sealing the upper lip of exposed termination bars and penetrations and around clamping rings and comes with a 20 yr ltd warranty against leaks caused by manufacturing defects. Meets the performance criteria of ASTM D412, ASTM D2196, ASTM D1475 and ASTM D1644, **FlexSeal™ Roof Sealant**, by GAF.

- G. Low VOC solvent based primer for preparing surfaces to receive butyl based adhesive tapes, **EverGuard® TPO Low VOC Primer**, by GAF.
- H. Low VOC TPO cleaner designed to clean exposed or contaminated seams prior to heat welding to remove any residual soap or revitalize aged membranes. Contains only 50 grams per liter of Volatile Organic Content and has been formulated using a blend of primarily VOC-exempt ingredients to be in compliance with air quality regulations for single ply roofing products. **EverGuard® CleanWeld® Cleaner** by GAF®.
- I. One part butyl based high viscosity sealant suitable for sealing between flashing membrane and substrate surface behind exposed termination bars and for sealing between roofing membrane and drain flange. **EverGuard® Water Block**, by GAF.
- J. 100% solids epoxy based two-part sealant suitable for filling sealant pans at irregularly-shaped penetrations. Epoxy is part A. Polyamide is part B. **EverGuard® 2-Part Pourable Sealant**, by GAF.
- K. One-part, moisture-cure, self-leveling sealant designed for use in pitch pans on single ply roof systems. **EverGuard® One-Part Pourable Sealant**.
- L. Insulation Adhesive: **Oly-Bond 500™** distributed by GAF®.

2.07 ACCESSORIES

A. Mechanical Fasteners

- 1. **Drill•Tec™ Standard Screws**: Standard duty alloy steel insulation fastener with CR-10 coating with a .215" diameter thread. Factory Mutual Standard 4470 Approved, #3 Phillips head for use on steel and wood decks.
- 2. **Drill•Tec™ Insulation Plates**: Galvalume, 3" (76 mm) diameter, suitable for use with Drill•Tec™ Standard and HD screws, and Drill•Tec™ Spikes. Special design available for use with Drill•Tec™ Polymer Screws.

B. FLASHING ACCESSORIES

- 1. A smooth type, unreinforced thermoplastic polyolefin based membrane for use as an alternative flashing/reinforcing material for penetrations and corners. Required whenever preformed vent boots cannot be used, available in White, Tan, Gray, Regal Red, Regal Blue, and Hartford Green, 0.055 inches (55 mils) nominal thickness and sheet size: 24in x 50ft. **EverGuard® TPO Detailing Membrane**, by GAF.
- 2. An 8 inch (20 cm) wide smooth type, polyester scrim reinforced thermoplastic polyolefin membrane strip for use as a cover strip over coated metal and stripping-in coated metal flanges and general repairs: 0.045 inches (45 mils) nominal thickness with 100 foot length, available in White, Tan, Gray, Regal Red, Regal Blue, and Hartford Green **EverGuard® TPO Flashing Membrane**, by GAF.
- 3. Extruded aluminum termination bar with angled lip caulk receiver and lower leg bulb stiffener. Pre-punched slotted holes at 6" on center or 8" on center. ¾" x 10' with 0.090" cross section, **Drill-Tec™ Termination Bar**, by GAF.
- 4. A 6 inch (14 cm) wide, smooth type, heat-weldable polyester scrim reinforced thermoplastic polyolefin membrane strip. Designed for use as a cover strip over non-coated metal edges and flanges. Each full roll contains approximately 100 Lineal Ft. of material, 6" X 100'. **EverGuard® TPO Heat-Weld Cover Tape**, by GAF.

5. .045" reinforced TPO membrane with pressure sensitive adhesive, to be installed on horizontal surfaces using plates and fasteners as a base attachment in fully adhered systems. Size 6" x 100', **EverGuard® RTA (Roof Transition Anchor) Strip™**, by GAF
6. 24 gauge steel with 0.025" thick TPO based film as required for fabrication into metal gravel stop and drip edge profiles, metal base and curb flashings, sealant pans, and scupper sleeves. Standard sheet size 4' x 10', sheet weight 47 lbs. Custom sizes available, **EverGuard® TPO Coated Metal**, by GAF.

C. WALL & CURB ACCESSORIES

1. 55 mil TPO membrane and 24 gauge coated metal prefabricated into standard and custom size thru wall scuppers. Available in two sizes: 4" x 6" x 12" (l x w x d) with a 5.75" x 3.75" opening and 8" x 10" x 12" (l x w x d) with a 9.75" x 7.75" opening, **EverGuard® TPO Scupper**, by GAF
2. .045" thick reinforced TPO membrane fabricated corners. Available in four standard sizes to flash curbs. Four corners are required to flash the curb, **EverGuard® Corner Curb Wraps**, by GAF.
3. 0.045" thick molded TPO membrane outside corners of base and curb flashing. Hot-air welds directly to EverGuard TPO membrane. Size 4" x 4" with 6" flange, **EverGuard® TPO Universal Corners** by GAF.
4. 0.055" molded TPO membrane inside corners of base and curb flashing. Hot-air welds directly to Everguard TPO membrane. Size 6" x 6" x 5.5" high **EverGuard® TPO Preformed Corners** by GAF.
5. 8" diameter, nominal .050" vacuum formed unreinforced TPO membrane for use in flashing outside corners of base and curb flashings, **EverGuard® TPO Fluted Corner**, by GAF.

D. PENETRATION ACCESSORIES

1. 0.075" thick molded TPO membrane sized to accommodate most common pipe and conduits, (1" to 6" diameter pipes), including square tube. Hot-air welded directly to EverGuard TPO membrane, supplied with stainless steel clamping rings, **EverGuard® TPO Preformed Vent Boots** by GAF.
2. 0.045" thick molded TPO membrane preformed boots are split to accommodate most common pipes and conduits and available in three standard sizes, **EverGuard® TPO Split Pipe Boots**, by GAF.
3. 0.045" thick molded TPO membrane preformed square boots are split to accommodate most common square penetrations and conduits and available in three standard sizes, **EverGuard® TPO Square Tube Wraps**, by GAF.
4. .070 thick molded penetration pocket to provide structure and foundation for the application of a pourable sealant for a variety of roof penetrations, weldable and 9" x 6" x 4" (l x w x h). **EverGuard® TPO Pourable Sealer Pocket**
5. .055" thick smooth type, unreinforced thermoplastic polyolefin membrane designed for use as a conforming membrane seal over T-joints in 60 and 80 mil membrane applications. **EverGuard® TPO Drain** by GAF
6. Aluminum drain unit coated with a weldable TPO compound. TPO membrane can be heat welded directly to the drain body, resulting in a strong, secure installation. Each drain is fitted with a BlueSeal® mechanical drain seal for a secure, tight seal into the building drain system. Available in two sizes (3" and 4"), and custom sizes are available. **Everguard® TPO Coated Metal Drain** by GAF®

E. ROOF EDGE ACCESSORIES

1. Three piece fascia system with continuous galvanized steel spring cant, exterior decorative snap-on fascia and available in 10 foot lengths in standard or custom colors, **EverGuard® Snap-on Fascia** by GAF®.
 2. Two piece fascia system with rigid terminator base plate and exterior decorative fascia cover available in 10 foot lengths in standard or custom colors for use with 45 mil and 60 mil only, **EverGuard® EZ Fascia** by GAF®.
 3. Two piece fascia system with rigid extruded terminator base plate and exterior decorative snap-on fascia cover available in 10 foot lengths in standard or custom colors, **EverGuard® EZ Fascia EX** by GAF®.
- F. FIELD OF ROOF ACCESSORIES
1. Pre-manufactured expansion joint covers used to bridge expansion joint openings in a roof structure. Fabricated to accommodate all roof to wall and roof to roof applications, made of .060" reinforced TPO membrane, available in 5 standard sizes for expansion joint openings up to 8" wide. **EverGuard® TPO Expansion Joint Covers**, by GAF
 2. .055" thick smooth type, unreinforced thermoplastic polyolefin membrane designed for use as a conforming membrane seal over T-joints in 60 and 80 mil membrane applications. **EverGuard® T-Joint Patches**, by GAF.
 3. 1/8" thick extruded and embossed TPO roll 34" x 50', heat welds directly to roofing membrane. Unique herringbone traction surface. Available in gray or yellow, **EverGuard® TPO Walkway Rolls**, GAF.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that the surfaces and site conditions are ready to receive work.
- B. Verify that the deck is supported and secured.
- C. Verify that the deck is clean and smooth, free of depressions, waves, or projections, and properly sloped to drains, valleys, eaves, scuppers or gutters.
- D. Verify that the deck surfaces are dry and free of ice or snow.
- E. Verify that all roof openings or penetrations through the roof are solidly set, and that all flashings are tapered.

3.02 SUBSTRATE PREPARATION

- A. Steel Deck
 1. Metal decks must be a minimum uncoated thickness of 22 gauge (0.8 mm) and shall have a G-90 galvanized finish on all panels. FM requirements may supersede those set forth in this section. Consult the current FM Guide for more information.
 2. Decks must comply with the gauge and span requirements in the current Factory Mutual FM Approval Guide and be installed in accordance with Loss Prevention Data Sheet 1-28 or specific FM approval.
 3. When re-roofing over steel decks, surface corrosion shall be removed, and repairs to severely corroded areas made. Loose or inadequately secured decking shall be fastened, and irreparable or otherwise defective decking shall be replaced.
- B. Plywood Deck
 1. Plywood sheathing must be exterior grade, minimum 4 ply, and not less than 15/32" (12 mm) thick.
 2. Preservatives or fire retardants used to treat the decking must be compatible with roofing materials.
 3. The deck must be installed over joists that are spaced 24" (61 cm) o.c. or less.

4. The deck must be installed so that all four sides of each panel bear on and are secured to joist and cross blocking. "H" clips are not acceptable.
5. Panels must be installed with a 1/8" to 1/4" (3mm – 6mm) gap between panels and must match vertically at joints to within 1/8" (3mm).
6. Decking should be kept dry and roofed promptly after installation.

3.03 INSTALLATION - GENERAL

- A. Install GAF's EverGuard® TPO roofing system according to all current application requirements in addition to those listed in this section.
- B. GAF EverGuard® TPO Specification #: TFANI60
- C. Start the application of membrane plies at the low point of the roof or at the drains, so that the flow of water is over or parallel to, but never against the laps.

3.04 INSULATION - GENERAL

- A. Do not apply roof insulation or roofing until all other work trades have completed jobs that require them to traverse the deck on foot or with equipment. A vapor retarder coated lightly with asphalt may be applied to protect the inside of the structure prior to the insulation and final roofing installation. Before the application of the insulation, any damage or deterioration to the vapor retarder must be repaired.
- B. Do not install wet, damaged or warped insulation boards.
- C. Install insulation boards with staggered board joints in one direction (unless taping joint).
- D. Install insulation boards snug. Gaps between board joints must not exceed ¼" (6 mm). All gaps in excess of ¼" (6 mm) must be filled with like insulation material.
- E. Wood nailers must be 3-1/2" (8.9 cm) minimum width or 1" (25 mm) wider than metal flange. They shall be of equal thickness as the insulation, and be treated for rot resistance. All nailers must be securely fastened to the deck.
- F. Do not kick insulation boards into place.
- G. Miter and fill the edges of the insulation boards at ridges, valleys and other changes in plane to prevent open joints or irregular surfaces. Avoid breaking or crushing of the insulation at the corners.
- H. Insulation should not be installed over new lightweight insulating concrete.
- I. Do not install any more insulation than will be completely waterproofed each day.

3.05 INSULATION – BASE LAYER

- A. Loose apply the base layer of insulation for subsequent layers to be simultaneously attached. Minimal fastening should be performed to avoid movement of the boards.

3.06 INSULATION – SECOND LAYER

- A. The insulation must be securely attached to the roof deck. A minimum FMRC 1-60 attachment is recommended. Refer to FMRC Approval Guide for FM fastening patterns. Factory Mutual requires fastener density increased in corner areas for FM 1-60 as well as perimeter and corner area fastener density increases for FM 1-90 or greater. Refer to FM Loss Prevention Data Sheets 1-7, 1-28, and 1-49.

- B. Multiple layers of insulation of the same, non-tapered insulation material may be simultaneously mechanically fastened with approved fasteners and plates through the top layer of insulation to the structural deck.
- C. Use only fasteners with a minimum 3 inch (7.6 cm) stress plate when mechanically attaching insulation. Do not attach insulation with nails.

3.07 INSULATION – SUBSEQUENT LAYERS

- A. The substrate must be free of and debris, dust, dirt, oil, grease, and standing water before applying the adhesive.
- B. OlyBond 500 must be applied using the specially designed PaceCart dispenser. OlyBond 500 SpotShot shall be applied using one of the specially designed dual cartridge dispensers. OlyBond 500 Equipment Free Canister System dispenses with 25' hose and gun assembly included with product.
- C. Install insulation layers applied with bands of Oly Bond 500 spaced 12" O.C. Approximate coverage rate is ½ to 1 gallon per 100 square feet, depending on the substrate. Allow the foam to rise ¾" to 1". Walk each board firmly into place. Stagger the joints of additional layers in relation to the insulation joints in the layer(s) below by a minimum of 6" (15.2 cm) to eliminate continuous vertical gaps.
- D. Do not install any more insulation than will be completely waterproofed each day.

3.08 MEMBRANE APPLICATION

- A. Fully Adhered:
 1. Place membrane so that wrinkles and buckles are not formed. Any wrinkles or buckles must be removed from the sheet prior to permanent attachment. Roof membrane shall be fully adhered immediately after it is rolled out, followed by welding to adjacent sheets.
 2. Overlap roof membrane a minimum of 3" (15 cm) for side laps and 3" (15 cm) for end laps.
 3. Install membrane so that the side laps run across the roof slope lapped towards drainage points.
 4. All exposed sheet corners shall be rounded a minimum of 1".
 5. Use full width rolls in the field and perimeter region of roof.
 6. Use appropriate bonding adhesive for substrate surface, applied with a solvent-resistant roller, brush or squeegee.
 7. Apply bonding adhesive at 3 squares of finished, mated surface area per 5 gallons (Solvent Based). A greater quantity of bonding adhesive may be required based upon the substrate surface condition.
 8. Prevent seam contamination by keeping the adhesive application a few inches back from the seam area.
 9. Adhere approximately one half of the membrane sheet at a time. One half of the sheet's length shall be folded back in turn to allow for adhesive application. Lay membrane into adhesive once the bonding adhesive is tacky to the touch.
 10. Roll membrane with a weighted roller to ensure complete bonding between adhesive and membrane.
 11. Membrane laps shall be heat-welded together. All welds shall be continuous, without voids or partial welds. Welds shall be free of burns and scorch marks.
 12. Weld shall be a minimum of 1-1/2" in width for automatic machine welding and a minimum 2" in width for hand welding.
 13. All cut edges of reinforced membrane must be sealed with EverGuard® TPO Cut Edge Sealant.
 14. Supplemental membrane attachment is required at the base of all walls and curbs, and where the angle of the substrate changes by more than five (5) degrees (1" in 12"). Roofing membrane shall be secured to the structural deck with appropriate Drill-Tec™ screws and plates spaced every 12" o.c. The screws and plates must be installed no less than ½" from the membrane edge. Alternatively, the roofing membrane may be turned up the vertical plane a minimum of 3" and secured with screws and termination bar. Fastener spacing is the same as is used for in-lap attachment. The termination bar must be installed within 1-1/2" to 2" of the plane of the roof membrane, with a minimum of 1" of membrane extending above the termination bar.

15. Supplemental membrane attachment to the structural deck is required at all penetrations unless the insulation substrate is fully adhered to the deck. Roofing membrane shall be secured to the deck with appropriate Drill-Tec™ screws and plates.
16. Fasteners must be installed to achieve the proper embedment depth. Install fasteners without lean or tilt.
17. Install fasteners so that the plate or termination bar is drawn down tightly to the membrane surface. Properly installed fasteners will not allow the plate or termination bar to move (underdriving), but will not cause wrinkling of the membrane (overdriving).

3.09 FLASHINGS

- A. All penetrations must be at least 24" (61 cm) from curbs, walls, and edges to provide adequate space for proper flashing.
- B. Flash all perimeter, curb, and penetration conditions with coated metal, membrane flashing, and flashing accessories as appropriate to the site condition.
- C. All coated metal and membrane flashing corners shall be reinforced with preformed corners or non-reinforced membrane.
- D. Hot-air weld all flashing membranes, accessories, and coated metal. A minimum 2" wide (hand welder) weld or minimum 1 - 1/2" automatic machine weld is required.
- E. Non-coated metal edge details must be installed in accordance with current EverGuard® construction details and requirements.
- F. All twenty (20) year EverGuard® systems require the use of coated metal edges where applicable. Bonding adhesive and/or cover tape is not acceptable.
- G. All cut edges of reinforced membrane must be sealed with EverGuard® TPO Cut Edge Sealant.
- H. Consult the EverGuard® *Application and Specifications Manual* or GAF Contractor Services for more information on specific construction details.

3.10 TRAFFIC PROTECTION

- A. Install walkway rolls at all roof access locations and other designated locations including roof-mounted equipment work locations and areas of repeated rooftop traffic.
- B. Walkway pads must be spaced 2" apart to allow for drainage between the pads.
- C. Heat-weld walkway rolls to the roof membrane surface continuously around the perimeter of the roll.
- D. Walkway rolls may be installed with TPO primer and 3" seam tape.
 1. Roll or brush the TPO primer on the back of the TPO pad along the edges and down the middle length of the pad.
 2. Clean and prime the roof membrane where the pad will be installed.
 3. Install tape to the back of the cleaned area of the pad and roll in with a silicone hand roller.
 4. Remove release paper and install the tapes pads directly onto the roof membrane. Roll pads to secure in place

3.11 ROOF PROTECTION

- A. Protect all partially and fully completed roofing work from other trades until completion.
- B. Whenever possible, stage materials in such a manner that foot traffic is minimized over completed roof areas.

- C. When it is not possible to stage materials away from locations where partial or complete installation has taken place, temporary walkways and platforms shall be installed in order to protect all completed roof areas from traffic and point loading during the application process.
- D. Temporary tie-ins shall be installed at the end of each workday and removed prior to commencement of work the following day.

3.12 CLEAN-UP

- A. All work areas are to be kept clean, clear and free of debris at all times.
- B. Do not allow trash, waste, or debris to collect on the roof. These items shall be removed from the roof on a daily basis.
- C. All tools and unused materials must be collected at the end of each workday and stored properly off of the finished roof surface and protected from exposure to the elements.
- D. Dispose of or recycle all trash and excess material in a manner conforming to current EPA regulations and local laws.
- E. Properly clean the finished roof surface after completion, and make sure the drains and gutters are not clogged.
- F. Clean and restore all damaged surfaces to their original condition.

END OF SECTION

SECTION 07600

FLASHING AND SHEET METAL

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes the following:
 - 1. Metal counter flashing; and base flashing (if any).
 - 2. Metal wall flashing and expansion joints.
 - 3. Gutters and downspouts (rain drainage).
 - 4. Miscellaneous sheet metal accessories.

1.03 SUBMITTALS

- A. Product data; Flashing, Sheet Metal, and Accessories: Manufacturer's technical product data, installation instructions and general recommendations for each specified sheet material and fabricated product.
- B. Shop drawings showing layout, profiles, methods of joining, and anchorages details, including major counter-flashings, trim/fascia units, gutters, downspouts, scuppers and expansion joint systems. Provide layouts at 1/8 inch scale and details at 3 inch scale.

1.04 PROJECT CONDITIONS

- A. Coordinate work of this section with interfacing and adjoining work for proper sequencing of each installation. Ensure best possible weather resistance and durability of work and protection of materials and finishes.

PART 2 - PRODUCTS

2.01 SHEET METAL FLASHING AND TRIM MATERIALS

- A. Zinc-Coated Steel: Commercial quality with 0.20 percent copper, ASTM A 526 except ASTM A 527 for lock-forming, G90 hot-dip galvanized, mill phosphatized where indicated for painting; (24 gage core steel) except as otherwise indicated.
- B. Miscellaneous Materials and Accessories:
 - 1. Solder: For use with steel or copper, provide 50 - 50 tin/lead solder (ASTM B 32), with rosin flux.
 - 2. Fasteners: Same metal as flashing/sheet metal or, other non-corrosive metal as recommended by sheet manufacturer. Match finish of exposed heads with material being fastened.
 - 3. Bituminous Coating: SSPC - Paint 12, solvent type bituminous mastic, nominally free of sulfur, compounded for 15-mil dry film thickness per coat.
 - 4. Mastic Sealant: Compatible with roofing system.
 - 5. Adhesives: Type recommended by flashing sheet manufacturer for waterproof/weather-resistant seaming and adhesive application of flashing sheet.
 - 6. Polyethylene Underlayment: Minimum 6-mil carbonated polyethylene film; resistant to decay when tested in accordance with ASTM E 154.
 - 7. Reglets: Metal or plastic units of type and profile indicated, compatible with flashing indicated, noncorrosive.
 - 8. Metal Accessories: Provide sheet metal clips, straps, anchoring devices and similar accessory units as required for installation of work, matching or compatible with material being installed, noncorrosive, size and gage required for performance.

2.02 FABRICATED UNITS

- A. General Metal Fabrication: Shop-fabricate work to greatest extent possible. Comply with details shown, and with applicable requirements of SMACNA "Architectural Sheet Metal Manual" and other recognized industry practices. Fabricate for waterproof and weather-resistant performance; with expansion provisions for running work, sufficient to permanently prevent leakage, damage or deterioration of the work. Form work to fit substrates. Comply with material manufacturer instructions and recommendations for forming material. Form exposed sheet metal work without excessive oil-canning, buckling and tool marks, true to line and levels indicated, with exposed edges folded back to form hems.

- B. Seams: Fabricate non-moving seams in sheet metal with flat-lock seams. For metal other than aluminum, tin edges to be seamed, form seams, and solder. Form aluminum seams with epoxy seam sealer; rivet joints for additional strength where required.
- C. Expansion Provisions: Where lapped or bayonet-type expansion provisions in work cannot be used, or would not be sufficiently water/weatherproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).
- D. Sealant Joints: Where movable, non-expansion type joints are indicated or required for proper performance of work, form metal to provide for proper installation of elastomeric sealant, in compliance with SMACNA standards.
- E. Separations: Provide for separation of metal from noncompatible metal or corrosive substrates by coating concealed surfaces at locations of contact, with bituminous coating or other permanent separation as recommended by manufacturer/fabricator.
- F. Aluminum Extrusion Units: Fabricate extruded aluminum running units with formed or extruded aluminum joint covers, for installation behind main members where possible. Fabricate mitered and welded corner units.

PART 3 - EXECUTION

3.01 INSTALLATION REQUIREMENTS

- A. General: Except as otherwise indicated, comply with manufacturer's installation instructions and recommendations, and with SMACNA "Architectural Sheet Metal Manual". Anchor units of work securely in place by methods indicated, providing for thermal expansion of metal units; conceal fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints and seams which will be permanently watertight and weatherproof.
- B. Underlayment: Where stainless steel or aluminum is to be installed directly on cementitious or wood substrates, install a slip sheet of red rosin paper and a course of polyethylene underlayment.
- C. Bed flanges of work in a thick coat of bituminous roofing cement where required for waterproof performance.
- D. Install reglets to receive counterflashing in manner and by methods indicated. Where shown in concrete, furnish reglets to trades of concrete work for installation as work of Division 3 sections. Where shown in masonry, furnish reglets to trades of masonry work, for installation as work of

Division 4 sections.

1. Install counterflashing in reglets, either by snap-in seal arrangement, or by welding in place for anchorage and filling reglet with mastic or elastomeric sealant, as indicated and depending on degree of sealant exposure.
- E. Nail flanges of expansion joint units to curb nailers, at maximum spacing of 6 inches o.c. Fabricate seams at joints between units with minimum 3 inch overlap, to form a continuous, waterproof system.

3.02 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces, removing substances which might cause corrosion of metal or deterioration of finishes.
- B. Protection: Advise Contractor of required procedures for surveillance and protection of flashings and sheet metal work during construction, to ensure that work will be without damage or deterioration, other than natural weathering at time of substantial completion.

END OF SECTION

SECTION 07900

JOINT SEALERS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.02 DESCRIPTION OF WORK:

- A. Extent of each form and type of joint sealer is indicated on drawings.
- B. Refer to Division-15 and -16 sections for joint sealers in mechanical and electrical work; not work of this section.

1.03 SYSTEM PERFORMANCES:

- A. Provide joint sealers that have been produced and installed to establish and maintain watertight and airtight continuous seals.

1.04 QUALITY ASSURANCE:

- A. Installer Qualifications: Engage an Installer who has successfully completed within the last 3 years at least 5 joint sealer applications similar in type and size to that of this project and who will assign mechanics from these earlier applications to this project, of which one will serve as lead mechanic.
- B. Single Source Responsibility for Joint Sealer Materials: Obtain joint sealer materials from a single manufacturer for each different product required.

1.05 DELIVERY, STORAGE, AND HANDLING:

- A. Deliver materials to project site in original unopened containers or bundles with labels informing about manufacturer, product name and designation, color, expiration period for use, pot life, curing time and mixing instructions for multicomponent materials.
- B. Store and handle materials to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.06 PROJECT CONDITIONS:

- A. Environmental Conditions: Do not proceed with installation of joint sealers under the following conditions:
 - 1. When ambient and substrate temperature conditions are outside the limits permitted by joint sealer manufacturers.
 - 2. When joint substrates are wet due to rain, frost, condensation or other causes.
- B. Joint Width Conditions: Do not proceed with installation of joint sealers when joint widths are less than allowed by joint sealer manufacturer for application indicated.

PART 2 - PRODUCTS

2.01 MATERIALS, GENERAL:

- A. Compatibility: Provide joint sealers, joint fillers and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by testing and field experience.
- B. Colors: Provide color of exposed joint sealers indicated or, if not otherwise indicated, as selected by Architect from manufacturer's standard colors.

2.02 ELASTOMERIC JOINT SEALANTS:

- A. Elastomeric Sealant Standard: Provide manufacturer's standard chemically curing, elastomeric sealant of base polymer indicated which complies with ASTM C 920 requirements, including those for Type, Grade, Class, and Uses.
- B. Polyurethane Sealant: ASTM C920, Type M, Grade P, Class 25, Uses T, M, A, and O as applicable to substrate, 2-part elastomeric sealant, self-leveling; Vulkem 245 manufactured by Mameco International, Inc., or equivalent product by acceptable manufacturer.
- C. Silicone Sealant: ASTM C920, Type S, Grade NS, Class 25, Uses NT, M, G, A, and O as applicable to substrate, one-part silicone rubber-based elastomeric sealant; non-acid type; tensile strength of 80 psi or less at 150 percent relative humidity in accordance with ASTM D412; Dow Corning 795 manufactured by Dow Corning Corporation, or equivalent product by acceptable manufacturer.
- D. Silicone Sealant: ASTM C920, Type S, Grade NS, Class 25, Uses NT, G, A

and O as applicable to substrate, one-part silicone rubber-based elastomeric sealant; acid type; Dow Corning 999 manufactured by Dow Corning Corporation, or equivalent product by acceptable manufacturer.

- E. Silicone Sealant: ASTM C920 Type S, Grade NS, Class 25, Uses NT, G, A, and O as applicable to non-porous substrates, one-part silicone rubber-based elastomeric sealant; mildew resistant type of wet areas; Dow Corning 8640 manufactured by Dow Corning Corporation, or equivalent product by acceptable manufacturer.

2.03 LATEX SEALANTS:

- A. For use at all interior joints and under thresholds where schedules.
- B. Acrylic Sealant: ASTM C834, one-part acrylic emulsion sealant compound, non-sag, mildew resistant, paintable, recommended by manufacturer for exposed interior applications; AC-20 manufactured by Pecora Corporation, or equivalent product by acceptable manufacturer.

2.04 JOINT SEALANT BACKING:

- A. General: Provide sealant backings of material and type which are non-staining; are compatible with joint substrates, sealants, primers and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Plastic Foam Joint-Fillers: Preformed, compressible, resilient, non-waxing, non-extruding strips of plastic foam of material indicated below, and of size, shape and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
 - 1. Either flexible, open cell polyurethane foam or non-gassing, closed-cell polyethylene foam, unless otherwise indicated, subject to approval of sealant manufacturer.
- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape as recommended by sealant manufacturer for preventing bond between sealant and joint filler or other materials at back (3rd) surface of joint. Provide self-adhesive tape where applicable.

2.05 MISCELLANEOUS MATERIALS:

- A. Primer: Provide type recommended by joint sealer manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint sealer- substrate and field tests.

- B. Cleaners for Nonporous Surfaces: Provide non-staining, chemical cleaner of type acceptable to manufacturer of sealant and sealant backing materials which are not harmful to substrates and adjacent nonporous materials.
- C. Masking Tape: Provide non-staining, non-absorbent type compatible with joint sealants and to surfaces adjacent to joints.

PART 3 - EXECUTION

3.01 INSPECTION:

- A. Require Installer to inspect joints indicated to receive joint sealers for compliance with requirements for joint configuration, installation tolerances and other conditions affecting joint sealer performance. Do not allow joint sealer work to proceed until unsatisfactory conditions have been corrected. Commencement of joint sealer work signifies acceptance of substrate and responsibility of correction of non-conforming work.

3.02 PREPARATION:

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealers to comply with recommendations of joint sealer manufacturers and the following requirements:
 - 1. Remove all foreign material from joint substrates which could interfere with adhesion of joint sealer, including dust; paints, except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer; oil; grease; waterproofing; water repellants; water; surface dirt and frost.
 - 2. Clean concrete, masonry, unglazed surfaces of ceramic tile and similar porous joint substrate surfaces, by brushing, grinding, blast cleaning, mechanical abrading, acid washing or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealers. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air.
 - 3. Remove laitance and form release agents from concrete.
 - 4. Clean metal, glass, porcelain enamel, glazed surfaces of ceramic tile and other 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 sealers.
- B. Joint Priming: Prime joint substrates where indicated or where recommended by joint sealer manufacturer. Apply primer to comply with joint sealer manufacturer's recommendations. Confine primers to areas of joint sealer bond, do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking type where required to prevent contact of

sealant with adjoining surfaces which 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.

3.03 INSTALLATION OF JOINT SEALERS:

- A. General: Comply with joint sealer manufacturer's printed installation instructions applicable to products and applications indicated, except where more stringent requirements apply.
- B. Elastomeric Sealant Installation Standard: Comply with recommendations of ASTM C 962 for use of joint sealants as applicable to materials, applications and conditions indicated.
- C. Installation of Sealant Backings: Install sealant backings to comply with the following requirements:
 - 1. Install joint-fillers of type indicated to provide support of sealants during application and at position required to produce the cross-sectional shapes and depths of installed sealants relative to joint widths which allow optimum sealant movement capability.
 - 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 tape between sealants and joint-fillers, compression seals or back of joints where required to prevent third-side adhesion of sealant to back of joint.
 - 3. Install compressible seals serving as sealant backings to comply with requirements indicated above for joint fillers.
- D. Installation of Sealants: Install sealants by proven techniques that result in sealants directly contacting and fully wetting joint substrates, completely filling recesses provided for each joint configuration and providing uniform, cross-sectional shapes and depths relative to joint widths which allow optimum sealant movement capability.
- E. Tooling of Nonsag Sealants: Immediately after sealant application and prior to time skinning or curing begins, tool sealants to form smooth, uniform beads of configuration indicated, to eliminate air pockets and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents which discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.
 - 1. Concave joint configuration per Figure 6A in ASTM C 962, unless otherwise indicated.
- F. Installation of Preformed Foam Sealants: Install each length of sealant immediately after removing protective wrapping, taking care not to pull or stretch material, and complying with sealant manufacturer's directions for installation methods, materials and tools which produce seal continuity at ends, turns, and intersections of joints. For applications at low ambient

temperatures where expansion of sealant requires acceleration to produce seal, apply heat to sealant in conformance with sealant manufacturer's recommendations.

3.04 PROTECTION AND CLEANING:

- A. Protect joint sealers during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they 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 sealers immediately and reseal joints with new materials to produce joint sealer installations with required areas indistinguishable from original work.
- B. Clean off excess sealants or sealant smears adjacent to joints as work progresses by methods and with cleaning materials approved by manufacturers of joint sealers and of products in which joints occur.

END OF SECTION

SECTION 07920

SEALERS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. Cast-in-place concrete: Refer to Section 03330
- C. Caulking, sealing and joint filler: Refer to Section 07900.

1.02 SECTION INCLUDES:

- A. Exterior water repellent coatings for:
 - a. Precast concrete
 - b. Brick
 - c. Concrete Block
- B. Extended written warranty

1.03 SUBMITTALS:

- A. Comply with Section 01300, unless otherwise indicated.
- B. Product Data:
 - Manufacturer's specifications and technical data, including the following:
 - a. Detailed specification of construction and fabrication
 - b. Manufacturer's installation instructions.
 - c. Certified test reports indicating compliance with performance requirements specified herein.
- C. Quality Control Submittals
 - a. Statement of qualifications.
 - b. Statement of compliance with Regulatory Requirements.
 - c. Field Quality Control Submittals as specified in Part 3.
 - d. Manufacturer's field reports.

1.04 QUALITY ASSURANCE:

- A. Manufacturer's Qualification
 - Not less than 5 years experience in the actual production of specified products. Manufacturer's production facilities must be certified for quality by ISO, under the 9002 provisions
- B. Installer's Qualifications:
 - Firm experienced in installation or application of systems similar in complexity to those required for this Project, plus the following:

- a. Acceptable to or licensed by manufacturer.
- b. Not less than 3 years experience with systems.
- c. Successfully completed not less than 5 comparable scale projects using this system.

C. Product Qualifications

- a. For Five (5) Year Warranty Projects:

Comply with the provisions of the following standards for concrete:

- i. Surface Appearance – No change in the surface appearance or texture.
- ii. NCHRP #244 Series II:
 - 1. 80% reduction in water absorption
 - 2. 85% reduction in chloride ion intrusion
- iii. NCHRP #244 Series IV:
 - 1. 95% reduction in chloride ion intrusion
- iv. ASTM C642 “Water Absorption of Hardened Concrete” 48-hour water soak:
 - 1. Less than 0.50% absorption
 - 2. Control (untreated) concrete absorbs more than 3.5%
- v. ASTM C672 “Deicer Sealing of Concrete”:
 - 1. Treated sample “0” Rating after 60 cycles
 - 2. Untreated sample “5” Rating after 40 to 50 cycles
- vi. Penetration – 0.15 inches average (on NCHRP #244 Concrete)

- b. For Ten (10) Year Warranty Projects:

Comply with the provisions of the following standards for concrete:

- i. Surface Appearance – No change in the surface appearance or texture.
- ii. NCHRP #244 Series II:
 - 1. 85% reduction in water absorption
 - 2. 88% reduction in chloride ion intrusion
- iii. NCHRP #244 Series IV:
 - 1. 98% reduction in chloride ion intrusion
- iv. Alberta T&U Type 1b Penetrating Sealer Test:
 - 1. Minimum 82.5% Effective Before Abrasion
 - 2. Minimum 82.5% Effective After Abrasion
- v. ASTM C642 “Water Absorption of Hardened Concrete” 48-hour water soak:
 - 1. Less than 0.35% absorption
 - 2. Control (untreated) concrete absorbs more than 3.5%
- vi. ASTM C672 “Deicer Sealing of Concrete”:
 - 1. Treated sample “0” Rating after 60 cycles
 - 2. Untreated sample “5” Rating after 40 to 50 cycles
- vii. Penetration – 0.20 inches average (on NCHRP #244 Concrete)

- c. Special Ten (10) Year Monitoring Warranty:

Comply with the provisions of the following standards for concrete:

- i. Surface Appearance – No change in the surface appearance or texture.
 - ii. Alberta T&U Type 1c Penetrating sealer test:
 - 1. Minimum 90% Effective After Double Abrasion
 - iii. Extended chloride diffusion test, 150 days minimum
 - 1. Delay steady state diffusion minimum 110 days
 - 2. Impart chloride ion screening equivalent to 3.5 inches of concrete
 - iv. ASSHTO T277 “Rapid Determination of the Chloride Permeability of Concrete:”
 - 1. Minimum 400 hours before current increase to maximum compared to control
- d. Regulatory Requirements

Products shall comply with state and local regulations concerning AIM (Architectural, Industrial and Maintenance) coatings regarding Volatile Organic Content (VOC).

 - i. The use of 1,1,1-trichloroethane as an exempt solvent shall not be allowed

1.05 DELIVERY, STORAGE AND HANDLING:

- A. Packing and Shipping: Deliver Products in original unopened packaging with legible manufacturer’s identification.
- B. Storage and Protection: Comply with Manufacturer’s recommendations.

1.06 PROJECT CONDITIONS:

- A. Environmental Requirements
 - a. Maintain ambient temperature above 40°F during and 24 hours after installation.
 - b. Do not proceed with application on materials if ice or frost is covering the substrate.
 - c. Do not proceed with application if ambient temperature of surface exceeds 100°F.
 - d. Do not proceed with the application of materials in rainy conditions or if heavy rain is anticipated within 4 hours of application.
- B. Sealer Coordination
 - a. Verify compatibility with curing compounds, patching materials, repair mortars, paints, sealants, etc. to be used on masonry surfaces to ensure compatibility with the water repellent.

1.07 SPECIAL WARRANTIES:

Manufacturer shall stand behind installed system for period specified in “Materials,” below, from Date of Substantial Completion against all the conditions indicated below. When notified in writing from Owner, Manufacturer shall, upon notice correct said deficiencies promptly and at a cost not to exceed the Ratio of the age of the

application versus the age of the warranty coverage cost to Owner.

A. Loss of water repellency

- a. The system manufacturer shall furnish the Owner a written single-source performance warranty that the Concrete Penetrating Sealer System will be free of defects related to workmanship or material deficiency for period specified in "Materials" section (below) from the date of completion of the work provided under this section of the specification. The following performance standards shall be specifically covered under warranty:
 - i. Using ASTM D6489 procedure, the treated concrete shall not absorb more than 0.75% water for a period of 24 hours
 - ii. Using AASHTO T259 the concrete shall not absorb more than 250ppm of chlorides at the 1 ½ inch level over baseline conditions

PART 2 - PRODUCTS

2.01 MATERIALS:

Brick and Concrete Block Sealer, Protectosil Aqua-trete SG by Evernik Industries (www.protectosil.com). Follow all recommendations of the manufacturer.

PART 3 - EXECUTION

3.01 EXAMINATION:

- A. Verification of Conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion. Do not proceed until unsatisfactory conditions have been corrected.

3.02 PREPARATION:

- A. Protection: Install coverings to protect adjacent surfaces.
- B. Surface Preparation: Surfaces to receive sealer shall be cleaned of dirt, oil, grease, laitance, and other contaminants. Oil, grease and other automotive contaminants shall be removed with degreasers. All other surfaces shall be cleaned by high-pressure water (3000 psi). High-pressure water is the minimum cleaning that will be accepted; other methods, such as blastracking, mobile power scrubbing and sandblasting, may be submitted.

Remove dirt, dust and materials that will interfere with the proper and effective

application of the penetrating sealer. It is the responsibility of the Contractor to prepare the surfaces of the concrete to a condition acceptable to the Owner.

Check the compatibility of all caulking and patching material to be used with the penetrating sealer.

Sealants, patching materials, and expansion joints shall have been installed and approved.

3.03 APPLICATION

Read the manufacturer's Material Safety Data Sheet (MSDS) for the product being applied.

Product shall be applied as supplied by the manufacturer without dilution or alteration, unless noted in the manufacturer's data sheet.

Apply with low-pressure (15 psi) airless spray equipment with a fan spray nozzle, flooding the surface to obtain uniform coverage unless otherwise recommended by the manufacturer.

Apply at temperature and weather conditions recommended by the manufacturer or written in this specification.

Follow manufacturer's recommendations concerning protection of glass, metal and other non-porous substrates. Contractor will be responsible for cleaning all surfaces that are contaminated by the water repellent.

Apply water repellent by brush only at locations where overspray would affect adjacent materials and where not practical for spray application.

3.04 FIELD QUALITY CONTROL

- A. Manufacturer's Field Services
 - a. Furnish written certification that surface preparation methods and final condition have manufacturer's approval and comply with the warranty.
- B. Test Area
 - a. Before a sealer application, the following field evaluation will be done. The cost of the field testing will be the responsibility of the Water Repellent Manufacturer.
 - b. Prepare two three-foot by three-foot areas to be sprayed with the water repellent. The area will be determined by the Owner.
 - c. Apply the water repellent at a rate recommended in "Application" section, above.
 - d. After seven days to allow the material to cure, remove two three-inch by three-inch core samples from each test area. In addition, remove two core

samples from an untreated area.

- e. The following tests shall be performed on the core samples:
 - i. Water Absorption: Perform a modified ASTM C642 procedure on each core. The test shall be modified by sealing the sides and the bottom of the cores with a paraffin wax or other impervious material. Acceptable results are a reduction of the treated areas compared to the untreated area of 85 percent.
 - ii. Depth Penetration: After performing the water absorption test, split the cores longitudinally and place the fractured face in water for 30 seconds. Remove the core and measure the non-wetted band at 10 intervals to the nearest 0.01 inches; this is the depth of penetration. Acceptable results are 0.10 inches, average for 5-year warranty and 0.20 inches for a 10-year warranty.

3.05 CLEANING

- A. As Work Progresses: Clean spillage and overspray from adjacent surfaces using materials and methods as recommended by water repellent manufacturer.
- B. Remove protective coverings from adjacent surfaces when no longer needed.

3.06 COMPLETION

- A. Work which does not conform to specified requirements shall be corrected and/or replaced as directed by the Owner's Representative at contractor's expense without extension of time.

END OF SECTION

DIVISION 8

DOORS AND WINDOWS

SECTION 08110

STEEL DOORS AND FRAMES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.02 DESCRIPTION OF WORK:

- A. Extent of standard steel doors and frames is indicated and scheduled on drawings.
- B. Finish hardware is specified elsewhere in Division-8.
- C. Building in of anchors and grouting of frames in masonry construction is specified in Division 4.

1.03 QUALITY ASSURANCE:

- A. Provide doors and frames complying with Steel Door Institute "Recommended Specifications: Standard Steel Doors and Frames" (SDI-100) and as herein specified.
- B. Fire-Rated Door Assemblies: Where fire-rated door assemblies are indicated or required, provide fire-rated door and frame assemblies that comply with NFPA 80 "Standard for Fire Doors and Windows", and have been tested, listed, and labeled in accordance with ASTM E 152 "Standard Methods of Fire Tests of Door Assemblies".

1.04 SUBMITTALS:

- A. Shop Drawings: Submit for fabrication and installation of steel doors and frames. Include details of each frame type, elevations of door design types, conditions at openings, details of construction, location and installation requirements of finish hardware and reinforcements, and details of joints and connections. Show anchorage and accessory items.
 - 1. Provide schedule of doors and frames using same reference numbers for details and openings as those on contract drawings.
 - 2. Indicate glazing frames and stops with glass and glazing requirements.

1.05 DELIVERY, STORAGE AND HANDLING:

- A. Deliver hollow metal work cartoned or crated to provide protection during transit and job storage. Provide additional sealed plastic wrapping for factory finished doors.
- B. Inspect hollow metal work upon delivery for damage. Minor damages may be repaired provided refinished items are equal in all respects to new work and acceptable to Architect; otherwise, remove and replace damaged items as directed.
- C. Store doors and frames at building site under cover. Place units on minimum 4" high wood blocking. Avoid use of non-vented plastic or canvas shelters which could create humidity chamber. If cardboard wrapper on door becomes wet, remove carton immediately. Provide 1/4" spaces between stacked doors to promote air circulation.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

- A. Manufacturers: Subject to compliance with requirements, provide steel doors and frames by one of the following acceptable alternate manufacturer:
 - 1. Steel Doors and Frames, (General):
 - a. Amweld/Div. American Welding & Mfg. Co.
 - Ceco Corp.
 - Fenestra Corp.
 - Steelcraft/Div. American Standard Co.
 - 2. Thermal Rated Steel Door and Frame Assemblies:
 - a. Amweld/Div. American Welding & Mfg. Co.
 - Ceco Corp.
 - Fenestra Corp.
 - Steelcraft/Div. American Standard Co.

2.02 MATERIALS:

- A. Hot-Rolled Steel Sheets and Strip: Commercial quality carbon steel, pickled and oiled, complying with ASTM A 569 and ASTM A 568.
- B. Cold-Rolled Steel Sheets: Commercial quality carbon steel, complying with ASTM A 366 and ASTM A 568.
- C. Galvanized Steel Sheets: Zinc-coated carbon steel sheets of commercial quality, complying with ASTM A 526, with ASTM A 525, G60 zinc coating,

mill phosphatized.

- D. Supports and Anchors: Fabricate of not less than 18 gage galvanized sheet steel.
- E. Inserts, Bolts and Fasteners: Manufacturer's standard units, except hot-dip galvanize items to be built into exterior walls, complying with ASTM A 153, Class C or D as applicable.
- F. Shop Applied Paint:
 - 1. Primer: Lead free, V.O.C. compliant rust-inhibitive enamel or paint, either air-drying or baking, suitable as a base for specified finish paints.

2.03 FABRICATION, GENERAL:

- A. Fabricate steel door and frame units to be rigid, neat in appearance and free from defects, warp or buckle. Wherever practicable, fit and assemble units in manufacturer's plant. Clearly identify work that cannot be permanently factory assembled before shipment, to assure proper assembly at project site. Comply with SDI-100 requirements as follows:
 - 1. Exterior Doors: SDI-100, Grade II, Model 4, minimum 16-gage faces.
 - 2. Interior Doors: SDI-100, Grade II, Model 4, minimum 18-gage faces.
- B. Fabricate exposed faces of doors and panels, including stiles and rails of nonflush units, from only cold-rolled steel.
- C. Fabricate frames, concealed stiffeners, reinforcement, edge channels, louvers and moldings from either cold-rolled or hot-rolled steel (at fabricator's option).
- D. Fabricate exterior doors, panels, and frames from galvanized sheet steel. Close top and bottom edges of exterior doors as integral part of door construction or by addition of minimum 16-gage inverted steel channels.
- E. Exposed Fasteners: Unless otherwise indicated, provide countersunk flat Phillips heads for exposed screws and bolts.
- F. Thermal-Rated (Insulating) Assemblies:
 - 1. At exterior locations and elsewhere as shown or scheduled, provide doors which have been fabricated as thermal insulating door and frame assemblies and tested in accordance with ASTM C 236.
 - 2. Unless otherwise indicated, provide thermal-rated assemblies with U-factor of 0.24 BTU/(hr*sq ft*deg F) or better.
- G. Finish Hardware Preparation: Prepare doors and frames to receive mortised and concealed finish hardware in accordance with final Finish Hardware

Schedule and templates provided by hardware supplier. Comply with applicable requirements of ANSI A115 series specifications for door and frame preparation for hardware.

- H. Reinforce doors and frames to receive surface-applied hardware. Drilling and tapping for surface-applied finish hardware may be done at project site.
- I. Locate finish hardware as indicated on final shop drawings or, if not indicated, in accordance with "Recommended Locations for Builder's Hardware", published by Door and Hardware Institute.
- J. Shop Painting:
 - 1. Clean, treat, and paint exposed surfaces of steel door and frame units, including galvanized surfaces.
 - 2. Clean steel surfaces of mill scale, rust, oil, grease, dirt, and other foreign materials before application of paint.
 - 3. Apply shop coat of prime paint of even consistency to provide a uniformly finished surface ready to receive finish paint.
 - 4. Interior Units: 0.30 oz./sq. ft. galvanized.
 - 5. Exterior Units: 2.0 oz./sq. ft. galvanized.
 - 6. Primer: Baked on.
 - 7. Masonry Frames; Coast inside of frame with bituminous coating to a thickness of 1/16 inch.

2.04 STANDARD STEEL DOORS:

- A. Provide metal doors of types and styles indicated on drawings or schedules.

2.05 STANDARD STEEL FRAMES:

- A. Provide metal frames for doors, transoms, sidelights, borrowed lights, and other openings, of types and styles as shown on drawings and schedules. Conceal fastenings, unless otherwise indicated. Fabricate frames of cold-rolled furniture steel, 16-gage for exterior units, 18-gage for interior units..
 - 1. Fabricate frames with mitered corners, knocked down, for field assembly.
 - 2. Form exterior frames of hot dip galvanized steel.
- B. Door Silencers: Except on weatherstripped frames, drill stops to receive 3 silencers on strike jambs of single-swing frames and 2 silencers on heads of double-swing frames.

PART 3 - EXECUTION

3.01 INSTALLATION:

- A. General: Install standard steel doors, frames, and accessories in accordance with final shop drawings, manufacturer's data, and as herein specified.
- B. Placing Frames: Comply with provisions of SDI-105 "Recommended Erection Instructions For Steel Frames", unless otherwise indicated.
 - 1. Except for frames located at in-place concrete or masonry and at drywall installations, place frames prior to construction of enclosing walls and ceilings. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is completed, remove temporary braces and spreaders leaving surfaces smooth and undamaged.
 - 2. In masonry construction, locate 3 wall anchors per jamb at hinge and strike levels.
 - 3. At in-place concrete or masonry construction, set frames and secure to adjacent construction with machine screws and masonry anchorage devices.
 - 4. In metal stud partitions, install at least 3 wall anchors per jamb at hinge and strike levels. In open steel stud partitions, place studs in wall anchor notches and wire tie. In closed steel stud partitions, attach wall anchors to studs with tapping screws.
- C. Door Installation:
 - 1. Fit hollow metal doors accurately in frames, within clearances specified in SDI-100.

3.02 ADJUST AND CLEAN:

- A. Prime Coat Touch-up: Immediately after erection, sand smooth any rusted or damaged areas of prime coat and apply touch-up of compatible air-drying primer.
- B. Protection Removal: Immediately prior to final inspection, remove protective plastic wrappings from prefinished doors.
- C. Final Adjustments: Check and readjust operating finish hardware items, leaving steel doors and frames undamaged and incomplete and proper operating conditions.

END OF SECTION

SECTION 08360

SECTIONAL OVERHEAD DOORS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. All of the Contract Documents, including General and Supplementary Conditions, and Division 1 General Requirements, apply to the work of this Section.

1.02 SUMMARY

- A. The work of this Section includes upward-acting sectional doors.
- B. Related Sections: Other specification sections which directly relate to the work of this Section include, but are not limited to, the following:
 - 1. Section 05500 - Miscellaneous Metal; metal framing and supports.
 - 2. Section 08710 - Finish Hardware; key cylinders for locks.
 - 3. Section 09900 - Painting; field painting.
 - 4. Section 16100 - Electrical; wiring.

1.03 SUBMITTALS

- A. Product Data: Submit manufacturers product data and installation instructions for each type of sectional door. Include both published data and any specific data prepared for this project.
- B. Shop Drawings: Submit shop drawing for approval prior to fabrication. Include detailed plans, elevations, details of framing members, required clearances, anchors, and accessories. Include relationship with adjacent materials.

1.04. QUALITY ASSURANCE

- A. Manufacturer: Sectional doors shall be manufactured by a firm with a minimum of five years experience in the fabrication and installation of sectional doors. Manufacturers proposed for use, which are not named in these specifications, shall submit evidence of ability to meet performance and fabrication requirements specified, and include a list of five projects of similar design and complexity completed within the past five years.
- B. Installer: Installation of sectional doors shall be performed by the authorized representative of the manufacturer.
- C. Single-Source Responsibility: Provide doors, tracks, motors, and accessories from one manufacturer for each type of door. Provide secondary components from source acceptable to manufacturer of primary components.
- D. Pre-Installation Conference: Schedule and convene a pre-installation conference just prior to commencement of field operations, to establish procedures to maintain optimum working conditions and to coordinate this work with related and adjacent work.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials and products in labeled protective packages. Store and handle in strict compliance with manufacturers instructions and recommendations. Protect from damage from weather, excessive temperatures and construction operations.

1.06 WARRANTIES

- A. Provide manufacturer's standard 1-year warranty. All components supplied by the door manufacturer shall be covered under warranty.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURER

- A. Provide sectional doors by Overhead Door Corporation, Lewisville, Texas; Telephone 800-972-1730 or 469-549-7121; Fax 972-528-1021 or equal. Contact: Angela Burgess, angela_burgess@overheaddoor.com.

2.02 ALUMINUM SECTIONAL DOORS

- A. Trade Reference: 511 Series Aluminum Doors by Overhead Door Corporation or equal. Doors must be rated for 100,000 cycles minimum.
- B. Sectional Door Assembly: Stile and rail assembly secured with 1/4

diameter through rods. Units shall have the following characteristics:

1. Panel Thickness: 1-3/4"
 2. Aluminum Panels: 0.050 thick, aluminum.
 3. Stiles and Rails: 6063 - T6 aluminum.
 4. Standard Springs; 100,000 cycles. (High cycles.)
 5. Glazing: Tempered glass
- C. Finish and Color:
1. Anodized Finish. Refer to drawings for color.
- D. Windload Design: ANSI/NAGDM 102 standards and as required by Code.
- E. Hardware: Galvanized steel hinges and fixtures. Ball bearing rollers with hardened steel races.
- F. Lock: Interior galvanized single unit.
- G. Weatherstripping: Flexible PVC on bottom section. (Jamb seals.) (Header seal.)
- H. Track: Provide track as recommended by manufacturer to suit loading required and as available.
- I. Electric Motor Operation: (Openers not required).

PART 3 – EXECUTION

3.01 PREPARATION

- A. Take field dimension and examine conditions of substrates, supports, and other conditions under which this work is to be performed. Do not proceed with work until unsatisfactory conditions are corrected.

3.02 INSTALLATION

- A. Strictly comply with manufacturers installation instructions and recommendations. Coordinate installation with adjacent work to ensure proper clearances and allow for maintenance.
- B. Instruct Owners personnel in proper operating procedures and maintenance schedule.

3.03 ADJUSTING AND CLEANING

- A. Test sectional doors for proper operation and adjust as necessary to provide proper operation without binding or distortion.
- B. Touch-up damaged coatings and finishes and repair minor damage. Clean exposed surfaces using non-abrasive materials and methods recommended by manufacturer of material or product being cleaned.

END OF SECTION

SECTION 08410

ALUMINUM ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.02 SUMMARY:

- A. Extent of aluminum entrances and storefronts is indicated on drawings and schedules.
- B. Aluminum entrance and storefront types required for the project include:
 - 1. Exterior entrance doors.
 - 2. Frames for exterior entrances.
 - 3. Storefront type framing system.
- C. Glazing: Refer to "Glass and Glazing" section of Division 8 for glazing requirements for aluminum entrances and storefronts, including doors specified to be factory pre-glazed.
- D. Lock cylinders are specified in Division-8 hardware section.

1.03 SYSTEM DESCRIPTION:

- A. Performance Requirements: Provide aluminum entrance and storefront assemblies that comply with specified performance characteristics.
- B. Thermal Movement: Provide systems capable of withstanding thermal movements resulting from an ambient temperature range of 120 deg. F (67 deg. C), that could cause a metal surface temperature range of 180 deg. F (100 deg. C) within the framing system.
- C. Wind Loading: Design per wind speed and exposure of site as shown on the structural drawings.

D. Fixed Framing Transmission Characteristics: Provide thermal aluminum entrance and storefront framing system that complies with requirements indicated for transmission characteristics.

1. Air Infiltration: Provide framing system with an air infiltration rate of not more than 0.06 CFM per sq. ft. of fixed area (excluding operable door edges) when tested in accordance with ASTM E 283 at an inward test pressure differential of 10.0 psf.
2. Water Penetration: Provide framing systems with no water penetration (excluding operable door edges) as defined in the test method when tested in accordance with ASTM E 331 at an inward test pressure differential of 6.24 lbf. per sq. ft.
3. Condensation Resistance: Where framing systems are "thermal-break construction, provide units tested for thermal performance in accordance with AAMA 1502 showing condensation resistance factor (CRF) of not less than 45.
4. Average Thermal Conductance: Provide aluminum-framed systems with fixed glazing and framing areas having average U-factor of not more than 0.68 Btu/sq. ft. x h x deg F. when tested according to AAMA 1503.

NOTE: Thermal skip debridge and thermal slotted storefront systems are not approved.

E. Aluminum Entrance Transmission Characteristics: Provide entrance doors with jamb and head frames that comply with requirements indicated for transmission characteristics.

1. Air Infiltration: Provide doors with an air infiltration rate of not more than 0.05 CFM for single doors and 1.0 for pairs of doors when tested in accordance with ASTM E 283 at an inward test pressure of 1.567 psf.

1.04 SUBMITTALS

A. Shop Drawings: Submit shop drawings for fabrication and installation of entrances and storefronts, including the following:

1. Elevations.
2. Detail sections of typical composite members.
3. Hardware, schedule, and mounting heights.
4. Anchorages and reinforcements.
5. Expansion provisions.
6. Glazing details.
7. Finish and accessories.

1.05 QUALITY ASSURANCE:

- A. Single Source Responsibility: Provide entrance and storefront produced by a single manufacturer capable of showing prior production of units similar to those required.
- B. Installer's Qualifications: Entrances and storefront shall be installed by a firm that has not less than 5-years successful experience in the installation of systems similar to those required and who has attended an installation & fabrication school through the manufacture of attended an installation & fabrication school through the National Glass Association.
- C. Design Criteria: Drawings are based on one manufacturer's entrance and storefront system. Another manufacturer's system of a similar and equivalent nature will be acceptable when, in the Architect's sole judgement, differences do not materially detract from the design concept or intended performance.

1.06 PROJECT CONDITIONS:

- A. Field Measurements: Check openings by field measurement before fabrication to ensure proper fitting of work; show measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delay in the work. Where necessary, proceed with fabrication without field measurements, and coordinate fabrication tolerances to ensure proper fit.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

- A. Manufacturer: Base Bid: Kawneer Company, Inc.

Subject to compliance with requirements, provide alternate bid from one of the following:

PPG Industries, Inc.
United States Aluminum Corp., International Alum. Corp.
Vistawall Architectural Products.

2.02 MATERIALS:

- A. Aluminum Members: Provide alloy and temper recommended by the manufacturer for strength, corrosion resistance, and application of required

finish; comply with ASTM B 221 for extrusions and ASTM B 209 for sheet or plate.

- B. Fasteners: Provide fasteners of aluminum, non-magnetic stainless steel, or other materials warranted by manufacturer to be noncorrosive and compatible with aluminum components, hardware, anchors and other components.
 - 1. Reinforcement: Where fasteners screw-anchor into aluminum less than 0.125" thick, reinforce the interior with aluminum or nonmagnetic stainless steel to receive screw threads, or provide standard non-corrosive pressed-in splined grommet nuts.
 - 2. Exposed Fasteners: Except where unavoidable for application of hardware, do not use exposed fasteners. For the application of hardware, use fasteners that match the finish of member or hardware being fastened.
 - a. Provide Phillips flat-head machine screws for exposed fasteners.
- C. Concealed Flashing: Provide 26 gage minimum dead-soft stainless steel, or 0.026" minimum extruded aluminum of alloy and type selected by manufacturer for compatibility with other components. See drawings for additional flashing information.
- D. Brackets and Reinforcements: Where feasible, provide high-strength aluminum brackets and reinforcements; otherwise provide nonmagnetic stainless steel or hot-dip galvanized steel complying with ASTM A 386.
- E. Concrete/Masonry Inserts: Provide concrete and masonry inserts fabricated from cast-iron, malleable iron, or hot-dip galvanized steel complying with ASTM A 386.
- F. Compression Weatherstripping: Provide the manufacturer's standard replaceable compressible weatherstripping gaskets of molded neoprene complying with ASTM D 2000 or molded PVC complying with AAMA D 2287.
- G. Sliding Weatherstripping: Provide the manufacturer's standard replaceable weatherstripping of wool, polypropylene, or nylon woven pile, with nylon fabric or aluminum strip backing, complying with AAMA 701.2.
- H. Glass and Glazing Materials: Glass and glazing materials shall comply with requirements of "Glass and Glazing" section of these specifications.

2.03 COMPONENTS:

- A. Storefront Framing System: Provide inside-outside matched resilient flush-glazed storefront framing system with provisions for glass replacement. Shop-fabricate and pre-assemble frame components where possible.
 - a. Kawneer 190 Narrow Stile Entrance or equal.

1. Thermally Improved Construction: Fabricate storefront framing system with integral thermally improved design. Use manufacturer's standard construction that has been in use for similar projects for period of not less than 3 years.
- B. Stile-and-Rail Type Aluminum Doors:
1. Frame: Provide tubular frame members, fabricated with mechanical joints using heavy inserted reinforcing plates and concealed tie-rods or j-bolts.
 2. Design: Provide 1-3/4" thick doors of design indicated.
 - a. Narrow stile (2" nominal width).
 - b. 10" Bottom stile at storefront doors
 3. Glazing: Fabricate doors to facilitate replacement of glass or panels, without disassembly of stiles and rails. Provide snap-on extruded aluminum glazing stops, with exterior stops anchored for non-removal.
 4. Pull Force: 5.0 pounds of force maximum allowed for operation of door to comply with ADA requirements.
- 2.04 HARDWARE:
- A. General: Refer to hardware section in Division-8 for requirements for hardware items other than those indicated to be provided by the aluminum entrance manufacturer.
- B. Provide manufacturer's heavy-duty hardware units as indicated, scheduled, or required for operation of each door, including the following items of sizes, number, and type recommended by manufacturer for service required; finish to match door.
1. Offset Pivot Sets: Provide offset pivot assemblies complying with ANSI A156.4, Grade 1; provide exposed parts of cast aluminum alloy; provide an intermediate pivot for doors over 7'-6" high.
- C. Surface-Mounted Overhead Closers with backcheck: Provide surface-mounted overhead closers, modern type with cover, for hinge side installation; comply with ANSI A156.4, Grade 1. Comply with manufacturer's recommendations for size of closer, depending on door size, exposure to weather, handicapped access and anticipated frequency of use.
- D. Keyed Cylinders: Provide mortise type, 5-pin tumbler, outside cylinder units and inside thumbturn cylinder units with cast aluminum face; comply with ANSI A156.5, Grade 1.
1. Deadlocks: Provide mortised maximum security type deadlocks, with minimum 1" long pivoted bolt and stainless steel strike box; comply with ANSI A156.5, Grade 1.
- E. Push-Pull Plates: Provide manufacturer's standard aluminum push-pull plates finished to match doors.
- F. Thresholds: Provide extruded aluminum threshold of size and design indicated in mill finish, complete with anchors and clips.

G. Letter Magazine Slot: Provide standard Magazine slot, 2 5/8" x 12 1/8". Finish to match door.

H. Exit Indicator: Provide standard exit indicator at all thumbturns. Finish to match door.

2.05 FABRICATION:

A. General: Sizes of door and frame units, and profile requirements, are indicated on drawings. Variable dimensions are indicated, with maximum and minimum dimensions required to achieve design requirements and coordination with other work.

B. Prefabrication: Before shipment to the project site, complete fabrication, assembly, finishing, hardware application, and other work to the greatest extent possible. Disassemble components only as necessary for shipment and installation.

1. Preglaze door and frame units to greatest extent possible.
2. Do not drill and tap for surface-mounted hardware items until time of installation at project site.
3. Perform fabrication operations, including cutting, fitting, forming, drilling and grinding of metal work to prevent damage to exposed finish surfaces. For hardware, perform these operations prior to application of finishes.

C. Welding: Comply with AWS recommendations; grind exposed welds smooth and restore mechanical finish.

D. Reinforcing: Install reinforcing as required for hardware and necessary for performance requirements, sag resistance and rigidity.

E. Dissimilar Metals: Separate dissimilar metals with zinc chromate primer, bituminous paint, or other separator that will prevent corrosion.

F. Continuity: Maintain accurate relation of planes and angles, with hairline fit of contacting members.

G. Fasteners: Conceal fasteners wherever possible.

H. Weatherstripping: For exterior doors, provide compression weatherstripping against fixed stops; at other edges, provide sliding weatherstripping retained in adjustable strip mortised into door edge.

1. Provide EPDM or vinyl blade gasket weatherstripping in bottom door rail, adjustable for contact with threshold.

2.06 FINISHES:

- A. All aluminum storefront shall be anodized. Refer to drawings for color.

PART 3 - EXECUTION

3.01 INSTALLATION:

- A. Comply with manufacturer's instructions and recommendations for installation.
- B. Set units plumb, level, and true to line, without warp or rack of framing members, doors, or panels. Provide proper support and anchor securely in place.
 - 1. Separate aluminum and other corrodible metal surfaces from sources of corrosion of electrolytic action at points of contact with other materials. Comply with requirements specified under paragraph "Dissimilar Materials" in the Appendix to AAMA 101-85.
- C. Drill and tap frames and doors and apply surface-mounted hardware items. Comply with hardware manufacturer's instructions and template requirements. Use concealed fasteners wherever possible.
- D. Set sill members and other members in bed of sealant as indicated, or with joint fillers or gaskets as indicated to provide weathertight construction. Comply with requirements of Division 7 for sealants, fillers, and gaskets.
- E. Refer to "Glass and Glazing" Section of Division 8 for installation of glass and other panels shown to be glazed into doors and framing, and not preglazed by manufacturer.

3.02 ADJUSTING:

- A. Adjust operating hardware to function properly, for smooth operation without binding, and for weathertight closure.

3.03 CLEANING:

- A. Clean the completed system, inside and out, promptly after installation, exercising care to avoid damage to coatings.

- B. Clean glass surfaces after installation, complying with requirements contained in the "Glass and Glazing" section for cleaning and maintenance. Remove excess glazing and sealant compounds, dirt and other substances from aluminum surfaces.

3.04 PROTECTION:

- A. Institute protective measures required throughout the remainder of the construction period to ensure that aluminum entrances and storefronts will be without damage or deterioration, other than normal weathering, at time of acceptance.

3.05 HARDWARE SCHEDULE:

Refer to drawings, Sheet A6-1 for Hardware Schedule.

3.06 WARRANTY

- A. Special Assembly Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of aluminum-framed systems that do not comply with requirements or that deteriorate as defined in this Section within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including, but not limited to, excessive deflection.
 - b. Noise or vibration caused by thermal movements.
 - c. Water leakage through fixed glazing and framing areas.
 - 2. Warranty Period: Two years from date of Substantial Completion. Corner Warranty "Life-Time".

END OF SECTION

SECTION 08710

FINISH HARDWARE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.02 DESCRIPTION OF WORK:

- A. Definition: "Finish Hardware" includes items known commercially as finish hardware which are required for swing, sliding and folding doors, except special types of unique and non-matching hardware specified in the same section as the door and door frame.
- B. Extent of finish hardware required is indicated on drawings and in schedules.
- C. Thresholds for aluminum entrance doors are specified with entrance doors elsewhere in Section 08410.

1.03 QUALITY ASSURANCE:

- A. Manufacturer: Obtain each type of hardware (latch and lock sets, hinges, closers, etc.) from a single manufacturer, although several may be indicated as offering products complying with requirements.
 - 1. Locks and Latches: Manufactured by Schlage (SCH), or Weiser/Falcon (WF), no substitutions.
 - 2. Signs, Stops and/or Silencers: Manufactured by: Trimco/BBW/Quality, Pemko or approved equal.
 - 3. Closers: Manufactured by: Rixon (RX), Norton (NO), Corbin (CO), LCN, or approved equal.
 - 4. Threshold, Door Bottoms and Weatherstrip: Manufactured by: Pemko, Hager or approved equal.
 - 5. Padlocks: Schlage (SCH) Weiser/Falcon (WF), Almont (AL), no substitutions.

- B. Supplier: A recognized architectural finish hardware supplier, with warehousing facilities, who has been furnishing hardware in the project's vicinity for a period of not less than 3 years, and who is, or who employs an experienced architectural hardware consultant who is available, at reasonable times during the course of the work, for consultation about project's hardware requirements, to Owner, Architect and Contractor.
- C. Fire-Rated Openings: Provide hardware for fire-rated openings in compliance with NFPA Standard NO. 80 and local building code requirements. Provide only hardware which has been tested and listed by UL or FM for types and sizes of doors required and complies with requirements of door and door frame labels.

1.04 SUBMITTALS:

- A. Product Data: Submit manufacturer's technical product data for each item of hardware in accordance with Division-1 section "Submittals". Include whatever information may be necessary to show compliance with requirements.
- B. Hardware Schedule: Submit final hardware schedule in manner indicated below. Coordinate hardware with doors, frames and related work to ensure proper size, thickness, hand, function and finish of hardware.
 - 1. Final Hardware Schedule Content: Based on finish hardware indicated, organize hardware schedule into "hardware sets" indicating complete designations of every item required for each door or opening. Provide all components required to make a functional, code-complaint assembly, wheather indicated or not. Include the following information:
 - a. Type, style, function, size and finish of each hardware item.
 - b. Name and manufacturer of each item.
 - c. Fastenings and other pertinent information.
 - d. Location of hardware set cross-referenced to indications on Drawings both on floor plans and in door and frame schedule.
 - e. Explanation of all abbreviations, symbols, codes, etc. contained in schedule.
 - f. Mounting locations for hardware.
 - g. Door and frame sizes and materials.
 - h. Keying information.
 - 2. Submittal Sequence: Submit schedule at earliest possible date particularly where acceptance of hardware schedule must precede fabrication of other work (e.g., hollow metal frames) which is critical in the project construction schedule.
 - 3. Templates: Furnish hardware templates to each fabricator of doors, frames and other work to be factory-prepared for the installation of hardware. Upon request, check shop drawings of such other work, to confirm that adequate provisions are made for proper location and

installation of hardware.

1.05 PRODUCT HANDLING:

- A. Tag each item or package separately, with identification related to final hardware schedule, and included basic installation instructions with each item or package.
- B. Packaging of hardware, is responsibility of supplier. As material is received by hardware supplier from various manufacturers, sort and repackage in containers clearly marked with appropriate hardware set number to match set numbers of approved hardware schedule. Two or more identical sets may be packed in same container.
- C. Deliver individually packaged hardware items at the proper times to the proper locations (shop or project site) for installation.
- D. Inventory Hardware jointly with representatives of hardware supplier and hardware installer until each is satisfied that count is correct.
- E. Provide secure lock-up for hardware delivered to the project, but not yet installed. Control handling and installation of hardware items which are not immediately replaceable, so that completion of the work will not be delayed by hardware losses, both before and after installation.

PART 2 - PRODUCTS

2.01 SCHEDULED HARDWARE:

- A. Requirements for design, grade, function, finish, size and other distinctive qualities of each type of finish hardware is indicated in the Finish Hardware Data Sheet and Hardware Schedule on the drawings. Products are identified by using hardware designation numbers of the following.
 - 1. Manufacturer's Product Designations: One or more manufacturers are listed for each hardware type required. An asterisk (*) after a manufacturer's name indicates whose product designation is used in the Hardware Schedule for purposes of establishing minimum requirements. Provide either the product designated, or, where more than one manufacturer is listed, the comparable product of one of the other manufacturers which comply with requirements including those specified elsewhere in this section.

2.02 MATERIALS AND FABRICATION:

A. General:

1. Hand of door: Drawings show direction of slide, swing or hand of each door leaf. Furnish each item of hardware for proper installation and operation of door movement as shown.
2. Manufacturer's Name Plate: Do not use manufacturer's products which have manufacturer's name or trade name displayed in a visible location (omit removable nameplates), except in conjunction with required UL labels and as otherwise acceptable to Architect.
 - a. Manufacturer's identification will be permitted on rim of lock cylinders only.
3. Base Metals: Produce hardware units of basic metal and forming method indicated, using manufacturer's standard metal alloy, composition, temper and hardness, but in no case of lesser (commercially recognized) quality than specified for the applicable hardware units by applicable ANSI A156 series standard for each type hardware item and with ANSI A156.18 for finish designations indicated. Do not furnish "optional" materials or forming methods for those indicated, except as otherwise specified.
4. Fasteners: Provide hardware manufactured to conform to published templates, generally prepared for machine screw installation. Do not provide hardware which has been prepared for self-tapping sheet metal screws, except as specifically indicated.
5. Furnish screws for installation, with each hardware item. Provide Phillips flat-head screws except as otherwise indicated. Finish exposed (exposed under any condition) screws to match hardware finish or, if exposed in surfaces of other work, to match finish of such other work as closely as possible, including "prepared for paint" in surfaces to receive painted finish.
6. Provide concealed fasteners for hardware units which are exposed when door is closed, except to the extent no standard units of the type specified are available with concealed fasteners. Do not use thru-bolts for installation where bolt head or nut on opposite face is exposed in other work, except where it is not feasible to adequately reinforce the work. In such cases, provide sleeves for each thru-bolt or use sex screw fasteners.

- B. Tools and Maintenance Instructions for Maintenance: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of finish hardware.

2.03 HINGES, BUTTS AND PIVOTS:

- A. Templates: Except for hinges and pivots to be installed entirely (both leaves)

into wood doors and frames, provide only template- produced units.

- B. Screws: Furnish Phillips flat-head or machine screws for installation of units, except furnish Phillips flat-head or wood screws for installation of units into wood. Finish screw heads to match surface of hinges or pivots.
- C. Hinge Pins: Except as otherwise indicated, provide hinge pins as follows:
 - 1. Steel Hinges: Steel pins.
 - 2. Non-ferrous Hinges: Stainless steel pins.
 - 3. Exterior Doors: Non-removable pins.
 - 4. Interior Doors: Non-rising pins.
 - 5. Tips: Flat button and matching plug, finished to match leaves, except where hospital tip (HT) indicated.
 - 6. Number of hinges: Provide number of hinges indicated but not less than 3 hinges for door leaf for doors 90" or less in height and one additional hinge for each 30" of additional height.

2.04 LOCK CYLINDERS AND KEYING:

- A. General: Supplier will meet with Owner to finalize keying requirements and obtain final instructions in writing.
- B. Standard System: Except as otherwise indicated, provide 2 keying groups:
 - 1. Master key only as directed by Owner/Franchisee
 - 2. All other locks: One change key and keyed to master (includes padlocks).
- C. Equip locks with manufacturer's standard permanent 6-pin tumbler cylinders during construction. Re-Key all cylinders before turnover according to final keying schedule. Composite keyways are not acceptable.
- D. Metals: Construct lock cylinder parts from brass/bronze, stainless steel or nickel silver.
- E. Key Material: Provide keys of nickel silver only.
- F. Key Quantity: Furnish 3 original keys for each group.
 - 1. Deliver keys to Owner's representative.

2.05 LOCKS, LATCHES AND BOLTS:

- A. Strikes: Provide manufacturer's standard wrought box strike for each latch or lock bolt, with curved lip extended to protect frame, finished to match hardware set.
 - 1. Provide standard (open) strike plates for interior doors of residential units where wood door frames are used.

- B. Lock Throw: Provide 5/8" minimum throw of latch and deadbolt used on pairs of doors.
 - 1. Provide 1/2" minimum throw on other latch and deadlock bolts.
- C. Flush Bolt Heads: Minimum of 1/2" diameter rods of brass, bronze or stainless steel, with minimum 12" long rod for doors up to 7'-0" in height. Provide longer rods as necessary for doors exceeding 7'-0" in height.
- D. Exit Device Dogging: Wherever closers are provided on doors equipped with exit devices, equip the units with keyed dogging device to hold the push bar down and the latch bolt in the open position.

2.06 PUSH/PULL UNITS:

- A. Exposed Fasteners: Provide manufacturer's standard exposed fasteners for installation; through-bolted for matched pairs, but not for single units.

2.07 CLOSERS

- A. Size of Units: Except as otherwise specifically indicated, comply with the manufacturer's recommendations for size of door control unit, depending upon size of door, exposure to weather and anticipated frequency of use.
 - 1. Provide parallel arms for all overhead closers, except as otherwise indicated.
- B. Access-Free Manual Closers: Where manual closers are indicated for doors required to be accessible to the physically handicapped, provide adjustable units complying with ADA and/or ANSI A 117.1 provisions for door opening force and delayed action closing.
- C. Provide black resilient parts for exposed bumpers.

2.08 DOOR TRIM UNITS:

- A. Fasteners: Provide manufacturer's standard exposed fasteners for door trim units (kick plates, edge trim, viewers, mail drops and similar units); either machine screws or self-tapping screw.
- B. Fabricate edge trim of stainless steel, not more than 1/2" nor less than 1/16" smaller in length than door dimension.
- C. Fabricate protection plates (armor, kick or mop) not more than 1- 1/2" less than door width on stop side and not more than 1/2" less than door width on pull side, x the height indicated.
 - 1. Metal Plates: Stainless steel, .050" (U.S. 18 ga.)

2.09 WEATHERSTRIPPING:

- A. General: Except as otherwise indicated, provide continuous weatherstripping at each edge of every exterior door leaf. Provide type, sizes and profiles shown or scheduled. Provide non-corrosive fasteners as recommended by manufacturer for application indicated.
- B. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strip is easily replaceable and readily available from stocks maintained by manufacturer.
- C. Weatherstripping at Jambs and Heads:
 - 1. Provide bumper-type resilient insert and metal retainer strips, surface-applied unless shown as mortised or semi-mortised, of following metal, finish and resilient bumper material:
 - a. Flexible, hollow neoprene bulb or loop insert, conforming to MIL R 6055, Class II, Grade 40.
- D. Weatherstripping at Door Bottoms:
 - 1. Provide threshold consisting of contact type resilient insert and metal housing of design and size shown; of following metal, finish, and resilient seal strip:
 - a. Solid neoprene wiper or sweep seal complying with MIL R 6055, Class II, Grade 40.

2.10 THRESHOLDS:

- A. General: Except as otherwise indicated provide standard metal threshold unit of type, size and profile as shown or scheduled.
- B. Exterior Hinged/Pivoted Doors: Provide units not less than 4" wide, formed to accommodate change in floor elevation where indicated, fabricated to accommodate door hardware and to fit door frames, and as follows:
 - 1. For out-swinging doors provide handicap approved flat units to accommodate grade change. Hager #404S or equal.

2.11 DOOR SIGNS

- A. Provide manufacturer's standard phenolic plastic signs, with international handicapped symbol and braille designation at door #11, for directional purposes, dark grey with white letters.

2.12 HARDWARE FINISHES:

- A. Provide matching finishes for hardware units at each door or opening, to the greatest extent possible, and except as otherwise indicated. Reduce

differences in color and textures as much as commercially possible where the base metal or metal forming process is different for individual units of hardware exposed at the same door or opening. In general, match items to the manufacturer's standard finish for the latch and lock set (or push-pull units if no latch-lock sets) for color and texture.

- B. Provide finishes which match those established by BHMA or, if none established, match the Architect's sample.
- C. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness and other qualities complying with manufacturer's standards, but in no case less than specified for the applicable units of hardware by referenced standards.
- D. Provide protective lacquer coating on all exposed hardware finishes of brass, bronze and aluminum, except as otherwise indicated.
- E. The designations used in schedules and elsewhere to indicate hardware finished are those listed in ANSI A156.18 "Materials & Finishes Standard", including coordination with the traditional U.S. finishes shown by certain manufacturers for their products.

PART 3 - EXECUTION

3.01 INSTALLATION:

- A. Mount hardware units at heights indicated in "Recommended Locations for Builders Hardware" for Standard Steel Doors and Frames" by the Door and Hardware Institute, except as specifically indicated or required to comply with governing regulations, and except as may be otherwise directed by Architect.
- B. Install each hardware item in compliance with the manufacturer's instructions and recommendations. Wherever cutting and fitting is required to install hardware onto or into surfaces which are later to be painted or finished in another way, coordinate removal, storage and reinstallation or application of surface protections with finishing work specified in the Division-9 sections. Do not install surface-mounted items until finishes have been completed on the substrate.
- C. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.
- D. Drill and countersink units which are not factory-prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.
- E. Set thresholds for exterior doors in full bed of butyl-rubber or polyisobutylene

mastic sealant.

3.02 ADJUST AND CLEAN:

- A. Adjust and check each operating item of hardware and each door, to ensure proper operation or function of every unit. Replace which cannot be adjusted to operate freely and smoothly as intended for the application made.
- B. Clean adjacent surfaces soiled by hardware installation.
- C. Final Adjustment: Wherever hardware installation is made more than one month prior to acceptance or occupancy of a space or area, return to the work during the week prior to acceptance or occupancy, and make final check and adjustment of all hardware items in such space or area. Clean operating items as necessary to restore proper function and finish of hardware and doors. Adjust door control devices to compensate for final operation of heating and ventilating equipment.
- D. Instruct Owner's Personnel in proper adjustment and maintenance of hardware and hardware finishes, during the final adjustment of hardware.

END OF SECTION

SECTION 08800

GLASS AND GLAZING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.02 SUMMARY:

- A. Extent of glass and glazing work is indicated on drawings and schedules.
- B. Types of work in this section include glass and glazing for:
 - 1. Window units.
 - 2. Storefront construction.
 - 3. Entrances and other doors, not indicated as "preglazed".

1.03 SYSTEM DESCRIPTION:

- A. Provide glass and glazing that has been produced, fabricated and installed to withstand normal thermal movement, wind loading and impact loading (where applicable), without failure including loss or breakage of glass, failure of sealants or gaskets to remain watertight and airtight, deterioration of glass and glazing materials and other defects in the work.
- B. Normal thermal movement is defined as that resulting from an ambient temperature range of 120 deg. F (67 deg. C) and from a consequent temperature range within glass and glass framing members of 180 deg. F (100 deg. C).
- C. Deterioration of insulating glass is defined as failure of hermetic seal due to other causes than breakage which results in intrusion of dirt or moisture, internal condensation or fogging, deterioration of protected internal glass coating, if any, resulting from seal failure, and any other visual evidence of seal failure or performance.

1.04 SUBMITTALS:

- A. Product Data: Submit manufacturer's technical data for each glazing material and fabricated glass product required, including installation and maintenance instructions.

1.05 QUALITY ASSURANCE:

- A. Glazing Standards: Comply with recommendations of Flat Glass Marketing Association (FGMA) "Glazing Manual" and "Sealant Manual" except where more stringent requirements are indicated. Refer to those publications for definitions of glass and glazing terms not otherwise defined in this section or other referenced standards.
- B. Safety Glazing Standard: Where safety glass is indicated or required by authorities having jurisdiction, provide type of products indicated which comply with ANSI Z97.1 and testing requirements of 16 CFR Part 1201 for category II materials.
- C. Insulating Glass Certification Program: Provide insulating glass units permanently marked either on spacers or at least one component pane of units with appropriate certification label of inspecting and testing organization indicated below:
 - 1. Insulating Glass Certification Council (IGCC).
- D. Single Source Responsibility for Glass: To ensure consistent quality of appearance and performance, provide materials produced by a single manufacturer or fabricator for each kind and condition of glass indicated and composed of primary glass obtained from a single source for each type and class required.

1.06 DELIVERY, STORAGE, AND HANDLING:

- A. Protect glass and glazing materials during delivery, storage and handling to comply with manufacturer's directions and as required to prevent edge damage to glass, and damage to glass and glazing materials from effects of moisture including condensation, of temperature changes, of direct exposure to sun, and from other causes.
- B. Where insulating glass units will be exposed to substantial altitude changes, avoid hermetic seal ruptures by complying with insulating glass fabricator's recommendations for venting and sealing.

1.07 PROJECT CONDITIONS:

- A. Environmental Conditions: Do not proceed with glazing when ambient and substrate temperature conditions are outside the limits permitted by glazing material manufacturer or when joint substrates are wet due to rain, frost, condensation or other causes.

1.08 WARRANTY:

- A. General: Warranties shall be in addition to, and not a limitation of, other rights the Owner may have under the Contract Documents.
- B. Manufacturer's Special Project Warranty on Insulating Glass: Provide written warranty signed by manufacturer of insulating glass agreeing to furnish f.o.b. point of manufacture, freight allowed project site, within specified warranty period indicated below, replacements for those insulating glass units developing manufacturing defects. Manufacturing defects are defined as failure or hermetic seal of air space (beyond that due to glass breakage) as evidenced by intrusion of dirt or moisture, internal condensation or fogging, deterioration of protected internal glass coatings, if any, and other visual indications of seal failure or performance; provided the manufacturer's instructions for handling, installing, protecting and maintaining units have been complied with during the warranty period.
 - 1. Warranty Period: Manufacturer's standard but not less than 10 years after date of substantial completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

- A. Manufacturers: Subject to compliance with requirements, provide products of one of the following or approved equivalent product:
 - 1. Manufacturers of Clear and Tinted Float Glass and Heat Treated Glass:
 - Ford Glass Division.
 - Guardian Industries Corp.
 - PPG Industries, Inc.
 - 2. Manufacturers of Insulating Glass:
 - Insulite Glass Company or equal

2.02 GLASS PRODUCTS, GENERAL:

- A. Primary Glass Standard: Provide primary glass which complies with ASTM C 1036 requirements, including those indicated by reference to type, class, quality, and, if applicable, form, finish, mesh and pattern.

Exterior insulating glazing units shall be low-e glass as shown in 2.05 below.

- B. Heat-Treated Glass Standard: Provide heat-treated glass which complies with ASTM C 1048 requirements, including those indicated by reference to kind, condition, type, quality, class, and, if applicable, form, finish, and pattern.
- C. Wire Glass: ASTM C1036, Type II, class 1 clear, Q-8, complying with ANSI Z97.1, polished both sides, diagonal mesh of woven stainless steel wire of ½" grid size, 1/4" thick, ASTM E163, and listed by UL for fire resistance.
- D. Sizes: Fabricate glass to sizes required for glazing openings indicated, with edge clearances and tolerances complying with recommendations of glass manufacturer. Provide thicknesses indicated or, if not otherwise indicated, as recommended by glass manufacturer for application indicated.

2.03 PRIMARY GLASS PRODUCTS:

- A. Clear Float Glass: Type I (transparent glass, flat), Class 1 (clear), Quality q3 (glazing select).

2.04 HEAT-TREATED GLASS PRODUCTS:

- A. Manufacturing Process: Manufacture heat-treated glass as follows:
 - 1. By horizontal (roller hearth) process with roll wave distortion parallel with bottom edge of glass as installed, unless otherwise indicated.
- B. Uncoated Clear Heat-Treated Float Glass: Condition A (uncoated surfaces), Type I (transparent glass, flat), Class 1 (clear), Quality q3 (glazing select), kind as indicated below.
 - 1. Kind FT (fully tempered) where indicated or required by codes.

2.05 FIRE-RATED GLASS CERAMIC

- 1. Nippon Electric Glass Company, Ltd; Firelite Premium, 60 minimum rated, clear.

2.05 Low -E INSULATING GLASS: (All exterior glass)

1. Make-Up
1/4" AGC Energy Select 73 (2)
1/2" black
1/2" Clear

NFRC Center of Pane Performances

Transmittance

Visible Light: 74%
Solar Energy: 55%

Reflectance

Visible Light (Exterior) 16%
Visible Light (Interior) 16%
Solar Energy 13%

ASHRAE U-Value

Winter Nighttime .33
Summer Daytime .32

Shading Coefficient .73

Solar Factor .63

2.06 ELASTOMERIC GLAZING SEALANTS AND PREFORMED GLAZING TAPES:

- A. General: Provide products of type indicated and complying with the following requirements:
 1. Compatibility: Select glazing sealants and tapes of proven compatibility with other materials with which they will come into contact, including glass products, seals of insulating glass units, and glazing channel substrates, under conditions of installation and service, as demonstrated by testing and field experience.
 2. Suitability: Comply with recommendations of sealant and glass manufacturers for selection of glazing sealants and tapes which have performance characteristics suitable for applications indicated and conditions at time of installation.
 3. Elastomeric Sealant Standard: Provide manufacturer's standard chemically curing, elastomeric sealant of base polymer indicated which complies with ASTM C 920 requirements, including those for Type, Grade, Class and Uses.
 4. Colors: Provide color of exposed sealants indicated or, if not otherwise indicated, as selected by Architect from manufacturer's standard colors.

- B. Products: Subject to compliance with requirements, provide one of the following:
 - 1. One-Part Acid-Curing Silicone Glazing Sealant: Type S; Grade NS; Class 25; Uses NT, G, A, and, as applicable to uses indicated, O.
"Chem-Calk 1200"; Bostik Construction Products Div.
"Dow Corning 999"; Dow Corning Corp.
"SCS 1200"; General Electric Corp.

2.07 GLAZING GASKETS:

- A. Lock-Strip Gaskets: Neoprene extrusions of size and shape indicated, fabricated into frames with molded corner units and zipper lock strips, complying with ASTM C 542; black.
 - 1. Neoprene.
 - 2. EPDM.
- B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:

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2.08 MISCELLANEOUS GLAZING MATERIALS:

- A. Compatibility: Provide materials with proven record of compatibility with surfaces contacted in installation.
- B. Cleaners, Primers and Sealers: Type recommended by sealant or gasket manufacturer.
- C. Setting Blocks: Neoprene, EPDM or silicone blocks as required for compatibility with glazing sealants, 80 to 90 Shore A durometer hardness.
- D. Spacers: Neoprene, EPDM or silicone blocks, or continuous extrusions, as required for compatibility with glazing sealant, of size, shape and hardness recommended by glass and sealant manufacturers for application indicated.
- E. Edge Blocks: Neoprene, EPDM or silicone blocks as required for compatibility with glazing sealant, of size and hardness required to limit lateral movement (side-walking) of glass.
- F. Compressible Filler Rods: Closed-cell or waterproof-jacketed rod stock of synthetic rubber or plastic foam, flexible and resilient, with 5-10 psi compression strength for 25 percent deflection.

PART 3 - EXECUTION

3.01 EXAMINATION:

- A. Require Glazier to inspect work of glass framing erector for compliance with manufacturing and installation tolerances, including those for size, squareness, offsets at corners; for presence and functioning of weep system; for existence of minimum required face or edge clearances; and for effective sealing of joinery. Do not allow glazing work to proceed until unsatisfactory conditions have been corrected. Commencement of glazing work signifies acceptance of substrate and responsibility for replacement of non-conforming work.

3.02 PREPARATION:

- A. Clean glazing channels and other framing members to receive glass, immediately before glazing. Remove coatings which are not firmly bonded to substrates. Remove lacquer from metal surfaces where elastomeric sealants are indicated for use.

3.03 GLAZING, GENERAL:

- A. Comply with combined printed recommendations of glass manufacturers, of manufacturers of sealants, gaskets and other glazing materials, except where more stringent requirements are indicated, including those of referenced glazing standards.
- B. Glazing channel dimensions as indicated in details are intended to provide for necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by job conditions at time of installation.
- C. Protect glass from edge damage during handling and installation; use a rolling block in rotating glass units to prevent damage to glass corners. Do not impact glass with metal framing. Use suction cups to shift glass units within openings; do not raise or drift glass with a pry bar. Rotate glass with flares or bevels along one horizontal edge which would occur in vicinity of setting blocks so that these are located at top of opening. Remove from project and dispose of glass units with edge damage or other imperfections of kind that, when installed, weakens glass and impairs performance and appearance.
- D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.

5. Provide components required to provide fire ratings indicated.

3.04 GLAZING:

- A. Install setting blocks of proper size in sill rabbet, located one quarter of glass width from each corner, but with edge nearest corner not closer than 6" from corner, unless otherwise required. Set blocks in thin course of sealant which is acceptable for heel bead use.
- B. Provide spacers inside and out, of correct size and spacing to preserve required face clearances, for glass sizes larger than 50 united inches (length plus height), except where gaskets or glazing tapes with continuous spacer rods are used for glazing. Provide 1/8" minimum bite of spacers on glass and use thickness equal to sealant width, except with sealant tape use thickness slightly less than final compressed thickness of tape.
- C. Provide edge blocking to comply with requirements of referenced glazing standard, except where otherwise required by glass unit manufacturer.
- D. Set units of glass in each series with uniformity of pattern, draw, bow and similar characteristics.
- E. Provide compressible filler rods or equivalent back-up material, as recommended by sealant and glass manufacturers, to prevent sealant from extruding into glass channel weep systems and from adhering to joints back surface as well as to control depth of sealant for optimum performance, unless otherwise indicated.
- F. Force sealants into glazing channels to eliminate voids and to ensure complete "wetting" or bond of sealant to glass and channel surfaces.
- G. Tool exposed surfaces of sealants to provide a substantial "wash" away from glass. Install pressurized tapes and gaskets to protrude slightly out of channel, so as to eliminate dirt and moisture pockets.
- H. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage to ensure that gasket will not "walk" out when installation is subjected to movement.
- I. Miter cut wedge-shaped gaskets at corners and install gaskets in manner recommended by gasket manufacturer to prevent pull away at corners; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

- J. Lock-Strip Gasket Glazing: Comply with ASTM C 716 and gasket manufacturer's printed recommendations. Provide supplementary wet seal and weep system unless otherwise indicated.

3.05 PROTECTION AND CLEANING:

- A. Protect exterior glass from breakage immediately upon installation by use of crossed streamers attached to framing and held away from glass. Do not apply markers to surfaces of glass. Remove nonpermanent labels and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations. If, despite such protection, contaminating substances do come into contact with glass, remove immediately by method 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 often than once a month, for build-up of dirt, scum, alkali deposits or staining. When examination reveals presence of these forms of residue, remove by method recommended by glass manufacturer.
- D. Remove and replace glass which is broken, chipped, cracked, abraded or damaged in other ways during construction period, including natural causes, accidents and vandalism
- E. Wash glass on both faces not more than 4 days prior to date scheduled for inspections intended to establish date of substantial completion in each area of project. Wash glass by method recommended by glass manufacturer.

END OF SECTION

DIVISION 9

FINISHES

SECTION 09250

GYPSUM DRYWALL

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.02 DESCRIPTION OF WORK:

- A. Types of work include:
 - 1. Gypsum drywall including screw-type metal support system.
 - 2. Gypsum drywall applied to metal framing.
 - 3. Gypsum backing boards for application of other finishes.
 - 4. Drywall finishing (joint tape-and-compound treatment).

1.03 QUALITY ASSURANCE:

- A. Gypsum Board Terminology Standard: GA-505 by Gypsum Association.
- B. Single-Source Responsibility: Obtain gypsum board products from a single manufacturer, or from manufacturers recommended by the prime manufacturer of gypsum boards.

1.04 DELIVERY, STORAGE AND HANDLING:

- A. Deliver materials in original packages, containers or bundles bearing brand name and identification of manufacturer or supplier.
- B. Store materials inside under cover and in manner to keep them dry, protected from weather, direct sunlight, surface contamination, corrosion and damage from construction traffic and other causes. Neatly stack gypsum boards flat to prevent sagging.
- C. Handle gypsum boards to prevent damage to edges, ends or surfaces. Protect metal corner beads and trim from being bent or damaged.

1.05 PROJECT CONDITIONS:

- A. Environmental Requirements, General: Comply with requirements of referenced gypsum board application standards and recommendations of gypsum board manufacturer, for environmental conditions before, during and after application of gypsum board.
- B. Cold Weather Protection: When ambient outdoor temperatures are below 55 deg F (13 deg C) maintain continuous, uniform, comfortable building working temperatures of not less than 55 deg F (13 deg C) for a minimum period of 48 hours prior to, during and following application of gypsum board and joint treatment materials or bonding of adhesives.
- C. Ventilation: Ventilate building spaces as required to remove water in excess of that required for drying of joint treatment material immediately after its application. Avoid drafts during dry, hot weather to prevent too rapid drying.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:
 - 1. Metal Support Materials:
Gold Bond Building Products Div., National Gypsum Co.
Milcor Division; Inryco Inc.
 - 2. Gypsum Board and Related Products:
Gold Bond Building Products Div., National Gypsum Co.
United States Gypsum Co.

2.02 METAL SUPPORT MATERIALS:

- A. Ceiling Support Materials and System:
 - 1. Direct Suspension System: Manufacturer's standard zinc-coated or painted steel system of furring runners, furring tees, and accessories designed for concealed support of gypsum drywall ceilings; of proper type for use intended.
- B. Wall/Partition Support Materials:
 - 1. Studs: ASTM C 645; 25-gage unless otherwise indicated.
 - 2. Depth of Section: 3-5/8", except as otherwise indicated.
 - 3. Runners: Match studs; type recommended by stud manufacturer for floor and ceiling support of studs, and for vertical abutment of drywall work at other work.

2.03 GYPSUM BOARD:

- A. Gypsum Wallboard: ASTM C 36, of types, edge configuration and thickness indicated below; in maximum lengths available to minimize end-to-end butt joints.
 - 1. Type: Type X.
 - 2. Edges: Tapered.
 - 3. Thickness: 5/8", unless otherwise indicated.
- B. Water-Resistant Backing Board: ASTM C 630, with tapered edges and of type and thickness indicated below; in maximum lengths available to minimize end-to-end butt joints.
 - 1. Type: Type X.
 - 2. Thickness: 5/8", unless otherwise indicated.

2.04 TRIM ACCESSORIES:

- A. General: Provide manufacturer's standard trim accessories of types indicated for drywall work, formed of galvanized steel unless otherwise indicated, with either knurled and perforated or expanded flanges for nailing or stapling, and beaded for concealment of flanges in joint compound. Provide corner beads, L-type edge trim-beads, U-type edge trim-beads, special L-kerf- type edge trim-beads, and one-piece control joint beads.

2.05 JOINT TREATMENT MATERIALS:

- A. General: ASTM C 475; type recommended by the manufacturer for the application indicated, except as otherwise indicated.
- B. Joint Tape: Perforated type.
- C. Joint Compound: On interior work provide chemical-hardening-type for bedding and filling, ready-mixed vinyl-type or vinyl-type powder type for topping.

2.06 MISCELLANEOUS MATERIALS:

- A. General: Provide auxiliary materials for gypsum drywall work of the type and grade recommended by the manufacturer of the gypsum board.
- B. Gypsum Board Screws: Comply with ASTM C 646.
- C. Gypsum Board Nails: Comply with ASTM C 514.

PART 3 - EXECUTION

3.01 INSTALLATION OF METAL SUPPORT SYSTEMS:

- A. General:
 - 1. Metal Support Installation Standard: Comply with ASTM C 754.
- B. Ceiling Support Suspension Systems:
 - 1. Direct-hung Metal Support System: Attach perimeter wall track or angle wherever support system meets vertical surfaces. Mechanically join support members to each other and butt-cut to fit into wall track.
- C. Wall/Partition Support Systems:
 - 1. Install supplementary framing, blocking and bracing at terminations in the work and for support of fixtures, equipment, services, heavy trim, grab bars, toilet accessories, furnishings and similar work to comply with details indicated or if not otherwise indicated, to comply with applicable published recommendations of gypsum board manufacturer, or if not available, of "Gypsum Construction Handbook" published by United States Gypsum Co.
 - 2. Isolate stud system from transfer of structural loading to system, both horizontally and vertically. Provide slip or cushioned type joints to attain lateral support and avoid axial loading. Provide slip joint at denusing partition head as detailed.
 - 3. Install runner tracks at floors, ceilings and structural walls and columns where gypsum drywall stud system abuts other work, except as otherwise indicated.
 - 4. Extend partition stud system through acoustical ceilings and elsewhere as indicated to the structural support and substrate above the ceiling.
 - 5. Space studs 16" o.c., unless otherwise indicated.
 - 6. Frame door openings to comply with details indicated or if not otherwise indicated, to comply with applicable published recommendations of gypsum board manufacturer, or if not available, of "Gypsum Construction Handbook" published by United States Gypsum Co. Attach vertical studs at jambs with screws either directly to frames or to jamb anchor clips on door frames; install runner track section (for jack studs) at head and secure to jamb studs.
 - a. Extend vertical jamb studs through suspended ceilings and attach to underside of floor or roof structure above, unless otherwise indicated.
 - 7. Frame openings other than door openings to comply with details indicated or if not indicated, in same manner as required for door openings; and install framing below sills of openings to match framing required above door heads.

3.03 GENERAL GYPSUM BOARD INSTALLATION REQUIREMENTS:

- A. Gypsum Board Application and Finishing Standards: ASTM C 840 and GA 216.
- B. Locate exposed end-butt joints as far from center of walls and ceilings as possible, and stagger not less than 1'-0" in alternate courses of board.
- C. Install ceiling boards in the direction and manner which will minimize the number of end-butt joints, and which will avoid end joints in the central area of each ceiling. Stagger end joints at least 1'-0".
- D. Install exposed gypsum board with face side out. Do not install imperfect, damaged or damp boards. Butt boards together for a light contact at edges and ends with not more than 1/16" open space between boards. Do not force into place.
- E. Locate either edge or end joints over supports, except in horizontal applications or where intermediate supports or gypsum board back-blocking is provided behind end joints. Position boards so that like edges abut, tapered edges against tapered edges and mill-cut or field-cut ends against mill-cut or field cut ends. Do not place tapered edges against cut edges or ends. Stagger vertical joints over different studs on opposite sides of partitions.
- F. Attach gypsum board to supplementary framing and blocking provided for additional support at openings and cutouts.
- G. Form control joints and expansion joints with space between edges of boards, prepared to receive trim accessories.
- H. Cover both faces of steel stud partition framing with gypsum board in concealed spaces (above ceilings, etc.), except in chase walls which are braced internally.
- I. Isolate perimeter of non-load-bearing drywall partitions at structural abutments. Provide 1/4" to 1/2" space and trim edge with "L"-type semi-finishing edge trim. Seal joints with acoustical sealant.

3.04 METHODS OF GYPSUM DRYWALL APPLICATION:

- A. Single-Layer Application: Install gypsum wallboard.
 - 1. On ceilings apply gypsum board prior to wall/partition board application to the greatest extent possible.
 - 2. On partitions/walls 8'-1" or less in height apply gypsum board horizontally (perpendicular); use maximum length sheets possible to minimize end joints.
- B. Single-Layer Fastening Methods: Apply gypsum boards to supports as follows:
 - 1. Fasten with screws.

3.05 INSTALLATION OF DRYWALL TRIM ACCESSORIES:

- A. General: Where feasible, use the same fasteners to anchor trim accessory flanges as required to fasten gypsum board to the supports. Otherwise, fasten flanges by nailing or stapling in accordance with manufacturer's instructions and recommendations.
- B. Install metal corner beads at external corners of drywall work.
- C. Install metal edge trim whenever edge of gypsum board would otherwise be exposed or semi-exposed. Provide type with face flange to receive joint compound except where semi-finishing type is indicated. Install L-type trim where work is tightly abutted to other work, and install special kerf-type where other work is kerfed to receive long leg of L-type trim. Install U-type trim where edge is exposed, revealed, gasketed, or sealant-filled (including expansion joints).

3.06 FINISHING OF DRYWALL:

- A. General: Apply treatment at gypsum board joints (both directions), flanges of trim accessories, penetrations, fastener heads, surface defects and elsewhere as required to prepare work for decoration. Prefill open joints and rounded or beveled manufacturer.
 - 1. Apply joint tape at joints between gypsum boards, except where trim accessories are indicated.
 - 2. Apply joint compound in 3 coats (not including prefill of openings in base), and sand between last 2 coats and after last coat.
- B. Water-Resistant Gypsum Backing Board Base for Ceramic Tile: Comply with recommendations of gypsum backing board manufacturer for treatment of joints behind ceramic tile.
- C. Partial Finishing: Omit third coat (if specified) and sanding on concealed drywall work which is indicated for drywall finishing.

- D. Refer to sections on painting, coatings and wall-coverings in Division-9 for decorative finishes to be applied to drywall work.

3.07 PROTECTION OF WORK:

- A. Provide final protection and maintain conditions, in a manner suitable to Installer, which ensures gypsum drywall work being without damage or deterioration at time of substantial completion.

END OF SECTION

SECTION 09330

CERAMIC TILE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

PART 2 - MATERIALS

2.01 TILE AND ACCESSORIES

- A. Tile shall comply with Tile Council of America Specification 137.1. Colors, textures, and patterns will be as selected by the Architect from manufacturer's samples. Delivered tile shall match samples approved by the Architect.
- B. Floor tile shall be as shown on the drawings
 - a. Floor tile shall have coefficient of friction not less than 0.50 as per ASTM F489, ASTM F609. Floor tile as per National Bureau of Standards Technical Note 895.
 - b. Tile shall conform to ANSI A137.1
 - c. Provide all accessory shapes to complete the work as shown in Drawings and specified herein.

2.02 SETTING MATERIALS

- A. Comply with Tile Council of America "Handbook for Ceramic Tile Installation."
- B. Latex-portland cement mortar as per ANSI A118.4.
- C. Organic adhesive as per ANSI A136.1. Type I where subject to extended water exposure. Type II at all other locations.

2.03 GROUT

- A. Comply with Tile Council of America "Handbook for Ceramic Tile Installation."
- B. Grout color shall be as selected by the Architect.
- C. Portland cement grout: Use mixture of Portland cement and other materials manufactured for this purpose. Grout must comply with tile manufacturer's

instructions.

2.04 OTHER MATERIALS

- A. Provide all related materials required for a complete, proper installation.
- B. Adhesive, sealant, and grout as per applicable trade standards and tile manufacturer's instructions, delivered in new unopened containers, with correct color additives.
- C. Provide non-corrosive lath, zinc-coated, lapped, and tied with zinc-coated wires.
- D. Install waterproofing and backing that will absolutely block water leakage. All waterproofing and backing must be as per manufacturer's instructions.

PART 3 – CONSTRUCTION AND INSTALLATION

3.01 PREPARATION

- A. Keep work surfaces and working environment clean, dry, well-lighted, well-ventilated, free of airborne construction dust and at a comfortable working temperature, minimum 60°F.
- B. Provide supports for fixtures and related construction. Pre-mark and double-check locations for accessories to be installed. Set accessories in place before beginning tile work. Put in place and properly position, work of related trades.
- C. Install all support framing, furring, and backing, plumb, square, aligned, and well-secured so surfaces will not move or deflect.
- D. Prepare floors for tiling so the finish floor will be either perfectly level or slope properly to drains.
- E. Work preparation:
 - a. Install waterproofing and backing that will absolutely block water leakage
 - b. Install control joints and edge strips securely fastened.
 - c. Set layout start points to achieve tile patterning that is symmetrical and complete.

3.02 INSTALLATION

- A. Work standards and conditions:
 - a. Comply with Tile Council of America "Handbook for Ceramic Tile Installation."
 - b. Comply with ANSI A108.1, ANSI A108.2.
 - c. Comply with manufacturer's instructions.
 - d. Work temperature must be as per instructions of materials manufacturers.
 - e. Tile over floor membrane may not be installed until membrane is tested and accepted.
- B. Tile must be installed as a complete, uninterrupted covering. Extend tile into recesses and under and behind future equipment or fixtures. Terminate tile neatly at edges, obstructions, or penetrations of other work.

- C. Lay tile in standard grid unless shown otherwise on Drawings or directed by the Architect. Align joints of adjoining same size tiles on floor, base, walls, and trim. In tile layout, center tile fields both directions on each floor or wall area. Joint widths must be consistent and uniform.
- D. Provide expansion and control joints where shown on Drawings and as instructed by the "Handbook for Ceramic Tile Installation" of the Tile Council of America.
- E. Perfectly match tile pieces with other tile work. Apply tile surface smoothly and free of irregularities, humps, or dips. Install tile joints straight, level horizontally, aligned and exact vertically. Make tile cuts uniform and not smaller than half a tile.
- F. Complete grouted or thin-set adhesion so no tiles can be pulled loose.

3.03 PROTECTION, CLEANING AND REPAIR

- A. Completely protect finished tile, and allow no damage to the work.
- B. Use cleaning solutions and materials as per manufacturer's instructions. Wash tile surfaces with clean water before and after cleaning. Remove excess corrosive cleaning solutions from site; do not empty into building drains.
- C. Repair and replace defective work. Reject tiles and replace if chipped, scratched, loose, or misaligned. Repair or replace all defective and non-conforming work as directed by the Architect. Make repairs undetectable.

END OF SECTION

SECTION 09410

CONCRETE SEALER

Refer to Section 03350 for concrete sealer product specification.

END OF SECTION

SECTION 09510
ACOUSTICAL CEILINGS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.02 SUMMARY:

- A. Extent of acoustical ceiling is shown on drawings.
- B. Types of acoustical ceilings specified in this section include the following:
 - 1. Acoustical tile ceilings, concealed suspension.

1.03 QUALITY ASSURANCE:

- A. Coordination of Work: Coordinate layout and installation of acoustical ceiling units and suspension system components with other work supported by, or penetrating through, ceilings, including light fixtures, HVAC equipment.

1.04 DELIVERY, STORAGE AND HANDLING:

- A. Deliver acoustical ceiling units to project site in original, unopened packages and store them in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination or other causes.
- B. Before installing acoustical ceiling units, permit them to reach room temperature and a stabilized moisture content.
- C. Handle acoustical ceiling units carefully to avoid chipping edges or damaging units in any way.

1.05 PROJECT CONDITIONS:

- A. Space Enclosure: Do not install interior acoustical ceilings until space is enclosed and weatherproof, wet-work in space is completed and nominally dry, work above ceilings is complete, and ambient conditions of temperature and humidity will be continuously maintained at values near those indicated for final occupancy.

1.06 EXTRA MATERIALS:

- A. Deliver extra materials to Owner. Furnish extra materials described below matching products installed, packaged with protective covering for storage and identified with appropriate labels.
- B. Acoustical Ceiling Units: Furnish quantity of full size units equal to 2.0% of amount installed.
- C. Exposed Suspension System Components: Furnish quantity of each exposed component equal to 2.0% of amount installed.

PART 2 - PRODUCTS

2.01 ACOUSTICAL TILES:

- A. Mineral composition tile, non-directional fissured, 5/8", square edge white, Armstrong USG "Omni," "Cortega," or Celotex "Baroque." (Second Look)
- B. Refer to drawings for tile sizes.

2.02 METAL SUSPENSION SYSTEMS, GENERAL:

- A. Standard for Metal Suspension Systems: Provide metal suspension systems of type, structural classification and finish indicated which comply with applicable ASTM C 635 requirements.
- B. Finishes and Colors: Provide manufacturer's standard factory- applied finish for type of system indicated.
- C. Attachment Devices: Size for 5 times design load indicated in ASTM C 635, Table 1, Direct Hung.
 - 1. Concrete Inserts: Inserts formed from hot-dipped galvanized sheet steel and designed for attachment to concrete forms and for embedment in concrete, with holes or loops for attachment at hanger wires.

- D. Hanger Wire: Galvanized carbon steel wire, ASTM A 641, soft temper, prestretched, Class 1 coating, sized so that stress at 3-times hanger design load (ASTM C 635, Table 1, Direct Hung), will be less than yield stress of wire, but provide not less than 12 gage.
- E. Edge Moldings and Trim: Metal or extruded plastic of types and profiles indicated or, if not indicated, provide manufacturer's standard molding for edges and penetrations of ceiling which fits with type of edge detail and suspension system indicated.
 - 1. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.

2.04 EXPOSED METAL DIRECT-HUNG SUSPENSION SYSTEMS:

- A. Non Rated Exposed Grid System: ASTM C635, intermediate duty, 15/16" non-fire rated, flat white; Chicago Metallic Corp No. 200 System, No. 211 mains, No. 214 cross tees, and No. 1420 edge molding, or approved equal by Donn, or Armstrong.

2.05 MISCELLANEOUS MATERIALS:

- A. Tile Fasteners: Cadmium plated, type recommended by tile manufacturer, but for not less than 1/2" penetration of substrate.

PART 3 - EXECUTION

3.01 PREPARATION:

- A. Coordination: Furnish layouts for inserts, clips, or other supports required to be installed by other trades for support of acoustical ceilings.
 - 1. Furnish concrete inserts and similar devices to other trades for installation well in advance of time needed for coordination of other work.
- B. Measure each ceiling area and establish layout of acoustical units to balance border widths at opposite edges of each ceiling. Avoid use of less-than-half width units at borders, and comply with reflected ceiling plans wherever possible.

3.02 INSTALLATION:

- A. General: Install materials in accordance with manufacturer's printed instructions, and to comply with governing regulations, fire-resistance rating

- requirements as indicated, and Cisca standards applicable to work.
- B. Install tile with pattern running in one direction.
 - C. Install suspension systems to comply with ASTM C 636, with hangers supported only from building structural members. Locate hangers not less than 6" from each end and spaced 4'-0" along each carrying channel or direct-hung runner, unless otherwise indicated, leveling to tolerance of 1/8" in 12'-0".
 - D. Secure wire hangers by looping and wire-tying, either directly to structures or to inserts, eye-screws, or other devices which are secure and appropriate for substrate, and which will not deteriorate or fail with age or elevated temperatures.
 - E. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum which are not part of supporting structural or ceiling suspension system. Splay hangers only where required to miss obstructions and offset resulting horizontal force by bracing, countersplaying or other equally effective means.
 - F. Install edge moldings of type indicated at perimeter of acoustical ceiling area and at locations where necessary to conceal edges of acoustical units.
 - G. Screw-attach moldings to substrate at intervals not over 16" o.c. and not more than 3" from ends, leveling with ceiling suspension system to tolerance of 1/8" in 12'-0". Miter corners accurately and connect securely.
 - H. Install acoustical panels in coordination with suspension system, with edges concealed by support of suspension members. Scribe and cut panels to fit accurately at borders and at penetrations.
 - 1. Install hold-down clips in areas where required by governing regulations or for fire-resistance ratings; space as recommended by panel manufacturer, unless otherwise indicated or required.

3.03 CLEANING:

- A. Clean exposed surfaces of acoustical ceilings, including trim, edge moldings, and suspension members; comply with manufacturer's instructions for cleaning and touch-up of minor finish damage. Remove and replace work which cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION

SECTION 09770
SPECIAL WALL SURFACES - FRP

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Special wall surfaces, including fiberglass reinforced plastic panels.

1.2 SYSTEM DESCRIPTION

- A. Performance Requirements: Provide fiberglass reinforced plastic (FRP) panels which have been manufactured and installed to maintain performance criteria stated by manufacturer without defects, damage, or failure.

1.3 SUBMITTALS

- A. General: Submit listed submittals in accordance with Conditions of the Contract and Division 1 Submittal Procedures Section.
- B. Product Data: Submit product data, including manufacturer's SPEC-DATA product sheet, for specified products.
- C. Shop Drawings: Submit shop drawings showing layout, profiles, and product components, including anchorage, accessories, finish colors, patterns and textures. Indicate location and dimension of joints and fastener attachment.
- D. Samples: Submit selection and verification samples for finishes, colors and textures. Submit two samples of each type of panel, trim and fastener.
- E. Quality Assurance Submittals: Submit the following:
 - 1. Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties.
 - 2. Certificates: Product certificates signed by manufacturer certifying materials comply with specified performance characteristics, criteria and physical requirements.
 - 3. Manufacturer's Instructions: Manufacturer's installation instructions. Submit manufacturer's Installation Guide #6211.
 - 4. Manufacturer's Field Reports: Manufacturer's field reports specified herein.
- F. Closeout Submittals: Submit the following:

1. Operation and Maintenance Data: Operation and maintenance data for installed products in accordance with Division 1 Closeout Submittals (Maintenance Data and Operation Data) Section. Include methods for maintaining installed products, and precautions against cleaning materials and methods detrimental to finishes and performance.
2. Warranty: Warranty documents specified herein.

1.4 QUALITY ASSURANCE

A. Qualifications:

1. Installer Qualifications: Installer should be experienced in performing work of this section and should have specialized in installation of work similar to that required for this project.
 - a. Certificate: When requested, submit certificate indicating qualifications.
2. Manufacturer Qualifications: Manufacturer should be capable of providing field service representation during construction and should be capable of approving application method.

B. Regulatory Requirements:

1. Products and installation shall comply with all regulatory agencies.

C. Mock-Ups: Install at project site a job mock-up using acceptable products and manufacturer approved installation methods. Obtain Owner's and Architect's acceptance of finish color, texture, pattern, and workmanship standards. Comply with Division 1 Quality Control (Mock-Up Requirements) Section.

1. Mock-Up Size: 4' x 8'
2. Maintenance: Maintain mock-up during construction for workmanship comparison; remove and legally dispose of mock-up when no longer required.
3. Incorporation: Mock-up may be incorporated into final construction upon Owner's approval.

D. Pre-installation Meetings: Conduct pre-installation meeting to verify project requirements, substrate conditions, manufacturer's installation instructions, and manufacturer's warranty requirements. Comply with Division 1 Project Management and Coordination (Project Meetings) Section.

1.5 DELIVERY, STORAGE, & HANDLING

- A. General: Comply with Division 1 Product Requirements Sections.
- B. Ordering: Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.
- C. Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact. Package sheets on skids or pallets for shipment to project site.
- D. Storage and Protection: Store materials protected from exposure to harmful weather conditions and at temperature and humidity conditions recommended by manufacturer. Store panels indoors in a dry place at the project site.
- E. Handling: Remove foreign matter from face of panel by use of a soft bristle brush, avoiding abrasive action.

1.6 PROJECT CONDITIONS

- A. Environmental Requirements:
 - 1. Installation shall not begin until building is enclosed, permanent heating and cooling equipment is in operation, and residual moisture from plaster, concrete or terrazzo work has dissipated.
 - 2. During installation, and for not less than 48 hours before, maintain an ambient temperature and relative humidity within limits required by type of adhesive used and recommendation of adhesive manufacturer.
 - 3. Provide ventilation to disperse fumes during application of adhesive as recommended by adhesive manufacturer.
- B. Field Measurements: Verify actual measurements/openings by field measurements before fabrication; show recorded measurements on shop drawings. Coordinate field measurements and fabrication schedule with construction progress to avoid construction delays.

1.7 WARRANTY

- A. Project Warranty: Refer to Conditions of the Contract for project warranty provisions.
- B. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to, and not a limitation of, other rights Owner may have under Contract Documents.
 - 1. Warranty Period: Ten years commencing on Date of Substantial Completion.

1.8 MAINTENANCE

- A. Extra Materials: Deliver to Owner extra materials from same production run as products installed. Package products with protective covering and identify with descriptive labels. Comply with Division 1 Closeout Submittals (Maintenance Materials) Section.
 - 1. Delivery, Storage and Protection: Comply with Owner's requirements for delivery, storage and protection of extra materials.

PART 2 - PRODUCTS

2.1 FIBERGLASS REINFORCED PLASTIC (FRP) PANELS

- A. Manufacturer: Kemlite Company.
 - 1. Contact: P.O. Box 2429, Joilet, IL 60434; Telephone: (800) 435-0080, (815) 467-8600; Fax: (815) 467-8666.
- B. Proprietary Product(s)/System(s): Kemlite Fiberglass Reinforced Plastic (FRP) Panels.
 - 1. Glasbord Panels:
 - a. Color: **See Room Finish Schedule**
 - b. Size: 4' x 8'.
 - c. Moldings: Provide harmonizing PVC (polyvinyl chloride) moldings. **Color to match**
 - 2. Surfaseal Surface Protection: Provide manufacturer's proprietary surfaseal surface protection for fiberglass reinforced plastic (FRP) panels.
 - 3. Division Bars, Corner Trim: Panel manufacturer's standard length extruded vinyl pieces; longest length possible to eliminate end joints.
 - 4. Fasteners: Noncorrosive drive rivets.

2.2 PRODUCT SUBSTITUTIONS

- A. Substitutions: No substitutions permitted.

2.3 MANUFACTURED UNITS

- A. Kemlite Glasbord-P Fiberglass Panels with Surfaseal Surface Protection:

1. Rating: Class III (C) Interior Finish.
2. Wall Panels: Finish, thickness and color shall be:
 - a. Embossed 0.09" (2.3 mm) Glasbord-P with Surfaseal color: 48 pearl gray.
3. Performance Properties: Provide products with the following properties:
 - a. Class C Flamespread of 200 or less, Smoke Developed of 450 or lower per ASTM E84 latest version.
 - b. Barcol Hardness (scratch resistance) per ASTM D2583 of:
 - 1) 42 for embossed 0.09" (2.3 mm) Glasbord-P.
 - 2) 55 for embossed 0.12" (3.0 mm) Glasbord-PWI.
 - 3) 55 for smooth 0.075" (1.9 mm) Glasbord-PSI.
 - 4) 60 for embossed 0.10" (2.5 mm) Glasbord-CGI.
 - c. Panels shall exhibit no more than a 0.038percent weight loss after a 25-cycle Taber Abrasion Test using CS-17 abrasive wheels with 1000 g weight.
 - d. Meets USDA/FSIS Requirements.
 - e. Complies with ICBO Report Number 4583.
 - f. A means of frontside identification and confirmation of meeting Class III (C) the interior finish requirement after installation and while in service (without labels) embossed panels only.

2.4 ACCESSORIES

- A. Adhesive: Provide panel adhesive as recommended by panel manufacturer.

2.5 RELATED MATERIALS

- A. Related Materials: Refer to other sections listed in Related Sections paragraph herein for related materials.

2.6 SOURCE QUALITY

- A. Source Quality: Obtain fiberglass reinforced plastic (FRP) panels from a single manufacturer. Provide panels and molding only from manufacturer specified to ensure warranty and color harmonization of accessories.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

- A. Compliance: Comply with manufacturer's product data, including product technical bulletins, product catalog installation instructions, and product carton instructions for installation.

3.2 EXAMINATION

- A. Site Verification of Conditions: Verify that substrate conditions (which have been previously installed under other sections) are acceptable for product installation in accordance with manufacturer's instructions.
 - 1. Examine backup surfaces to determine that corners are plumb and straight, surfaces are smooth, uniform, clean, free from foreign matter, nails countersunk, joints and cracks filled flush and smooth with the adjoining surface.
 - 2. Do not begin installation until backup surfaces are in a satisfactory condition.

3.3 PREPARATION

- A. Surface Preparation: Prepare surface as recommended by manufacturer.

3.4 INSTALLATION

- A. Fiberglass Reinforced Panel (FRP) Installation:
 - 1. Cut and drill panels with carbide tipped saw blades or drill bits, or cut with snips.
 - 2. Install panels with manufacturer's recommended gap for panel field and corner joints.
 - 3. Predrill fastener holes in panels with 1/8" (3.2 mm) oversize.
 - 4. For trowel type and application of adhesive, follow adhesive manufacturer's recommendations.
 - 5. Using products acceptable to panel manufacturer, install FRP system in accordance with panel manufacturer's printed instructions. Comply with panel manufacturer's Installation Guide #6211.
- B. Related Products Installation: Refer to other sections listed in Related Sections paragraph herein for related materials installation.

3.5 FIELD QUALITY REQUIREMENTS

- A. Manufacturer's Field Services: Upon Owner's request, provide manufacturer's field service consisting of product use recommendations and periodic site visits

for inspection of product installation in accordance with manufacturer's instructions.

1. Site Visits: Site visits shall be specified by and coordinated with Owner.

3.6 CLEANING

- A. Cleaning: Remove temporary coverings and protection of adjacent work areas. Repair or replace products that have been installed and are damaged. Clean installed products in accordance with manufacturer's instructions prior to owner's acceptance. Remove construction debris from project site and legally dispose of debris.

1. Remove any adhesive or excessive sealant from panel face using solvent or cleaner recommended by panel manufacturer.

3.7 PROTECTION

- A. Protection: Protect installed product and finish surfaces from damage during construction.

END OF SECTION 09770

SECTION 09900

PAINTING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to this section.

1.02 SUMMARY

- A. This Section includes surface preparation, painting, and finishing of exposed interior and exterior items and surfaces.
 - 1. Surface preparation, priming, and finish coats specified in this section are in addition to shop priming and surface treatment specified under other sections.
- B. Paint exposed surfaces whether or not colors are designated in "schedules," except where a surface or material is specifically indicated not to be painted or is to remain natural. Where an item or surface is not specifically mentioned, paint the same as similar adjacent materials or surfaces. If color or finish is not designated, the Architect will select from standard colors or finishes available.
 - 1. Painting includes field painting exposed bare and covered pipes and ducts (including color coding), hangers, exposed steel and iron work, and primed metal surfaces of mechanical and electrical equipment.
- C. Painting is not required on prefinished items, finished metal surfaces, concealed surfaces, operating parts, and labels.
 - 1. Prefinished items not to be painted include the following factory-finished components:
 - a. Acoustic materials.
 - Architectural woodwork and casework.
 - Finished mechanical and electrical equipment.
 - Light fixtures.
 - 2. Finished metal surfaces not to be painted include:
 - a. Anodized aluminum.
 - Stainless steel.
 - Chromium plate.
 - Copper.
 - Bronze.
 - Brass.

3. Labels: Do not paint over Underwriter's Laboratories, Factory Mutual or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.
- D. Related Sections: The following sections contain requirements that relate to this section:
 1. Division 5 Section "Structural Steel" for shop priming structural steel.
 2. Division 5 Section "Metal Fabrications" for shop priming ferrous metal.
 3. Division 8 Section "Steel Doors and Frames" for shop priming steel doors and frames.

1.03 DEFINITIONS

- A. "Paint" includes coating systems materials, primers, emulsions, enamels, stains, sealers and fillers, and other applied materials whether used as prime, intermediate, or finish coats.

1.04 QUALITY ASSURANCE

- A. Single-Source Responsibility: Provide primers and undercoat paint produced by the same manufacturer as the finish coats.
- B. Coordination of Work: Review other sections in which primers are provided to ensure compatibility of the total systems for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to the job site in the 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 (7 deg C). Maintain containers used in storage in a clean condition, free of foreign materials and residue.
 1. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and application.

1.06 JOB CONDITIONS

- A. Apply water-based paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 50 deg F (10 deg C) and 90 deg F (32 deg C).

- B. Apply solvent-thinned paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 45 deg F (7 deg C) and 95 deg F (35 deg C).
- C. Do not apply paint in snow, rain, fog, or mist, when the relative humidity exceeds 85 percent, at temperatures less than 5 deg F (3 deg C) 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 the manufacturer during application and drying periods.

1.07 TESTING

- A. Application of block filler or exterior walls may be reviewed by owner's representative before finish coats of paint are applied. Coordinate schedule of primer and final coat with review requirements. Contractor is responsible to notify Owner when block filler application is ready for review. Do not apply finish coats of paint until filler is completed and wall coverage has been provided.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturer: Provide products from the approved manufacturer; no substitutions.
 - 1. The Sherwin-Williams Company (S.W.) provided by Contractor.

2.02 PAINT SYSTEMS

- A. Exterior Surfaces:
 - 1. Masonry:
 - a. Primer: High performance, heavy duty latex block filler for filling open texture exterior concrete masonry units. Provide minimum (2) coats and verify coverage. Apply additional coats required to yield full coverage on masonry surfaces; SH "Heavy Duty Block Filler," B42W46, Min 10.0 mils DFT/coat total 20 mils DFT minimum.
 - b. 2nd Coat: Latex house paint, S.W. "A-100 latex," A8W525, gloss, 1.4 mils DFT minimum.
 - c. 3rd Coat: Latex house paint, S.W. "A-100 latex," A8W525, gloss, 1.4 mils DFT minimum.
 - d. Reference drawings for striping schedule and paint formulations.

2. Ferrous Metals:
 - a. Primer: Quick drying rust inhibiting primer for use under full gloss and flat alkyd enamel; S.W. "Kem Kromik Metal Primer," B50N2 Brown, 3.0 mils DFT minimum.
 - b. 2nd Coat: Industrial Enamel; S.W. B54, 2.0 mils DFT minimum.
 - c. 3rd Coat: Industrial Enamel; S.W. B54, 2.0 mils DFT minimum.

3. MASONRY – EPOXY:

Preparation:

1. Solvent Cleaning – SW 13
2. Water Blasting – S-W 21
3. NACE Standard RP-01-72

Coating System:

1. 1st Coat: Kem Cati-Coat Epoxy Filler/Sealer, B42WA8/B42WA9 10.0-30.0 mils dft/ct as required to fill voids and provide a continuous substrate.
*Thin with R7K58 reducer 15% to roller apply.
2. 2nd Coat: MacroPoxy 646 Fast Cure Epoxy, B58-600/B58V600 5-10 mils dft (116-232 sq ft/gal approximate)
3. 3rd Coat: Corothane I Aliphatic Finish Coat, B65 Series 2.0-3.0 mils dft (278-417 sq ft/gal approximate)

Drying Schedule:

Kem Cati-Coat
MacroPoxy 646
Corothane I

To Recoat

18 Hours
8 Hours

To Service

3 Days

B. Interior Surfaces:

1. Masonry:
 - a. Primer: One coat high performance, heavy duty block filler; S.W., "Heavy Duty Block Filler," B42W46, minimum. 10.0 mils DFT.
 - b. 2nd Coat: Interior latex enamel; S.W. "Promar 200," B21W201, gloss, 2.0 mils DFT minimum.
 - c. 3rd Coat: Interior latex enamel; S.W. "Promar 200," B21W201, gloss, 2.0 mils DFT minimum.
 - d. 3rd Coat: Express Bays and Installation Bays; S.W. Gloss Alkyd, Industrial Enamel, B54 Series, 2.0 mils DFT minimum.
 5. Reference drawings for striping schedule and paint formulations.
2. Gypsum Board:
 - a. Primer: Latex, S.W., "Promar 200," B28W200, 1.1 mils DFT

- minimum.
 - b. 2nd Coat: Interior latex enamel; S.W., "Promar 200," B21W201, gloss, 2.0 mils DFT minimum.
 - c. 3rd Coat: Interior latex enamel; S.W., "Promar 200," B21W201, gloss, 2.0 mils DFT minimum.
 - 4. 3rd Coat: Express Bays and Installation Bays: S.W. Gloss Alkyd, Industrial Enamel B54 Series, 2.0 mils DFT minimum.
- 3. Plywood:
 - a. Primer: Alkyd enamel, S.W., "Promar 200," Undercoater, B49, 2.0 mils DFT minimum.
 - b. 2nd Coat: S.W., "Promar 20," Alkyd enamel, gloss B35, 1.6 mils DFT minimum.
 - c. 3rd Coat: S.W., "Promar 20," Alkyd enamel, gloss B35, 1.6 mils DFT minimum.
 - d. 3rd Coat: Express Bays and Installation Bays: S.W. Gloss Alkyd, Industrial Enamel B54 Series, 2.0 mils DFT minimum.
 - 5. Reference drawings for striping schedule and paint formulations.
- 4. Overhead exposed steel equipment, component and piping:
 - a. Primer: S.W., "Galvite," B50, 2.0 mils DFT minimum.
 - b. 2nd Coat: S.W., "Super Save-Lite Dryfall," B47, semi-gloss, 3.0 mils DFT minimum.
- 5. Steel (primed) and hollow metal:
 - a. Primer: S.W., "Galvite," B50, 2.0 mils DFT minimum.
 - b. 2nd Coat: S.W., "Promar Salon," B342, V.O.C. compliant alkyd enamel, semi-gloss, 2.7 mils DFT minimum.
 - c. 3rd Coat: S.W., "Promar Salon," B342, V.O.C. compliant alkyd enamel, semi-gloss, 2.7 mils DFT minimum.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates and conditions under which painting will be performed for compliance with requirements for application of paint. Do not begin paint application until unsatisfactory conditions have been corrected.
 - 1. Start of painting will be construed as the Applicator's acceptance of surfaces and conditions within a particular area.

3.02 PREPARATION

- A. General Procedures: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items in place that are not to be painted, or provide surface-applied protection prior to surface preparation and painting. Remove these items if necessary for complete painting of the

items and adjacent surfaces. Following completion of painting operations in each space or area, have items reinstalled by workers skilled in the trades involved.

1. Clean surfaces before applying paint or surface treatments. Remove oil and grease prior to cleaning. Schedule cleaning and painting so that dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.
 2. Protect areas not to be painted during dryfall operations.
 3. Furnish drop cloths, shields, and protective methods to prevent spray or droppings from disfiguring other surfaces.
- B. Surface Preparation: Clean and prepare surfaces to be painted in accordance with the manufacturer's instructions for each particular substrate condition and as specified.
1. Provide barrier coats over incompatible primers or remove and reprime. Notify Architect in writing of problems anticipated with using the specified finish-coat material with substrates primed by others.
- C. Cementitious Materials: Prepare concrete, concrete masonry block, 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.
1. Use abrasive blast-cleaning methods if recommended by the paint manufacturer.
 2. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause blistering and burning of finish paint, correct this condition before application. Do not paint surfaces where moisture content exceeds that permitted in manufacturer's printed directions.
- D. Ferrous Metals: Clean nongalvanized 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 recommendations of the Steel Structures Painting Council.
1. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by the paint manufacturer, and touch up with the same primer as the shop coat.
- E. Galvanized Surfaces: Clean galvanized surfaces with non-petroleum-based solvents so that the surface is free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.
- F. Materials Preparation: Carefully mix and prepare paint materials in accordance with manufacturer's directions.

1. Maintain containers used in mixing and application of 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. Remove film and, if necessary, strain material before using.
3. Use only thinners approved by the paint manufacturer, and only within recommended limits.

3.03 APPLICATION

- A. Apply paint in accordance with manufacturer's directions. Use applicators and techniques best suited for substrate and type of material being applied.
- B. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
 1. Paint colors, surface treatments, and finishes are indicated in "schedules."
 2. Provide finish coats that are compatible with primers used.
 3. The number of coats and film thickness required is the same regardless of the application method. Do not apply succeeding coats until the previous coat has cured as recommended by the manufacturer. Sand between applications where sanding is required to produce an even smooth surface in accordance with the manufacturer's directions.
 4. Apply additional coats when undercoats, stains, or other conditions show through final coat of paint until paint film is of uniform finish, color, and appearance. Give special attention to ensure that surfaces, including edges, corners, crevices, welds, and exposed fasteners, receive a dry film thickness equivalent to that of flat surfaces.
 5. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, connector covers, covers for finned tube radiation, grilles, and similar components are in place. Extend coatings in these areas as required to maintain the system integrity and provide desired protection.
 6. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Paint surfaces behind permanently fixed equipment or furniture with prime coat only before final installation of equipment.
 7. Paint interior surfaces of ducts, where visible through registers or grilles, with a flat, nonspecular black paint.
 8. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.
 9. Finish exterior doors on tops, bottoms, and side edges same as exterior faces.

10. Sand lightly between each succeeding enamel or varnish coat.
 11. Omit primer on metal surfaces that have been shop-primed and touch up painted.
- C. 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. Allow sufficient time between successive coats to permit proper drying. Do not recoat until paint has dried to where it feels firm, and does not deform or feel sticky under moderate thumb pressure and where application of another coat of paint does not cause lifting or loss of adhesion of the undercoat.
- D. Minimum Coating Thickness: Apply materials at not less than the manufacturer's recommended spreading rate. Provide a total dry film thickness of the entire system as recommended by the manufacturer.
- E. Block Fillers: Apply block fillers to concrete masonry block at a rate to ensure complete coverage with pores filled and no pinholes. Apply fillers by spray or brush equipment and backroll to evenly cover surface. Apply minimum (2) coats of block fillers. Repeat application until surface is evenly covered and all pinholes have been filled. Notify Owner of readiness for inspection before application of final coats of paint.
- F. Prime Coats: Before application of finish coats, apply a prime coat of material as recommended by the manufacturer to material that is required to be painted or finished and 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 assure a finish coat with no burn through or other defects due to insufficient sealing.
- G. HM doors and frames: Spray coats on door frames evenly without drips. Spray or roll doors.
- H. Stipple Enamel Finish: Roll and redistribute paint to an even and fine texture. Leave no evidence of rolling such as laps, irregularity in texture, skid marks, or other surface imperfections.
- I. Pigmented (Opaque) Finishes: Completely cover to provide an opaque, smooth 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.
- J. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not in compliance with specified requirements.

3.04 FIELD QUALITY CONTROL

- A. Owner reserves the right to invoke the following test procedure at any time and as often as they deem necessary during the period when paint is being applied:
 - 1. Owner may engage the services of an independent testing laboratory to sample the paint material being used. Samples of material delivered to the project will be taken, identified, sealed, and certified in the presence of the Contractor.
 - 2. The testing laboratory will perform appropriate tests for the following characteristics as required by the Owner:
 - a. Quantitative materials analysis.
 - Abrasion resistance.
 - Apparent reflectivity.
 - Flexibility.
 - Washability.
 - Absorption.
 - Accelerated weathering.
 - Dry opacity.
 - Accelerated yellowness.
 - Recoating.
 - Skinning.
 - Color retention.
 - Alkali and mildew resistance.
 - 3. If test results show material being used does not comply with specified requirements, the Contractor may be directed to stop painting, remove noncomplying paint, pay for testing, repaint surfaces coated with rejected paint, and remove rejected paint from previously painted surfaces if, upon repainting with specified paint, the two coatings are noncompatible.

3.05 CLEANING

- A. Cleanup: At the end of each work day, remove empty cans, rags, rubbish, and other discarded paint materials from the site.
- B. Upon completion of painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping, using care not to scratch or damage adjacent finished surfaces.

3.06 PROTECTION

- A. Protect work of other trades, whether to be painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting, as acceptable to Architect.

- B. Provide "wet paint" signs to protect newly painted finishes. Remove temporary protective wrappings provided by others for protection of their work after completion of painting operations.
 - 1. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

END OF SECTION

DIVISION 10

SPECIALTIES

Part 1: General

1.1 Description of Work

- A. Work in this section includes furnishing and installation of supershade aluminum overhead hanger rod style sunshades as manufactured by Mapes Industries Inc.
 - B. Related Items and Considerations
- 1 Determine wall construction, make-up and thickness.
 - 2 Ensure adequate wall condition to carry canopy loads where required.
 - 3 Any necessary removal or relocation of existing structures, obstructions or materials.

1.2 Quality Assurance

- A. Products meeting these specifications established standard of quality required as manufactured by Mapes Industries, Inc. Lincoln, Nebraska 1-888-273-1132.

1.3 Field Measurement

- A. Confirm dimensions prior to preparation of shop drawings when possible.
- B. If requested, supply manufacturer's standard literature and specifications for canopies.
- C. Submit shop drawings showing structural component locations/positions, material dimensions and details of construction and assembly.

1.4 Performance Requirements

- A. Canopy must conform to local building codes.
- B. Determine if specific load requirements have been established for canopies and if stamped calculations are required for location in which canopy is installed.

1.5 Deliver, Storage, Handling

- A. Deliver and store all canopy components in protected areas.

Part 2: Products

2.1 Manufacturer

- A. Mapes Canopies Lincoln, Nebraska Phone: 1-888-273-1132. Fax: 1-877-455-6572.

2.2 Materials

- A. Decking shall consist of louvered blades. (.110" extruded aluminum)
- B. Intermediate framing members shall be extruded aluminum, alloy 6063-T6, in profile and thickness shown in current Mapes brochures.
- C. Hanger rods to be powder coated finish to match the canopy.
- D. Fascia shall be standard 8" extruded J style (minimum .125 aluminum)

2.3 Finishes

- A. Finish shall be anodized. See exterior elevations for finish.

2.4 Fabrication

- A. All Louvered Sunshade canopies are shipped in preassembled sections for ease of installation.
- B. All connections shall be mechanically assembled utilizing 3/16 fasteners with a minimum shear stress of 350 lb. Pre-welded or factory-welded connections are not acceptable.

Part 3: Execution

3.1 Inspection

- A. Confirm that surrounding area is ready for the canopy installation.
- B. Installer shall confirm dimensions and elevations to be as shown on drawings provided by Mapes Industries.
- C. Erection shall be performed by an approved installer and scheduled after all concrete, masonry and roofing in the area is completed

3.2 Installation

- A. Installation shall be in strict accordance with manufacturer s shop drawings. Particular attention should be given to protecting the finish during handling and erection.

3.3 After installation, entire system shall be left in a clean condition.

SECTION 10 21 15
SOLID PLASTIC TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes solid plastic (HDPE) toilet compartments and urinals.
- B. Related Sections:
 - 1. Applicable provisions of Division 01 – General Requirements shall govern all work under this Section.
 - 2. Section 04 20 11 – Concrete Unit Masonry: Wall substrate
 - 3. Section 10 28 00 - Toilet, Bath, and Laundry Accessories.

1.2 REFERENCES

- A. ASTM International (ASTM):
 - 1. ASTM A666 - Standard Specification for Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
 - 2. NFPA 286 – Standard methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth; 2015.

1.3 SUBMITTALS

- A. Division 01 – General Requirements: Submittal procedures.
- B. Shop Drawings: Indicate partition plan, elevation views, dimensions, details of wall, floor, and ceiling supports, door swings.
- C. Product Data: Submit data on panel construction, hardware, and accessories.
- D. Samples: Submit two 3 x 6 inch in size illustrating panel finish, color, and sheen.
- E. Manufacturer's Installation Instructions: Submit special procedures, perimeter conditions requiring special attention.

1.4 COORDINATION

- A. Division 01 – General Requirements: Coordination and project conditions.
- B. Coordinate Work with placement of support framing and anchors in wall and ceiling,

PART 2 - PRODUCTS

2.1 SOLID PLASTIC (HDPE) TOILET COMPARTMENTS

A. Manufacturers:

1. Owner Preferred: Scranton Products Santana/Comtec/Capital); Hiny Hiders: www.scrantonproducts.com
2. Acceptable Manufactures: Subject to compliance with requirements.
 - a. Ampco Products, Inc; Solid Plastic: www.ampco.com.
 - b. Bradley Corporation; Solid Plastic (HDPE): www.bradleycorp.com
 - c. Global Steel Products Corp; Solid Plastic (HDPE): www.globalpartitions.com.
 - d. Metpar Corp; Polly Solid Plastic (DHPE): www.metpar.com.

B. Product Description: Floor mounted overhead braced.

C. Substitutions: See Division 01 – General Requirements.

2.2 COMPONENTS

- A. Toilet Compartments: Solid molded plastic panels, doors, and pilasters, floor-mounted headrail-braced and wall-hung.
 1. Color: Single color as selected.
- B. Door and Panel Dimensions:
 1. Thickness: 1 inch
 2. Door Width: 24 inch
 3. Accessible Door Width: 36 inch, out-swinging.
 4. Height: 58 inch
 5. Thickness of Pilasters: 1-1/4 inch.
- C. Urinal Screens: Wall mounted with Continuous panel bracket, and floor-to-ceiling vertical upright consisting of pilaster tubular headrail stock and sockets anchored to floor.

2.3 ACCESSORIES

- A. Pilaster Shoe: Formed chromed steel with satin finish, ASTM A666, Type 316 stainless steel with No. 4 finish, 3 inch high, concealing floor fastenings. Provide adjustment for floor variations with screw jack through steel saddles integral with pilaster.
- B. Head Rails: Hollow stainless steel tube, 1 x 1-5/8 inch size, with anti-grip profiles and cast socket wall brackets.
- C. Brackets: Satin stainless steel.
- D. Attachments, Screws, and Bolts: Stainless steel, tamper proof type.
 1. For attaching panels and pilasters to brackets: Through-bolts and nuts; tamper proof.
- E. Hardware: Satin Stainless steel:
 1. Pivot hinges, gravity type, adjustable for door close positioning; two for each door.
 2. Nylon bearings.

3. Thumb turn door latch with exterior emergency access feature.
4. Door strike and keeper with rubber bumper; mounted on pilaster in alignment with door latch.
5. Coat hook with rubber bumper; one for each compartment, mounted on door.
6. Furnish door pull for outswinging doors.
7. Furnish metal heat sink at bottom of doors and partitions.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Division 01 – General Requirements: Coordination and project conditions.
- B. Verify field measurements are as indicated on shop drawings.
- C. Verify correct spacing of and between plumbing fixtures.
- D. Verify correct location of built-in framing, anchorage, and bracing.

3.2 INSTALLATION

- A. Maintain 3/8 to 1/2 inch space between wall and panels and between wall and end pilasters.
- B. Attach panel brackets securely to walls using anchor devices.
- C. Attach panels and pilasters to brackets. Locate head rail joints at pilaster center lines.
- D. Field touch-up of scratches or damaged finish will not be permitted. Replace damaged or scratched materials with new materials.

3.3 ERECTION TOLERANCES

- A. Division 01 – General Requirements: Tolerances.
- B. Maximum Variation from Indicated Position: 1/4 inch.
- C. Maximum Variation from Plumb: 1/8 inch.

3.4 ADJUSTING

- A. Division 01 – General Requirements: Testing, adjusting, and balancing.
- B. Adjust and align hardware to uniform clearance at vertical edge of doors, not exceeding 3/16 inch.
- C. Adjust hinges to position doors in partial opening position when unlatched. Return out-swinging doors to closed position.
- D. Adjust adjacent components for consistency of line or plane.

SECTION 10522

FIRE EXTINGUISHERS, AND ACCESSORIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.02 DESCRIPTION OF WORK:

- A. Extent of fire extinguishers, and accessories is indicated on drawings.
- B. Types of products required include:
 - 1. Fire extinguishers.
 - 2. Mounting brackets.
- 3. Verify type and quantity with local jurisdiction.

1.03 QUALITY ASSURANCE:

- A. Single Source Responsibility: Obtain products in this section from one manufacturer.
- B. Coordination: Verify that fire extinguisher cabinets are sized to accommodate fire extinguishers of type and capacity indicated which will be provided by Owner under separate contract.
- C. UL-Listed Products: Provide new portable fire extinguishers which are UL-listed and bear UL "Listing Mark" for type, rating, and classification of extinguisher indicated.

1.04 SUBMITTALS:

- A. Product Data: Submit product data for each type of product included in this section.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

- A. Manufacturer: Subject to compliance with requirements, provide products of one of the following:
 - 1. J.L. Industries.
Larsen's Mfg. Co.

2.02 FIRE EXTINGUISHERS:

- A. General: Provide fire extinguishers for each location indicated, in standard color and finish.
- B. Abbreviations indicated below to identify extinguisher types related to UL classification and ratings system and not, necessarily to type and amount of extinguishing material contained in extinguisher.
 - 1. Type 1: UL-rated 4A-60BC, 10 lb. nominal capacity, in enameled steel container, for Class B and Class C fires
 - 2. Type 2: UL-rated 2A-10BC, 5 lb. nominal capacity, in enameled steel container, for Class B and Class C fires.

2.03 MOUNTING BRACKETS:

- A. Provide manufacturer's standard bracket designed to prevent accidental dislodgment of extinguisher of sizes required for type and capacity of extinguisher indicated, in manufacturer's standard plated finish.
 - 1. Provide brackets for extinguishers not located in cabinets and for those located in cabinets, where indicated or required.

PART 3 - EXECUTION

3.01 INSTALLATION:

- A. Install items included in this section in locations and at mounting heights indicated, or if not indicated, at heights to comply with applicable regulations of governing authorities.
- B. Where exact location of surface-mounted cabinets and bracket-mounted fire extinguishers is not indicated, locate as directed by Fire Marshall.

3.02 IDENTIFICATION:

- A. Identify bracket-mounted extinguishers with red letter decals spelling "FIRE

EXTINGUISHER" applied to wall surface.

END OF SECTION

SECTION 10800

TOILET AND BATH ACCESSORIES

PART 1 GENERAL

1.00 RELATED DOCUMENTS

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

1.01 SECTION INCLUDES

- A. Toilet and bath accessories.
- B. Attachment hardware.

1.02 RELATED SECTIONS

- A. Section 06110 - Rough Carpentry: Anchor reinforcement in walls.

1.03 QUALITY ASSURANCE

- A. Provide accessories by the same manufacturer for each type of accessory unit, and for units exposed in the same areas, to ensure matching of finishes.
- B. Comply with ASTM F446 for grab bars and accessories, anchorage, test methods, and performance.
- C. Specifications and Drawings are based on specific types and model numbers by the specified system standard manufacturer. Accessory types manufactured by other acceptable manufacturers are permitted, subject to compliance with specified requirements; and provided that deviations in dimensions and profile are minor, and do not detract substantially from the indicated design concept.

1.04 SUBMITTALS

- A. Submit product data under provisions of Section 01300.
- B. Submit data to illustrate each accessory at large scale and show installation method.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver accessories to site until rooms in which they are to be installed are ready to receive them.

- B. Pack accessories individually in a manner to protect accessory and its finish.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. American Specialties, Inc.
- B. Bobrick Washroom Equipment, Inc.
- C. Bradley Corp.
- D. McKinney/Parker, ESSEX Industries, Inc.
- E. Substitutions: Under provisions of Section 01600.

2.02 SYSTEM STANDARD

- A. The products scheduled are those of Bobrick Washroom Equipment, Inc. unless specifically noted otherwise.

2.03 MATERIALS

- A. Sheet Steel: ASTM A366; minimum 20 gage cold rolled stretcher leveled steel sheet; surface preparation and metal pretreatment as required for specified finish.
- B. Stainless Steel Sheet: ASTM A167, Type 302/304; minimum 22 gage.
- C. Stainless Steel Tubing: ASTM A269; commercial grade, seamless welded.
- D. Brass: FS QQ-B-613 for leaded and unleaded, flat products; FS QQ-B-626 for rods, shapes, forgings, and flat products with finished edges.
- E. Mirror Glass: ASTM C1036, Type I, Class 1, Quality q2; 1/4 inch thick, with silver coating, copper protective coating, and 2 mil minimum protective paint coating.

2.04 FABRICATION

- A. Weld and grind smooth joints of fabricated components.
- B. Form exposed surfaces from one sheet of stock, free of joints.

- C. Provide steel anchor plates and anchor components for installation on building finishes.
- D. Form surfaces flat without distortion. Maintain flat surfaces without scratches or dents.
- E. Back paint components where contact is made with building finishes to prevent electrolysis.
- F. Hot dip galvanize ferrous metal anchors and fastening devices.
- G. Shop assemble components and package complete with anchors and fittings.

2.05 FINISHES

- A. Chrome/Nickel Plating: ASTM B456, Type SC 2; satin or polished finish as specified.
- B. Stainless Steel: No. 4 satin luster or bright directional polished finish as specified.

PART 3 EXECUTION

3.01 PREPARATION

- A. Deliver inserts and rough-in frames to jobsite at appropriate time for building-in. Provide templates and rough-in measurements as required.
- B. Before starting work notify Architect in writing of any conflicts detrimental to installation or operation of units.
- C. Verify with Architect exact location of accessories.

3.02 INSTALLATION

- A. Install fixtures, accessories and items in accordance with manufacturer's instructions.
- B. Install true, plumb, and level, securely and rigidly anchored to substrate.
- C. Include anchorage devices, trim, and accessories required for complete installation.
- D. Use concealed fasteners wherever possible.

- E. Where exposed mounting devices and fasteners are necessary, provide such devices finished to match accessory; use security type fasteners for all exposed accessory mountings.
- F. Unless otherwise indicated, align accessory units with adjacent fixtures and other elements within the same area. Conform to ANSI A117.1 for positions and mounting heights.
- G. Coordinate locations of accessories with other work to avoid interference, and to assure proper operation and servicing of accessory units.

3.03 PROTECTION

- A. Protect adjacent or adjoining finished surfaces and work from damage during installation of work of this Section.
- B. Protect exposed accessory finishes from damage until final acceptance of the Work.

3.04 CLEANING AND ADJUSTMENT

- A. Clean and polish all exposed surfaces after installation, and after removal of labels and protective coatings or coverings.
- B. Test and adjust accessories for proper and smooth operation.

3.05 SCHEDULE

- 1. Mirror: B-290-2436.
- 2. Toilet Paper Dispenser: B-685.
- 3. Grab Bars: B61-6 series.
- 4. Mop Holders: B223x36.
- 5. Paper Towel Dispenser: Bobrick B-262
- 6. Soap Dispenser: Bobrick B-155\

Note: Toilet paper Dispenser, Paper Towel dispenser, and Soap dispenser shall be furnished by owner and installed by contractor. All others shall be furnished and installed by contractor.

END OF SECTION

DIVISION 11

EQUIPMENT

(NOT USED)

SECTION 11141

AUTOMOTIVE EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Information related to materials, products and execution shown on the drawings, as well as, information listed under Division 1 - General Requirements, apply to this section.

1.2 SCOPE OF WORK

- A. The work to be performed under this section is related to certain items of equipment that will be purchased and shipped to the job site by the Owner, or the Equipment Lessor including but not limited to, wheel alignment equipment, tire spreaders, tire changers, wheel balancers, air compressors, air hose reels and oil reels.
- B. The General Contractor shall accept delivery of the above equipment, unload, store in a secure area of the building, and protect against damage.
- C. The General Contractor shall assist with the installation of equipment as described below.

PART 2 - PRODUCTS

2.1 AUTOMOTIVE EQUIPMENT

- A. Air Compressors:
 - 1. Air compressor(s) will be furnished by the Owner's vendor or the Equipment Lessor. The air compressor(s) shall be installed by the Contractor in the locations shown on the drawings. The compressor(s) shall be set on vibration dampers and bolted to the floor slab. Lag bolts shall be tightened per manufacturer's recommendations. Do not compress vibration isolators with over tightening.
 - 2. The Contractor shall furnish all piping, fittings and valves and complete all plumbing and electrical connections shown on the drawings, specified under Division 15 and 16, or required by the manufacturer's installation drawings.

3. The air compressors, as shown on the drawings, shall be connected in such a manner to:
 - a. Operate simultaneously when required to satisfy high air demand periods such as during initial start-up or peak air demand periods.
 - b. Utilize one compressor when the demand for air is normal.
4. The Contractor shall fill the crankcase of each compressor with oil of the type recommended by the manufacturer and perform all start-up, operating and testing procedures required by the manufacturer's printed installation instructions.
5. The Contractor shall leave this equipment in perfect operating condition.

PART 3 - EXECUTION

3.1 LESSEE SUPPLIED EQUIPMENT

- A. Installation of miscellaneous Owner or Equipment Lessor supplied equipment, such as air hose reels, shall be installed as directed by by the Owner or in the drawings and specifications.
- B. Wheel alignment equipment will be furnished and installed by the Owner's equipment vendor or Equipment Lessor. The General Contractor shall furnish and install all compressed air piping and electrical connections as shown on the Drawings.

DIVISION 12

FURNISHINGS

(NOT USED)

SECTION 12500

FURNISHINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Information related to materials, products and execution shown on the drawings, as well as, information listed under Division 1 - General Requirements, apply to this section.

1.2 SCOPE OF WORK

- A. The work to be performed under this section includes all labor, material, equipment and services to assist in the installation of Owner furnished items. Such items include, but are not limited to the following: Display fixtures, cabinets, furniture, shelving, workbenches, tire storage racks and other miscellaneous items.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Basic items are indicated on the drawings.
- B. Provide all other materials required to make utility, electrical, etc., connections.

PART 3 - EXECUTION

3.1 GENERAL

- A. The above furnishings will be shipped to the job site by the Owner. The General Contractor shall accept delivery of the furnishings, unload and store in a secure area and protect against damage.
- B. Furnishings will be installed by the Owner. The General Contractor shall make all utility and electrical connections as shown on the drawings or as specified.

End of Division 12

DIVISION 13

SPECIAL CONSTRUCTION

(NOT USED)

DIVISION 14

CONVEYING SYSTEMS

(NOT USED)

SECTION 14450

VEHICLE LIFTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Information related to materials, products and execution shown on the drawings, as well as, information listed under Division 1 - General Requirements, apply to this section.

1.2 QUALITY ASSURANCE

- A. Hoists shall be installed only by qualified installers approved by hoist manufacturer.

PART 2 - PRODUCTS

2.1 LIFTS

- A. Refer to drawings for types and additional specifications.

End of Division 14

DIVISION 15

MECHANICAL

SECTION 15010

BASIC MECHANICAL REQUIREMENTS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of contract, including general and Supplementary Conditions and Division 1 Specification Sections, apply to this and the other sections of Division 15.

1.02 SUMMARY

- A. This section includes general administrative and procedural requirements for mechanical installations. The following administrative and procedural requirements are included in this Section to expand the requirements specified in Division 1:
 - Submittals.
 - Coordination drawings.
 - Record documents.
 - Maintenance manuals.
 - Rough-ins.
 - Mechanical installations.
 - Cutting and patching.
- B. Related Sections: The following sections contain requirements that relate to this section.
 - 1. Division 15 Section “BASIC MECHANICAL MATERIALS AND METHODS,” for materials and methods common to the remainder of Division 15, plus general related specifications including:
 - A. Access to mechanical installations.
 - B. Excavation for mechanical installations within the building boundaries, and from building to utilities connections.

1.03 SUBMITTALS

- A. General: Follow the procedures specified in Division 1 Section "SUBMITTALS."
- B. Increase, by the quantity listed below, the number of mechanical related shop drawings, product data, and samples submitted to allow for required distribution plus two copies of each submittal required, which will be retained by the Mechanical Consulting Engineer.

Shop Drawings – Initial Submittal: 1 additional blue – or black-line prints.

Shop Drawings – Final Submittal: 1 additional blue – or black-line prints.

Product Data: 1 additional copy of each item.

- C. Additional copies may be required by individual sections of these Specifications.

1.04 MAINTENANCE MANUALS

- A. Prepare maintenance manuals in accordance with Division 1 Section "PROJECT CLOSEOUT." In addition to the requirements specified in Division 1, include the following information for equipment items:
 - 1. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instruction; and summer and winter operating instructions.
 - 2. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
 - 3. Servicing instructions and lubrication charts and schedules.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification.

PART 2 – PRODUCTS – NOT APPLICABLE

PART 3 – EXECUTION

3.01 ROUGH-IN

- A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.
- B. Refer to equipment specifications in Divisions 2 through 16 for rough-in requirements.

3.02 MECHANICAL INSTALLATIONS

- A. General: Sequence, coordinate, and integrate the various elements of mechanical systems, materials, and equipment. Comply with the following requirements:
- B. Coordinate mechanical systems, equipment, and materials installation with other building components.
- C. Verify all dimensions by field measurements.
- D. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for mechanical installations.
- E. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
- F. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the work. Give particular attention to large equipment requiring positioning prior to closing in the building.
- G. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service. Provide sand/grease interceptor for trench drain acceptable to local authority.

- H. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Architect.
- I. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.
- J. Install mechanical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location.
- K. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.

3.03 CUTTING AND PATCHING

- A. General: Perform cutting and patching in accordance with Division 1 Section "CUTTING AND PATCHING." In addition to the requirements specified in Division 1, the following requirements apply:
 - 1. Protection of Installed Work: During cutting and patching operations, protect adjacent installations.
- B. Perform cutting, fitting, and patching of mechanical equipment and materials required to:
 - 1. Uncover work to provide for installation of ill-timed work.
 - 2. Remove and replace defective work.
 - 3. Remove and replace work not conforming to requirements of the Contract Documents.
- C. Upon written instructions from the Architect, uncover and restore work to provide for Architect/Engineer observation of concealed work.
- D. Patch finished surfaces and building components using new materials specified for the original installation and experienced

installers. Installers' qualifications refer to the materials and methods required for the surface and building components being patched.

END OF SECTION

SECTION 15050

BASIC MECHANICAL MATERIALS AND METHODS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Requirements specified in Division 15 Section “Basic Mechanical Requirements” apply to this Section.

1.02 SUMMARY

- A. This Section includes limited scope general construction materials and methods for application with mechanical installations as follows:
 - 1. Excavation for underground utilities and services, including underground piping (under the building and from building to utility connection), tanks, basins, and equipment.

1.03 DEFINITIONS

- A. The following definitions apply to excavation operations:
 - 1. Additional Excavation: Where excavation has reached required subgrade elevations, if unsuitable bearing materials are encountered, continue excavation until suitable bearing materials are reached.
 - 2. Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations or dimensions without specific direction from the Architect.

PART 2 – PRODUCTS

2.01 SOIL MATERIALS

- A. Drainage Fill: Washed, evenly graded mixture of crushed stone, or crushed or uncrushed gravel, with 100 percent passing a 1-1/2-inch sieve, and not more than 5 percent passing a No. 4 sieve.
- B. Backfill and Fill Materials: Materials complying with ASTM D2487 soil classification groups GW, GP, GM, SM, SW, and SP; free of clay, rock, or gravel larger than 2 inches in any dimension; debris;; waste; frozen materials; and vegetable and other deleterious matter.

PART 3 – EXECUTION

3.01 EXCAVATION

- A. Slope sides of excavations to comply with local codes and ordinances. Shore and brace as required for stability of excavation.
- B. Excavation for Underground Tanks, Basins, and Mechanical Structures: Conform to elevations and dimensions shown within a tolerance of plus or minus 0.10 foot; plus a sufficient distance to permit placing and removal of concrete formwork, installation of services, other construction, and for inspection.
- C. Take care not to disturb bottom of excavation. Excavate by hand to final grade just before concrete reinforcement is placed.
- D. Trenching: Excavate trenches for mechanical installations as follows:
- E. Excavate trenches to the uniform width, sufficiently wide to provide ample working room and a minimum of 6 to 9 inches clearance on both sides of pipe and equipment.
- F. Excavate trenches to depth indicated or required for piping to establish indicated slope and invert elevations. Beyond building perimeter, excavate trenches to an elevation below frost line.
- G. Limit the length of open trench to that in which pipe can be installed, tested, and the trench backfilled within the same day.

- H. Where rock is encountered, carry excavation below required elevation and backfill with a layer of crushed stone or gravel prior to installation of pipe. Provide a minimum of 6 inches of stone or gravel cushion between rock bearing surface and pipe.
- I. Excavate trenches for piping and equipment with bottoms of trench to accurate elevations for support of pipe and equipment on undisturbed soil. At each pipe joint over-excavate to relieve the bell or pipe joint of the pipe of loads, and to ensure continuous bearing of the pipe barrel on the bearing surface.

3.02 BACKFILLING AND FILLING

- A. Place soil materials in layers to required subgrade elevations for each area classification listed below.
 - 1. Under walks and pavements, use a combination of subbase materials and excavated or borrowed materials.
 - 2. Under building slabs, use drainage fill materials.
 - 3. Under piping and equipment, use subbase materials where required over rock bearing surface and for correction of unauthorized excavation.
- B. Backfill excavations as promptly as work permits, but not until completion of the following:
 - 1. Inspection, testing, approval, and locations of underground utilities have been recorded.
 - 2. Removal of concrete formwork.
 - 3. Removal of shoring and bracing, and backfilling of voids.
 - 4. Removal of trash and debris.

3.03 PLACEMENT AND COMPACTION

- A. Place back fill and fill materials in layers of not more than 8 inches in loose depth for material compacted by heavy equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
- B. Before compaction, moisten or aerate each layer as necessary to provide optimum moisture content. Compact each layer to require

percentage of maximum dry density or relative dry density for each area classification specified below. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.

- C. Place backfill and fill materials evenly adjacent to structures, piping, and equipment to required elevations. Prevent displacement of piping and equipment by carrying material uniformly around them to approximately same elevation in each lift.
- D. Compaction: Control soil compaction during construction, providing minimum percentage of density specified for each area classification indicated below.

3.04 PERCENTAGE OF MAXIMUM DENSITY REQUIREMENTS

- A. compact soil to not less than the following percentages of maximum density for soils which exhibit a well-defined moisture-density relationship (cohesive soils), determined in accordance with ASTM D 1557 and not less than the following percentages of relative density, determined in accordance with ASTM D 2049, for soils which will not exhibit a well-defined moisture-density relationship (cohesionless soils).
 - 1. Areas Under Structures, Building Slabs and Steps, Pavements: Compact top 12 inches of subgrade and each layer of backfill or fill material to 90 percent maximum density for cohesive material, or 95 percent relative density for cohesionless material.
 - 2. Areas Under Walkways: Compact top 6 inches of subgrade and each layer of backfill or fill material to 90 percent maximum density for cohesive material, or 95 percent relative density for cohesionless material.
 - 3. Other Areas: Compact to 6 inches of subgrade and each layer of backfill or fill material to 85 percent maximum density for cohesive soils, and 90 percent relative density for cohesionless soils.

END OF SECTION

SECTION 15055

BASIC PIPING MATERIALS AND METHODS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.02 SUMMARY

- A. This Section specifies piping materials and installation methods common to more than one section of Division 15 and includes joining materials, piping specialties, and basic piping installation instructions.

1.03 RELATED SECTIONS

- A. Division 15 Basic Mechanical Requirements section applies to the work at this Section.
- B. Piping materials and installation methods peculiar to individual systems are specified within their respective system specification sections of Divisions 2 and 15.
- C. Valves are specified in a separate section and in individual piping system sections of Division 15.
- D. Supports and Anchors are specified in a separate section of Division 15.

1.04 SUBMITTALS

- A. Refer to Division 1 and Basic Mechanical Requirements for administrative and procedural requirements for submittals.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Provide factory-applied plastic end-caps on each length of pipe and tube, except for concrete, corrugated metal, hub-and-spigot, clay pipe. Maintain end-caps through shipping, storage and handling to

prevent pipe-end damage and prevent entrance of dirt, debris, and moisture.

- B. Protect stored pipes and tubes. Elevate above grade and enclose with durable, waterproof wrapping. When stored inside, do not exceed structural capacity of the floor.
- C. Protect flanges, fittings, and specialties from moisture and dirt by inside storage and enclosure, or by packaging with durable, waterproof, wrapping.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturer uniformity: conform with the requirements specified in Basic Mechanical Requirements, under “Product Options.”
- B. Manufacturer: Subject to compliance with requirements, provide piping materials and specialties from one of the following:
- C. Pipe Escutcheons:
 - Chicago Specialty Mfg. Co.
 - Sanitary-Dash Mfg. Co.
 - Grinnell
- D. Dielectric Unions:
 - Eclipse, Inc.
 - Perfection Corp.
 - Watts Regulator Co.
- E. Flexible Connectors:
 - Keflex, Inc.
 - Vibration Mountings & Controls, Inc.
 - Proco Products, Inc.

2.02 PIPE AND FITTINGS

- A. Refer to the individual piping system specification sections in Division 15 for specifications on piping and fittings relative to that particular system.

2.03 JOINING MATERIALS

- A. Welding Materials: Comply with Section II, Part C, ASME Boiler and Pressure Vessel Code for welding materials appropriate for the wall thickness and chemical analysis of the pipe being welded.
- B. Brazing Materials: Comply with SFA-5.8, Section II, ASME Boiler and Pressure Vessel Code for brazing filler metal materials appropriate for the materials being joined.
- C. Soldering Materials: Refer to individual piping system specifications for solder appropriate for each respective system.

2.04 PIPING SPECIALTIES

- A. Escutcheons: Chrome-plated, stamped steel, hinged, split-ring escutcheon, with set screw. Inside diameter shall closely fit pipe outside diameter, or outside of pipe insulation where pipe is insulated. Outside diameter shall completely cover the opening in floors, walls, or ceilings.
- B. Unions: Malleable-iron, Class 150 for low pressure service and class 250 for high pressure service; hexagonal stock, with ball-and-socket joints, metal-to-metal bronze seating surfaces; female threaded ends.
- C. Dielectric Unions: Provide dielectric unions with appropriate end connections for the pipe materials in which installed (screwed, soldered, or flanged), which effectively isolate dissimilar metals, prevent galvanic action, and stop corrosion.
- D. Flexible Connectors: Provide flexible connectors with solder end connections of braided bronze. Construction is to be of corrugated, close pitch hose of bronze with bronze braid. Installation shall be per manufacturers recommendations.

PART 3 – EXECUTION

3.01 PREPARATION

- A. Ream ends of pipes and tubes, and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris for both inside and outside of piping and fittings before assembly.

3.02 INSTALLATIONS

- A. General Locations and Arrangements: Drawings (plans, schematics, and diagrams) indicate the general location and arrangement of the piping systems. Location and arrangement of piping layout take into consideration pipe sizing and friction loss, expansion, pump sizing, and other design considerations. So far as practical, install piping as indicated. Refer to individual system specifications for requirements for coordination drawing submittals.
- B. Conceal all pipe installations in walls, pipe chases, utility spaces, above ceilings, below grade or floors, unless indicated otherwise.
- C. Install piping free of sags or bends and with ample space between piping to permit proper insulation applications.
- D. Install exposed piping at right angles or parallel to building walls. Diagonal runs are not permitted, unless expressly indicated on the Drawings.
- E. Install piping tight to slabs, beams, joists, columns, walls, and other permanent elements of the building. Provide space to permit insulation applications, with 1" clearance outside the insulation. Allow sufficient space above removable ceiling panels to allow for panel removal.
- F. Locate groups of pipes parallel to each other, spaced to permit applying full insulation and servicing of valves.
- G. Exterior Wall Penetrations: Seal pipe penetrations through exterior walls. Pipe sleeves smaller than 6" shall be steel.

3.03 FITTINGS AND SPECIALTIES

- A. Use fittings for all changes in direction and all branch connections.
- B. Remake leaking joints using new materials.
- C. Install unions adjacent to each valve, and at the final connection to each piece of equipment and plumbing fixture having 2" and smaller connections, and elsewhere as indicated.
- D. Install dielectric unions to connect piping materials of dissimilar metals.

3.04 JOINTS

A. Steel Pipe Joints

Pipe 2" and Smaller: Thread pipe with tapered pipe threads in accordance with ANSI B2.1. Cut threads full and clean using sharp dies. Ream threaded ends to remove burrs and restore full inside diameter. Apply pipe joint lubricant or sealant suitable for the service for which the pipe is intended on the male threads at each joint and tighten joint to leave not more than 3 threads exposed.

B. Non-ferrous Pipe Joints:

Brazed and Soldered Joints: For copper tube and fitting joints, braze joints in accordance with ANSI B31.1.0 – Standard Code for Pressure Piping, Power Piping and ANSI B9.1 – Standard Safety code for Mechanical Refrigeration.

Thoroughly clean tube surface and inside surface of the cup of the fittings, using very fine emery cloth, prior to making soldered or brazed joints. Wipe tube and fittings clean and apply flux. Flux shall not be used as the sole means for cleaning tube and fitting surfaces.

3.05 FIELD QUALITY CONTROL

A. Testing: Refer to individual piping system specification sections.

END OF SECTION

SECTION 15060
PIPE AND PIPE FITTINGS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

This section is Division-15 Basic Materials and Methods section, and is part of each Division-15 section making reference to pipes and pipe fittings specified herein.

1.02 DESCRIPTION OF WORK

- A. Extent of pipe, tube, and fittings required by this section is indicated on drawings and/or specified in other Division-15 sections.
- B. Types of pipe, tube, and fittings specified in this section include the following:
 - Steel Pipes.
 - Copper Tube.
 - Cast-Iron Soil Pipes
 - Miscellaneous Piping Materials/Products.
- C. Pipes and pipe fittings furnished as part of factory-fabricated equipment, are specified as part of equipment assembly in other Division-15 sections.

1.03 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacturer of pipes and pipe fittings of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Except for hub-and-spigot, clay, and similar units of pipe, provide factory-applied plastic end-caps on each length of pipe and tube.

Maintain end-caps through shipping, storage and handling as required to prevent pipe-end damage and eliminate dirt and moisture from inside of pipe and tube.

- B. Where possible, store pipe and tube inside and protected from weather. Where necessary to store outside, elevate above grade and enclose with durable, waterproof wrapping.
- C. Protect fittings from moisture and dirt by inside storage and enclosure, or by packing with durable, waterproof wrapping.

PART 2 – PRODUCTS

2.01 GENERAL

- A. Piping Materials: Provide pipe and tube of type, joint type, grade, size and weight (wall thickness or Class) indicated for each service. Where type, grade or class is not indicated, provide proper selection as determined by Installer for installation requirements, and comply with governing regulations and industry standards.
- B. Pipe/Tube Fittings: Provide factory-fabricated fittings of type, materials, grade, class and pressure rating indicated for each service and pipe size. Provide sizes and types matching pipe, tube, valve or equipment connection in each case. Where not otherwise indicated, comply with governing regulations and industry standards for selections, and with pipe manufacturer's recommendations where applicable.

2.02 STEEL PIPES AND PIPE FITTINGS

- A. Black Steel Pipe: ASTM A 53, A 106 or A 120; except comply with ASTM A 53 or A 106 where close coiling or bending is required.
- B. Galvanized Steel Pipe: ASTM A 53 or A 120; except comply with ASTM A 53 where close coiling or bending is required.
- C. Malleable-Iron Threaded Fittings: ANSI B16.3; plain or galvanized as indicated.
- D. Malleable-Iron Threaded Unions: ANSI B16.39; selected by Installer for proper piping fabrication and service requirements, including style, end connections, and metal-to-metal seats (iron, bronze or brass); plain or galvanized as indicated.
- E. Cast-Iron Threaded Drainage Fittings: ANSI B16.12.

- F. Pipe Nipples: Fabricated from same pipe as used for connected pipe; except do not use less than Schedule 80 pipe where length remaining unthreaded length is less than 1½", and where pipe size is less than 1½", and do not thread nipples full length (no close-nipples).

2.03 COPPER TUBE AND FITTINGS

- A. Copper Tube: ASTM B 88; Type "L" or as indicated for each service; hard-drawn temper, except as otherwise indicated.
- B. DWV Copper Tube: ASTM B 306.
- C. Cast-Copper Solder-Joint Fittings: ANSI B16.18.
- D. Wrought-copper solder-Joint Fittings: ANSI B16.22.
- E. Cast-Copper Solder-Joint Drainage Fittings: ANSI B16.23
- F. Wrought-Copper Solder-Joint Drainage Fittings: ANSI B16.29
- G. Copper-Tube Unions: Provide standard products recommended by manufacturer for use in service indicated.

2.04 CAST-IRON SOIL PIPES AND PIPE FITTINGS

- A. Hubless Cast-Iron Soil Pipe: FS WW-P-401
- B. Cast-Iron Hub-and-Spigot Soil Pipe: ASTM A 74

2.05 HUBLESS CAST-IRON SOIL PIPE FITTINGS

- A. Neoprene gasket complying with ASTM C 564 and stainless steel clamp holding band.
- B. Cast-Iron Hub-and-Spigot soil Pipe Fittings: Match soil pipe units; complying with same standards (ASTM A 74).
- C. Compression Gaskets: ASTM C 564.
- D. Lead/Oakum Joint Materials: Provide products complying with governing regulations for use in service indicated.

2.06 MISCELLANEOUS PIPING MATERIALS/PRODUCTS

- A. Soldering Materials: Except as otherwise indicated, provide soldering materials as determined by Installer to comply with installation requirements.

Tin-antimony Solder: ASTM B 32, Grade 95TA.

PART 3 – EXECUTION

3.01 INSTALLATION

- A. General: Install pipes and pipe fittings in accordance with recognized industry practices which will achieve permanently-leakproof piping systems, capable of performing each indicated service without piping failure. Install each run with minimum joints and couplings, but with adequate and accessible unions for disassembly and maintenance/replacement of valves and equipment. Reduce sizes (where indicated) by use of reducing fittings. Align piping accurately at connections, within 1/16" misalignment tolerance.

Comply with ANSI B31 Code for Pressure Piping.

- B. Locate piping runs, except as otherwise indicated, vertically and horizontally (pitched to drain) and avoid diagonal runs wherever possible. Orient horizontal runs parallel with walls and column lines. Locate runs as shown or described by diagrams, details and notations or, if not otherwise indicated, run piping in shortest route which does not obstruct usable space or block access for servicing building and its equipment. Hold piping close to walls, overhead construction, columns and other structural and permanent-enclosure elements of building; limit clearance to 1/2" where furring is shown for enclosure or concealment of piping, but allow for insulation thickness, if any. Where possible, locate insulated piping for 1" clearance outside insulation. Wherever possible in finished and occupied spaces, conceal piping from view, by locating in column enclosures, in hollow wall construction or above suspended ceilings; do not encase horizontal runs in solid partitions, except as indicated.
- C. Electrical Equipment Spaces: Do not run piping through electrical equipment spaces and enclosures unless unavoidable. Install drip pan under piping that must be run through electrical spaces.

3.02 PIPING SYSTEM JOINTS

- A. General: Provide joints of type indicated in each piping system.

1. Thread pipe in accordance with ANSI B2.1; cut threads full and clean using harp dies. Ream threaded ends to remove burrs and restore full inside diameter. Apply pipe joint compound, or pipe joint tape (Teflon) where recommended by pipe/fitting manufacturer, on male threads at each joint and tighten joint to leave not more than 3 threads exposed.
 2. Solder copper tube-and-fitting joints where indicated, in accordance with recognized industry practice. Cut tube ends squarely, ream to full inside diameter, and clean outside of tube ends and inside of fittings. Apply solder flux to joint areas of both tubes and fittings. Insert tube full depth into fitting, and solder in manner which will draw solder full depth and circumference of joint. Wipe excess solder from joint before it hardens.
- B. Hubless Cast-Iron Joints: Comply with coupling manufacturer's installation instructions.

3.03 PIPING INSTALLATION

- A. Install drainage piping (perforated, porous or tile) from lowest end of slope to highest, solidly bedded in filtering or drainage fill. Shape bed for bells of piping (if any). Place bells/hubs and grooved ends of units up-stream.

3.04 CLEANING, FLUSHING, INSPECTING

- A. General: Clean exterior surfaces of installed piping systems of superfluous materials, and prepare for application of specified coatings (if any). Flush out piping systems with clean water before proceeding with required tests. Inspect each run of each system for completion of joints, supports and accessory items.

Inspect pressure piping in accordance with procedures of ASME B31.

- B. Disinfect water mains and water service piping in accordance with AWWA C601.

3.05 PIPING TESTS

- A. Test pressure piping in accordance with ASME B31. Test each piping system at 150% of operating pressure indicated, but not less than 25 psi test pressure.

Observe each test section for leakage at the end of test period. Test fails if leakage is observed or if pressure drop exceeds 5% of test pressure.

- B. Repair piping systems sections which fail required piping test, by disassembly and re-installation, using new materials to extent required to overcome leakage. Do not use chemicals, stop-leak compounds, mastics, or other temporary repair methods.

END OF SECTION

SECTION 15100

VALVES

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 specification sections, apply to this section.
- B. Requirements of the following Division 15 Sections apply to this section:
 - “Basic Mechanical Requirements.”
 - “Basic Mechanical Materials and Methods.”
 - “Basic Piping Materials and Methods.”

1.02 SUMMARY

- A. This Section includes general duty valves common to most mechanical piping systems.
- B. Valve tags and charts are specified in Division 15 Section “MECHANICAL IDENTIFICATION.”

1.03 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
- C. Product data, including body material, valve design, pressure and temperature classification, end connection details, seating materials, trim material and arrangement, dimensions and required clearances, and installation instructions.

1.04 QUALITY ASSURANCE

- A. Single Source Responsibility: Comply with the requirements specified in Division 1 Section “MATERIALS AND EQUIPMENT,” under “Source Limitations.”

- B. American society of Mechanical Engineers (ASME)
Compliance: Comply with ASME B31.9 for building services piping and ASME B31.1 for power piping.
- C. Manufacturers Standardization society of the Valve and Fittings Industry (MSS) Compliance: Comply with the various MSS Standard Practices referenced.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Preparation For Transport: Prepare valves for shipping as follows:

Ensure valves are dry and internally protected against rust and corrosion.

Protect valve ends against damage to threads, flange faces, and weld-end preps.

Set valves in best position for handling. Set globe and gate valves closed to prevent rattling; set ball and plug valves open to minimize exposure of functional surfaces; set butterfly valves closed or slightly open; and block swing check valves in either closed or open position.

- B. Storage: Use the following precautions during storage:

Do not remove valve end protectors unless necessary for inspection; then reinstall for storage.

Protect valves from weather. Store valves indoors. Maintain valve temperature higher than the ambient dew point temperature. If outdoor storage is necessary, support valves off the ground or pavement in watertight enclosures.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturer: Subject to compliance with requirements, provide products from one of the manufacturers listed in valve schedule.

2.02 VALVE FEATURES, GENERAL

- A. Valve Design: Rising stem or rising outside screw and yoke stems.
- B. Nonrising stem valves may be used where headroom prevents full extension of rising stems.
- C. Pressure and Temperature Ratings: As required to suit system pressures and temperatures.
- D. Sizes: Same size as upstream pipe, unless otherwise indicated.
- E. Operators: Provide the following special operator features:
 - 1. Handwheels, fastened to valve stem, for valves other than quarter turn.
 - 2. Lever handles, on quarter-turn valves 6-inch and smaller, except for plug valves. Provide plug valves with square heads.
- F. End Connections: As indicated in the valve specifications.
 - 1. Threads: Comply with ANSI B1.20.1
 - 2. Solder-Joint: Comply with ANSI B16.18

Caution: Where soldered end connections are used, use solder having a melting point below 840 deg. F for gate, globe, and check valves; below 421 deg. F for ball valves.

2.03 GATE VALVES

- A. Gate Valves, 2-inch and Smaller: MSS SP-80; Class 125, body and bonnet of ASTM B 62 cast bronze; with threaded or solder ends, solid disc, copper-silicon alloy stem, brass packing gland, "Teflon" impregnated packing, and malleable iron handwheel. Provide Class 150 valves meeting the above where system pressure requires.

2.04 BALL VALVES

- A. Ball Valves, 1 Inch and Smaller: Rated for 150 psi saturated steam pressure, 400 psi WOG pressure; two-piece construction; with bronze body conforming to ASTM B 62, standard (or regular) port, chrome-plated brass ball, replaceable "Teflon" or "TFE" seats and

seals, blowout-proof stem, and vinyl-covered steel handle. Provide solder ends for domestic hot and cold water service, and air service.

- B. Ball Valves, 1¼ inch to 2-Inch: Rated for 150 psi saturated steam pressure, 400 psi WOG pressure; 3-piece construction; with bronze body conforming to ASTM B 62, conventional port, chrome-plated brass ball, replaceable “Teflon” or “TFE” seats and seals, blowout proof stem, and vinyl-covered steel handle. Provide solder ends for domestic hot and cold water service, and air service.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Examine valve interior through the end ports for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks used to prevent disc movement during shipping and handling.
- B. Actuate valve through an open-close and close-open cycle. Examine functionally significant features, such as guides and seats made accessible by such actuation. Following examination, return the valve closure member to the shipping position.
- C. Examine threads on both the valve and the mating pipe for form (i.e., out-of-round or local indentation) and cleanliness.
- D. Prior to valve installation, examine the piping for cleanliness, freedom from foreign materials, and proper alignment.
- E. Replace defective valves with new valves.

3.02 VALVE ENDS SELECTION

- A. Select valves with the following ends or types of pipe/tube connections:
 - 1. Copper Tube Size, 2-Inch and Smaller: Solder ends.
 - 2. Steel Pipe Sizes, 2-Inch and Smaller: threaded.

3.03 VALVE INSTALLATIONS

- A. General Application: Use gate and ball valves for shut-off duty. Refer to piping system specification sections for specific valve applications and arrangements.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves and unions for each fixture and item of equipment arranged to allow equipment removal without system shutdown.
- D. Install valves in horizontal piping with stem at or above the center of the pipe.
- E. Install valves in a position to allow full tem movement.

3.04 SOLDER CONNECTIONS

- A. Cut tube square and to exact lengths.
- B. Clean end of tube to depth of valve socket with steel wool, sand cloth, or a steel wire brush to a bright finish. Clean valve socket in same manner.
- C. Apply proper soldering flux in an even coat to inside of valve socket and outside of tube.
- D. Open gate valves to full open position.
- E. Insert tube into valve socket, making sure the end rests against the shoulder inside valve. Rotate tube or valve slightly to ensure even distribution of the flux.
- F. Apply heat evenly to outside of valve around joint until solder will melt upon contact. Feed solder until it completely fills the joint around tube. Avoid hot spots or overheating valve. Once the solder starts cooling, remove excess amounts around the joint with a cloth or brush.

3.05 THREADED CONNECTIONS

- A. Note the internal length of threads in valve ends, and proximity of valve internal seat or wall, to determine how far pipe should be threaded into valve.

- B. Align threads at point of assembly.
- C. Apply appropriate tape or thread compound to the external pipe threads (except where dry seal threading is specified).
- D. Assemble joint, wrench tight. Wrench on valve shall be on the valve end into which the pipe is being threaded.

3.06 FIELD QUALITY CONTROL

- A. Tests: After piping systems have been tested and put into service, but before final adjusting and balancing, inspect valves for leaks. Adjust or replace packing to stop leaks; replace valves if leak persists.

3.07 ADJUSTING AND CLEANING

- A. Cleaning: Clean mill scale, grease, and protective coatings from exterior of valves and prepare valves to receive finish painting or insulation.

VALVE PRESSURE/TEMPERATURE CLASSIFICATION SCHEDULES

VALVES, 2-INCH AND SMALLER

<u>SERVICE</u>	<u>GATE</u>	<u>BALL</u>
Domestic Hot and Cold Water	125	150
Air	150	150

VALVE SCHEDULE

Gate Valves – 2 Inch and Smaller:

<u>MANUFACTURER</u>	<u>THREADED</u>		<u>SOLDER</u>	
	<u>NRS</u>	<u>RS</u>	<u>NRS</u>	<u>RS</u>
Crane	438	428	1701S	1700S
Grinnell	3000	3010	3000SJ	3010SJ

Hammond	IB645	IB640	IB647	IB635
Jenkins	370	47	1240	1242
Lunkenheimer	2129	2127	2133	2132
Milwaukee	105	148	155	1149
Nibco	T113	T111	S113	S111
Powell	507	500	1822	1821
Stockham	B103	B-100	B-104	B-108

Gate Valves – 2 Inch and Smaller:

MANUFACTURER	THREADED		SOLDER	
	NRS	RS	NRS	RS
Crane	x	431UB	x	x
Grinnell	3050	3060	x	x
Hammond	IB637	IB629	x	IB648
Jenkins	x	47U	x	x
Lunkenheimer	3153	3151	3154	3155
Milwaukee	x	1151	x	1169
Nibco	T-136	T-135	S-136	x
Powell	2712	2714	x	1842
Stockham	B-130	B-120	x	B-124

X means not available

Ball Valves – 1 Inch and Smaller:

MANUFACTURER	THREADED ENDS	SOLDER ENDS
Conbraco (Apollo)	70-100	70-200
Crane	9302	9322
Grinnell	3500	3500SJ
Jamesbury	351	x
Jenkins	900T	902T
Lunkenheimer	708HST	x
Metraflex	IT	IS
Nibco	T-580	S-580
Powell	4210T	x
Stockham	S-216 BR-R-T	S-216 BR-R-S
Watts	B-6000	B-6001

X means not available

Ball Valves – 1¼ Inch to 2 Inch:

MANUFACTURER	THREADED ENDS	SOLDER ENDS
Conbraco (Apollo)	82-100	82-200
Grinnell	3810	3810SJ
Nibco	T-590-Y	S-590-Y
Powell	4201R	x
Stockham	S-216 BR-R-T	S-216 BR-R-S
Watts	B-6800	B-6801

For grooved end connections, use Victaulic Style 721.
X means not available.

END SECTION 15100

SECTION 15140
SUPPORTS AND ANCHORS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary conditions and Division-1 Specification sections, apply to work of this section.
- B. This section is a Division-15 Basic Materials and Methods section, and is a part of each Division-15 section making reference to supports and anchors specified herein.

1.02 DESCRIPTION OF WORK

- A. Extent of supports and anchors required by this section is indicated on drawings and/or specified in other Division-15 sections.
- B. Types of supports and anchors specified in this section include the following:
 - Horizontal-Piping Hangers and Supports.
 - Vertical-Piping Clamps.
 - Hanger-Rod Attachments.
 - Building Attachments.
 - Miscellaneous Materials.
 - Equipment Supports.
 - Roof Equipment Supports.
- C. Supports and anchors furnished as part of factory-fabricated equipment, are specified as part of the equipment assembly in other Division-15 sections.

1.03 QUALITY ASSURANCE

- A. Manufacturers Qualifications: Firms regularly engaged in manufacture of supports and anchors, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

1.04 CODES AND STANDARDS

- A. Code Compliance: Comply with applicable plumbing codes pertaining to product materials and installation of supports and anchors.
- B. UL and FM Compliance: Provide products which are UL-listed and FM approved.
- C. MSS Standard Compliance:

Provide pipe hangers and supports of which materials, design, and manufacture comply with MSS SP-58.

Select and apply pipe hangers and supports, complying with MSS SP-69.

Fabricate and install pipe hangers and supports, complying with MSS SP-89.

Terminology used in this section is defined in MSS SP-90.

PART 2 – PRODUCTS

2.01 HORIZONTAL-PIPING HANGERS AND SUPPORTS

- A. General: Except as otherwise indicated, provide factory-fabricated horizontal-piping hangers and supports complying with MSS SP-58, of one of the following MSS types listed, selected by Installer to suit horizontal piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select size of hangers and supports to exactly fit pipe size for bare piping, and to exactly fit around piping insulation with saddle or shield for insulated piping. Provide copper-plated hangers and supports for copper-piping systems.
 - 1. Adjustable Steel Clevis Hangers: MSS Type 1.
 - 2. Steel Pipe Clamps: MSS Type 4
 - 3. Adjustable Swivel Pipe Rings: MSS Type 6
 - 4. Adjustable Steel Band Hangers: MSS Type 7
 - 5. Adjustable Band Hangers: MSS Type 9

6. Adjustable Swivel Rings, Band Type: MSS Type 10
7. Split Pipe Rings: MSS Type 11
8. Clips: MSS Type 26.

2.02 VERTICAL-PIPE CLAMPS

- A. General: Except as otherwise indicated, provide factory-fabricated vertical-piping clamps complying with MSS SP-58, of one of the following types listed, selected by Installer to suit vertical piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Select size of vertical piping clamps to exactly fit pipe size of bare pipe. Provide copper-plated clamps for copper-piping systems.

1. Two-Bolt Riser Clamps: MSS Type 8

2.03 HANGER-ROD ATTACHMENTS

- A. General: Except as otherwise indicated, provide factory-fabricated hanger-rod attachments complying with MSS SP-58, of one of the following MSS type listed, selected by Installer to suit horizontal-piping hangers and building attachments, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select size of hanger-rod attachments to suit hanger rods. Provide copper-plated hanger-rod attachments for copper-piping systems.

1. Malleable Iron Sockets: MSS Type 16.

2.04 BUILDING ATTACHMENTS

- A. General: Except as otherwise indicated, provide factory-fabricated building attachments complying with MSS SP-58, of one of the following MSS types listed, selected by Installer to suit building substrate conditions, in accordance with MSS SP-69 and manufacturer's published product information. Select size of building attachments to suit hanger to suit hanger rods. Provide copper-plated building attachments for copper-piping systems.

1. Top Beam C-Clamps: MSS Type 19
2. Side Beam or Channel Clamps: MSS Type 20

3. C-Clamps: MSS Type 23

B. Steel Brackets: One of the following for indicated loading:

1. Light Duty: MSS Type 31

2.05 MANUFACTURERS OF HANGERS AND SUPPORTS

A. Manufacturer: Subject to compliance with requirements, provide hangers and supports of one of the following:

B-Line Systems, Inc.
Carpenter and Patterson, Inc.
Corner & Lada Co., Inc.
Elcen Metal Products Co.
Fee & Mason Mfg. Co., Div. Figgie International.
ITT Grinnel Corp.

2.06 MISCELLANEOUS MATERIALS

A. Metal Framing: Provide products complying with NEMA STD ML 1.

PART 3 – EXECUTION

3.01 INSPECTION

A. Examine areas and conditions under which supports and anchors are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.02 PREPARATION

A. Proceed with installation of hangers, supports and anchors only after required building structural work has been completed in areas where the work is to be installed. Correct inadequacies including (but not limited to) proper placement of inserts, anchors and other building structural attachments.

B. Prior to installation of hangers, supports, anchors and associated work, Installer shall meet at project site with Contractor, installer of each component of associated work, inspection and testing agency representatives (if any), installers of other work requiring coordination with work of this section and Architect/Engineer for purpose of reviewing material selections and procedures to be followed in performing the work in compliance with requirements specified.

3.03 INSTALLATION OF HANGERS AND SUPPORTS

- A. General: Install hangers, supports, clamps and attachments to support piping properly from building structure; comply with MSS SP-69. Arrange for grouping of parallel runs of horizontal piping to be supported together on trapeze type hangers where possible. Install supports with maximum spacings complying with MSS SP-69.

Where piping of various sizes is to be supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe. Do not use wife or perforated metal to support piping, and do not support piping from other piping.

- B. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers and other accessories. Except as otherwise indicated for exposed continuous pipe runs, install hangers and supports of same type and style as install for adjacent similar piping.
- C. Prevent electrolysis in support of copper tubing by use of hangers and supports which are copper plated, or by other recognized industry methods.

3.04 PROVISIONS FOR MOVEMENT

- A. Install hangers and supports to allow controlled movement of piping systems and to permit freedom of movement between pipe anchors.
- B. Load Distribution: Install hangers and supports so that piping live and dead loading and stresses from movement will not be transmitted to connected equipment.

3.05 ADJUSTING AND CLEANING

- A. Hanger Adjustment: Adjust hangers so as to distribute loads equally on attachments.
- B. Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

END OF SECTION

SECTION 15190
MECHANICAL IDENTIFICATION

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work for this section.

This section is a Division-15 Basic Materials and Methods section, and is part of each Division-15 section making reference to identification devices specified herein.

1.02 DESCRIPTION OF WORK

- A. Extent of mechanical identification work required by this section is indicated on drawings and/or specified in other Division-15 sections.
- B. Types of identification devices specified in this section include the following:

Plastic Pipe Markers.

1.03 CODES AND STANDARDS

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

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Manufacturer: Subject to compliance with requirements, provide mechanical identification materials of one of the following:

Allen Systems, Inc.
Brady (W.H.) Co.; Signmark Div.
Industrial Safety Supply Co., Inc.
Seton Name Plate Corp.

2.02 MECHANICAL IDENTIFICATION MATERIALS

- A. General: Provide manufacturer's standard products of categories and types required for each application as referenced in other Division-15 sections. Where more than single type is specified for application, selection is Installer's option, but provide single selection for each product category.

2.03 PLASTIC PIPE MARKERS

- A. Snap-On Type: Provide manufacturer's standard pre-printed, semi-rigid snap-on, color-coded pipe markers, complying with ANSI A13.1.
- B. Pressure-Sensitive Type: provide manufacturer's standard pre-printed, permanent adhesive, color-coded, pressure-sensitive vinyl pipe markers, complying with ANSI A13.1.
- C. Small Pipes: For external diameters less than 6" (including insulation if any), provide full-band pipe markers, extending 360 degrees around pipe at each location, fastened by one of the following methods:

Snap-on application of pre-tensioned semi-rigid plastic pipe marker.

Adhesive lap joint in pipe marker overlap.

Laminated or bonded application of pipe marker to pipe (or insulation).

Taped to pipe (or insulation) with color-coded plastic adhesive tape, not less than $\frac{3}{4}$ " wide; full circle at both ends of pipe marker, tape lapped $1\frac{1}{2}$ ".

- D. Lettering: Manufacturer's standard pre-printed nomenclature which best describes piping system in each instance, as selected by Architect/Engineer in cases of variance with names as shown or specified.

PART 3 – EXECUTION

3.01 PIPING SYSTEM IDENTIFICATION

- A. General: Install pipe markers of one of the following types on each system indicated to receive identification.

Plastic pipe markers, with application system as indicated under "Materials" in this section.

Locate pipe markers and color bands wherever piping is exposed to view in occupied spaces.

Spaced intermediately at maximum spacing of 25'.

3.02 ADJUSTING AND CLEANING

- A. Adjusting: Relocate any mechanical identification device which has become visually blocked by work of this division or other divisions.

END OF SECTION

SECTION 15250

MECHANICAL INSULATION

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

Division-15 Basic Mechanical Materials and Methods sections apply to work of this section.

1.02 DESCRIPTION OF WORK

- A. Extent of mechanical insulation required by this section is indicated on drawings and schedules, and by requirements of this section.
- B. Types of mechanical insulation specified in this section include the following:

Ductwork System Insulation:

Fiberglass

- C. Refer to Division-15 section “Low Pressure Ductwork” for duct linings; not work of this Section.

1.03 QUALITY ASSURANCE

- A. Flame/Smoke Ratings: Provide composite mechanical insulation (insulation, jackets, coverings, sealers, mastics and adhesives) with flame-spread index of 25 or less, and smoke-developed index of 50 or less, as tested by ASTM E 84 (NFPA 255) method.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Deliver insulation, coverings, cements, adhesives, and coatings to site in containers with manufacturer’s stamp or label, affixed showing fire hazard indexes of products.

- B. Protect insulation against dirt, water, and chemical and mechanical damage. Do not install damaged or wet insulation; remove from project site.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Manufacturer: Subject to compliance with requirements, provide products of one of the following:

Armstrong World Industries, Inc.
Babcock & Wilcox Co., Insulating Products Div.
Certainteed Corp.
Knauf fiber Glass GmbH.
Manville Products Corp.
Owens-Corning Fiberglass Corp.
Pittsburgh Corning Corp.

2.02 DUCTWORK INSULATION MATERIALS

- A. Flexible Fiberglass Ductwork Insulation: ASTM C 553, Type I, Class B-4.
- B. Jackets for Ductwork Insulation: ASTM C 921, Type I.
- C. Ductwork Insulation Accessories: Provide staples, bands, wires, tape, anchors, corner angles and similar accessories as recommended by insulation manufacturer for applications indicated.
- D. Ductwork Insulation Compounds: Provide cements, adhesives, coatings, sealers, protective finishes and similar compounds as recommended by insulation manufacturer for applications indicated.

PART 3 – INSPECTION

3.01 INSPECTION

- A. Examine areas and conditions under which mechanical insulation is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.02 DUCTWORK SYSTEM INSULATION

- A. Insulation Omitted: Do not insulate fibrous glass ductwork, or lined ductwork.

3.03 DUAL TEMPERATURE DUCTWORK

- A. Application Requirements: Insulate the following dual temperature ductwork:

Hot/cold supply and return ductwork between fan discharge, or HVAC unit discharge, and room terminal outlets; except omit insulation on return air ductwork located in return air ceiling plenums.

- B. Insulate each ductwork system specified above with one of the following types and thicknesses of insulation:

Flexible Fiberglass: 2" thick, application limited to concealed locations.

3.04 INSTALLATION OF DUCTWORK INSULATION

- A. General: Install insulation products in accordance with manufacturer's written instructions, and in accordance with recognized industry practices to ensure that insulation serves its intended purpose.
- B. Install insulation materials with smooth and even surfaces.
- C. Clean and dry ductwork prior to insulating. Butt insulation joints firmly together to ensure complete and tight fit over surfaces to be covered.
- D. Maintain integrity of vapor-barrier on ductwork insulation, and protect it to prevent puncture and other damage.
- E. Lined Ductwork: Except as otherwise indicated, omit insulation on ductwork where internal insulation or sound absorbing linings have been installed.

3.05 PROTECTION AND REPLACEMENT

- A. Replace damaged insulation which cannot be repaired satisfactorily, including units with vapor barrier damage and moisture saturated units.
- B. Protection: Insulation Installer shall advise contractor of required protection for insulation work during remainder of construction period, to avoid damage and deterioration.

END OF SECTION

SECTION 15411

WATER DISTRIBUTION PIPING

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.02 SUMMARY

- A. This Section specifies the water distribution piping system, including potable cold and hot water piping, fittings, and specialties within the building to a point 5 feet outside the building.
- B. Products installed but which may not be furnished under this Section include water meters which may be provided by the utility company, to the site, ready for installation. Contractor shall coordinate requirements with the local utility company.

1.03 RELATED SECTIONS

- A. Separate sections in Division 2 specify water service piping (which connects the “Water Distribution Piping” to wells and public utilities), water wells, and trenching and backfilling.
- B. Separate sections of Division 15 specify Basic Piping Materials and Methods, Hangers and Supports, piping system identification materials and requirements, general duty valves and plumbing equipment.

1.04 DEFINITIONS

- A. Water Distribution Piping: A pipe within the building or on the premises which conveys water from the water service pipe or meter to the points of usage.
- B. Water Service Piping: The pipe from the water main or other source of potable water supply to the water distributing system of the building served.

1.05 SUBMITTALS

- A. Refer to Division 1 and Basic Mechanical Requirements for administrative and procedural requirements for submittals.
- B. Product Data: Submit manufacturer's product data for the following products:

Valves

1.06 QUALITY ASSURANCE

- A. Codes and Standards:
 - 1. Plumbing Code Compliance: comply with applicable portions of local plumbing codes or with BOCA Basic National Plumbing Code.
 - 2. ASME Compliance: Fabricate and stamp pressure temperature relief valves to comply with ASME Boiler and Pressure Vessel Code.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Store pipe in a manner to prevent sagging and bending.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturer uniformity: Conform with the requirements specified in Basic Mechanical Requirements, under "Product Options."
- B. Manufacturer: Subject to compliance with requirements, provide water distribution piping products from one of the following:
 - 1. Bibbs and Faucets:
 - Hammond Valve Corp.
 - Lee Brothers; Div. Phelps Dodge Brass Co.
 - Mansfield Plumbing Products
 - Nibco Inc.
 - Prier Brass Mfg. Co.
 - Woodford Mfg. Co.
 - Watts Regulator Co.

2.02 PIPE AND FITTINGS

- A. Pipe Within Building (except below slab):
 - 1. Pipe Size 4" and Smaller: Copper tubing. Conform to ASTM B88, Type L, hard temper, copper tube; ANSI B16.22 streamlined pattern wrought-copper fittings, with soldered joints using 95-5 tin-antimony solder.
- B. Pipes Inside and Outside Building, Below Ground:
 - 1. Pipe Sizes 3" and Smaller: Copper tubing. Conform to ASTM B88, Type K, soft temper copper tube. No joints permitted below ground.

2.03 VALVES:

- A. Gate, ball, butterfly, check, and drain valves are specified in a separate section of Division 15.

2.04 PIPING SPECIALTIES

- A. Hose Bibbs: Bronze body, renewable composition disc, tee handle, 1/2" NPT inlet, 3/4" hose outlet.
- B. Pressure Regulating Valves: Furnish if utility supply pressure is greater than 70 psi. Single seated, direct operated type; having bronze body with integral strainer, and complying with requirements of ASSE Standard 1003. Select proper size for maximum flow rate and inlet and outlet pressures indicated.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Verify all dimensions by field measurements. Verify that all water distribution piping may be installed in accordance with pertinent codes and regulations, the original design, and the referenced standards.
- B. Examine rough-in requirements for plumbing fixtures and other equipment having water connections to verify actual locations of piping connections prior to installation.
- C. Do not proceed until unsatisfactory conditions have been corrected.

3.02 JOINING PIPES AND FITTINGS

- A. Copper Tubing: Solder joints in accordance with the procedures specified in ANSI B9.1.

3.03 PIPING INSTALLATION

- A. Refer to the separate Division 15 section: Basic Piping Materials and Methods, for general piping installation instructions.
- B. General Locations and Arrangements: Drawing (plans, schematics, and diagrams) indicate the general location and arrangement of the piping systems. Location and arrangement of piping layout take into consideration pipe sizing and friction loss and other design considerations. So far as practical, install piping as indicated.
- C. Install piping with 1/32" per foot (1/4 percent) downward slope towards drain point.

3.04 SERVICE ENTRANCE

- A. Extend water distribution piping to connect to water service piping, of size and in location indicated for service entrance to building. Water service piping is specified in a separate section of Division 2.
- B. Install sleeve and sleeve seal at penetrations through foundation wall for watertight installation.
- C. Install shutoff valve at service entrance inside building.

3.05 INSTALLATION OF WATER METER

- A. Install water meter in accordance with utility company's installation instructions and requirements.

3.06 INSTALLATION OF VALVES

- A. Installation requirements for general duty valves are specified in a separate section of Division 15.
- B. Shutoff Valves: Install shutoff valves on inlet of each plumbing equipment item, and on inlet of each plumbing fixture, and elsewhere as indicated. For shutoff valves 2" and smaller, use gate or ball valves.

- C. Hose Bibbs: Install on exposed piping where indicated, with vacuum breaker.

3.07 INSTALLATION OF PIPING SPECIALTIES

- A. Install pressure regulating valves with inlet and outlet shutoff valves, and balance cock bypass. Install pressure gage on valve outlet.

3.08 EQUIPMENT CONNECTIONS

- A. Piping Runouts to Fixtures: Provide hot and cold water piping runouts to fixtures of sizes and indicated, but in no case smaller than required by Plumbing Code.

3.09 FIELD QUALITY CONTROL

- A. Inspections:
 - 1. Do not enclose, cover, or put into operation water distribution piping system until it has been inspected and approved by the authority having jurisdiction.
 - 2. During the progress of the installation, notify the plumbing official having jurisdiction, at least 24 hours prior to the time such inspection must be made. Perform tests specified below in the presence of the plumbing official.
 - 3. Rough-in Inspection: Arrange for inspection of the piping system before concealed or closed-in after system is roughed-in, and prior to setting fixtures.
 - 4. Final Inspection: Arrange for a final inspection by the plumbing official to observe the tests specified below and to insure compliance with the requirements of the plumbing code.
 - 5. Reinspections: Whenever the plumbing official finds that the piping system will not pass the test or inspection, make the required corrections and arrange for reinspection by the plumbing official.

3.10 PIPING SYSTEM TEST

- 1. Test for leaks and defects all new water distribution piping systems and parts of existing systems, which have been altered, extended or

repaired. If testing is performed in segments, submit a separate report for each test, complete with a diagram of the portion of the system tested.

2. Leave uncovered and unconcealed all new, altered, extended, or replaced water distribution piping until it has been tested and approved. Expose all such work for testing, that has been covered or concealed before it has been tested and approved.
3. Cap and subject the piping system to a static water pressure of 50 psi above the operating pressure without exceeding the pressure rating of the piping system materials. Isolate the test source and allow to stand for a period of 4 hours. Leaks and loss in test pressure constitute defects which must be repaired.
4. Repair all leaks and defects using new materials and retest system or portion thereof until satisfactory results are obtained.

3.11 ADJUSTING AND CLEANING

A. Cleaning and Disinfecting:

1. Purge all new water distribution piping systems and parts of existing systems, which have been altered, extended, or repaired prior to use.
2. Use the purging and disinfecting procedure proscribed by the authority having jurisdiction, or in case a method is not proscribed by that authority, the procedure described in either AWWA C601, or AWWA D105.

END OF SECTION

SECTION 15420

DRAINAGE AND VENT SYSTEMS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specifications sections, apply to work of this section.

1.02 SUMMARY

- A. This Section specifies building sanitary and storm drainage and vent piping systems, including drains and drainage specialties.

1.03 RELATED SECTIONS

- A. Separate sections in Division 2 specify foundation drainage, storm sewage systems sanitary sewage systems, septic systems, and trenching and backfilling.
- B. Separate sections in Division 7 specify flashing and sheet metal and joint sealers.
- C. Division 15 Basic Mechanical Requirements section applies to the work of this section.
- D. Separate sections of Division 15 specify Basic Piping Materials and Methods, Hangers and Supports, Expansion Compensation, piping system identification materials and requirements, pipe insulation, and plumbing equipment.

1.04 DEFINITIONS

- A. **Building Drain:** That part of the lowest piping of a drainage system which receives the discharge from soil, waste, and other drainage pipes inside the walls of the building and conveys it to the building sewer.
- B. **Building Sewer:** That part of the drainage system which extends from the end of the building drain and conveys its discharge to a

public sewer, private sewer, individual sewage disposal system, or other point of disposal.

- C. Drainage System: Includes all the piping within a public or private premises which conveys sewage, rain water or other liquid wastes to a point of disposal. It does not include the mains of public sewer systems or a private or public sewage treatment or disposal plant.
- D. Vent System: A pipe or pipes installed to provide a flow of air to or from a drainage system, or to provide a circulation of air within such system to protect trap seals from siphonage and back pressure.

1.05 SUBMITTALS

- A. Refer to Division 1 and Basic Mechanical Requirements for administrative and procedural requirements for submittals.
- B. Product Data: Submit product data for the following products:
 - Floor drains
 - Trench drains

1.06 QUALITY ASSURANCE

- A. Codes and Standards:

Plumbing Code Compliance: Comply with applicable portions of local plumbing code or BOCA Basic National Plumbing Code.

1.07 SEQUENCING AND SCHEDULING

- A. Coordinate the installation of flashing and roof penetrations.
- B. Coordinate flashing materials installation of roofing, waterproofing, and adjoining substrate work.
- C. Coordinate the installation of drains in poured-in-place concrete slabs, to include proper drain elevations, installation of flashing, and slope of slab to drains. Provide trench drain support angle to concrete contractor prior to shop floor being poured.
- D. Coordinate with installation of sanitary and storm sewer systems as necessary to interface building drains with drainage piping systems.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturer Uniformity: Conform with the requirements specified in Basic Mechanical Requirements, under “Product Options.”
- B. Manufacturer: Subject to compliance with requirements, provide drainage and vent systems from one of the following:

Drainage Piping Specialties, including drains and trench drains:

Ancon Inc.
Josam Mfg. Co.
Smith (Jay R) Mfg. Co.
Tyler Pipe; Subs. of Tyler Corp.
Zurn Industries Inc.; Hydromechanics Div.

2.02 ABOVE GROUND DRAINAGE AND VENT PIPE AND FITTINGS

- A. Pipe Sizes 3” and Smaller: Copper tube. Conform to ASTM B306, Type DWV for pipe, with cast-bronze, drainage pattern fittings, with soldered joints using 50-50 tin-lead solder, conforming to ASTM B32.
- B. Pipe Sizes Larger Than 3”: Cast-iron soil pipe. Conform to ASTM A74, for service weight, hub-and-spigot soil pipe and fittings, with clamps and compression gasket joints conforming to ASTM C564.
- C. Pipe Sizes Larger Than 3”: Hubless cast-iron soil pipe. Conform to CISPI Standard 301, Service weight, cast-iron soil pipe and fittings, with neoprene gaskets conforming to CISPI Standard 310.

2.03 UNDERGROUND BUILDING DRAIN PIPE AND FITTINGS

- A. Pipe Sizes 15” and Smaller: Cast-iron soil pipe. Conform to ASTM A74, for Extra-Heavy weight, hub-and-spigot soil pipe and fittings, with neoprene compression gasket joints conforming to ASTM C564. Pipe and fittings shall have a heavy coating of coal tar varnish or asphaltum on both inside and outside surfaces.

2.04 DRAINAGE PIPING SPECIALTIES

- A. Cleanout Plugs: Cast-bronze or brass, threads complying with ANSI B2.1, countersunk head.

- B. Floor Cleanouts: Cast-iron body and frame, with cleanout plug and adjustable round top as follows:
 - 1. Nickel-Bronze Top: Manufacturer's standard cast unit with the following patterns:

Exposed flush type, standard non-slip scored or abrasive finish.
 - 2. Cast-iron Top: Manufacturer's standard cast unit with the following patterns:

Exposed flush type, standard non-slip scored or abrasive finish.
- C. Wall Cleanouts: Cast-iron body adaptable to pipe with cast-bronze or brass cleanout plug; stainless steel cover including screws.
- D. Flashing Flanges: Cast-iron calking type roof coupling for cast-iron stacks, cast-iron threaded type roof coupling for steel stacks, and cast-bronze stack flashing sleeve for copper tubing.
- E. Vent Flashing Sleeves: Cast-iron calking type roof coupling for cast-iron stacks, cast-iron threaded type roof coupling for steel stacks, and cast-bronze stack flashing sleeve for copper tubing.

2.05 FLOOR DRAINS

- A. Floor drain type designations and sizes are indicated on Drawings.

2.06 TRENCH DRAINS

- A. Trench drain type designations and sizes are indicated on Drawings.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Verify all dimensions by field measurements. Verify that all drainage and vent piping and specialties may be installed in accordance with pertinent codes and regulations, the original design, and the referenced standards.

- B. Verify all existing grades, inverts, utilities, obstacles, and topographical conditions prior to installations.
- C. Examine rough-in requirements for plumbing fixtures and other equipment having drain connections to verify actual locations of piping connections prior to installation.
- D. Examine walls, floors, roof, and plumbing chases for suitable conditions where piping and specialties are to be installed.
- E. Do not proceed until unsatisfactory conditions have been corrected.

3.02 JOINING PIPES AND FITTINGS

- A. Copper Tubing: Solder joints in accordance with the procedures specified in ANSI B9.1.
- B. Cast-Iron Soil Pipe: Make compression joints, and hubless joints in accordance with the recommendations in the CISPI Cast Iron Soil Pipe and Fittings Handbook, Chapter IV.

3.03 INSTALLATION

- A. Refer to the separate Division 15 section: Basic Piping Materials and Methods, for general piping installation instructions.
- B. Install supports and anchors in accordance with Division-15 Basic Mechanical Materials and Methods section "Supports and Anchors".
- C. General Locations and Arrangements: Drawings (plans, schematics, and diagrams) indicate the general location and arrangement of the piping systems. Location and arrangement of piping layout take into account many design considerations. So far as practical, install piping as indicated.
- D. Make changes in direction for drainage and vent piping using appropriate 45-degree wyes, half-wyes, or long sweep quarter, sixth, eighth, or sixteenth bends. Sanitary tees or short quarter bends may be used on vertical stacks of drainage lines where the change in direction of flow is from horizontal to vertical, except use long-turn tees where two fixtures are installed back to back and have a common drain. Straight tees, elbows, and crosses may be used on vent lines. No change in direction of flow greater than 90 degrees shall be made. Where different sizes of drainage pipes and fittings are connected, use proper size, standard increasers

and reducers. Reduction of the size of drainage piping in the direction of flow is prohibited.

- E. Install underground building drains to conform with the plumbing code, and in accordance with the Cast Iron Soil Pipe Institute Engineering Manual. Lay underground building drains beginning at low point of systems, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install required gaskets in accordance with manufacturer's recommendations for use of lubricants, cements, and other special installation requirements. Maintain swab or drag in line and pull past each joint as it is completed.
- F. Install building drain pitched down at minimum slope of $\frac{1}{4}$ " per foot (2 percent) for piping 3" and smaller, and $\frac{1}{8}$ " per foot (1 percent) for piping 4" and larger.
- G. Extend building drain to connect to sewer piping, of size and in location indicated for service entrance to building. Sewer piping is specified in a separate section of Division 2.
- H. Install sleeve and sleeve seal through foundation wall for watertight installation.

3.04 INSTALLATION OF PIPING SPECIALTIES

- A. Above Ground Cleanouts: Install in above ground piping and building drain piping as indicated, and:
 - 1. as required by plumbing code;
 - 2. at each change in direction of piping greater than 45 degrees;
 - 3. at minimum intervals of 50' for piping 4" and smaller and 100' for larger piping;
 - 4. at base of each vertical soil or waste stack.
- B. Cleanout Covers: Install floor and wall cleanout covers for concealed piping, types as indicated.
- C. Vent Flashing Sleeves: Install on stacks passing through roof, secure over stack flashing in accordance with manufacturer's instructions.

3.05 CONNECTIONS

- A. Piping Runouts to Fixtures: Provide drainage and vent piping runouts to plumbing fixtures and drains, with approved trap, of sizes indicated; but in no case smaller than required by the plumbing code.
- B. Locate piping runouts as close as possible to bottom of floor slab supporting fixtures or drains.

3.06 FIELD QUALITY CONTROL

- A. Inspections
 - 1. Do not enclose, cover, or put into operation drainage and vent piping system until it has been inspected and approved by the authority having jurisdiction.
 - 2. During the progress of the installation, notify the plumbing official having jurisdiction, at least 24 hours prior to the time such inspection must be made. Perform tests specified below in the presence of the plumbing official.
 - 3. Rough-in Inspection: Arrange for inspection of the piping system before concealed or closed-in after system is roughed-in, and prior to setting fixtures.
 - 4. Final Inspection: Arrange for a final inspection by the plumbing official to observe the tests specified below and to insure compliance with the requirements of the plumbing code.
 - 5. Reinspections: Whenever the piping systems fails to pass the test or inspection, make the required corrections, and arrange for reinspected by the plumbing official.

3.07 PIPING SYSTEM TEST

- A. Test for leaks and defects all new drainage and vent piping systems and parts of existing systems, which have been altered, extended or repaired. If testing is performed in segments, submit a separate report for each test, complete with a diagram of the portion of the system tested.
- B. Leave uncovered and unconcealed all new, altered, extended, or replaced drainage and vent piping until it has been tested and

approved. Expose all such work for testing, that has been covered or concealed before it has been tested and approved.

3.08 DRAINAGE AND VENTING SYSTEM TESTING PROCEDURES

- A. Rough Plumbing: Except for outside leaders, test the piping of plumbing drainage and venting systems upon completion of the rough piping installation. Tightly close all openings in the piping system, and fill with water to the point of overflow, but not less than 10 feet head of water. Water level shall not drop during the period from 15 minutes before the inspection starts, through completion of the inspection. Inspect all joints for leaks.
- B. Finished Plumbing: After the plumbing fixtures have been set and their traps filled with water, their connections shall be tested and proved gas and water-tight. Plug the stack openings on the roof and building drain where it leaves the building, and introduce air into the system equal to a pressure of 1" water column. Use a "U" tube or manometer inserted in the trap of a water closet to measure this pressure. Air pressure shall remain constant without the introduction of additional air throughout the period of inspection. Inspect all plumbing fixture connections for gas and water leaks.
- C. Repair all leaks and defects using new materials and retest system or portion thereof until satisfactory results are obtained.

3.09 ADJUSTING AND CLEANING

- A. Clean interior of piping. Remove dirt and debris as work progresses.

3.10 PROTECTION

- A. Protect drains during remainder of construction period, to avoid clogging with dirt and debris, and to prevent damage from traffic and construction work.
- B. Place plugs in ends of uncompleted piping at end of day or whenever work stops.

END OF SECTION

SECTION 15440
PLUMBING FIXTURES

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. Related Sections:

Separate grab bars and toilet accessories not an integral part of plumbing fixtures are specified in Division 10.

Electrical Requirements For Mechanical Equipment, Water Heaters and other plumbing equipment are specified in other Sections of Division 15.

1.02 SUMMARY

- A. This Section specifies plumbing fixtures and trim. The types of fixtures specified include the following:

- Lavatories;
 - Service Sinks;
 - Water Closets;
 - Wall Mounted Water Coolers;
 - Faucets;
 - Toilet Seats;
 - Fittings, Trim, and Accessories.

1.03 QUALITY ASSURANCE

- A. Codes and Standards:

- ASHRAE Standard 18: "Method of Testing for Rating Drinking Water Coolers with Self-Contained Mechanical Refrigeration Systems."

- ARI Standard 1010: "Drinking-Fountains and Self-Contained Mechanically-Refrigerated Drinking-Water Coolers"

UL Standard 399: "Drinking-Water Coolers."

1.04 SUBMITTALS

- A. Product Data: Submit Product Data and installation instructions for each fixture, faucet, specialties, accessories, and trim specified; clearly indicate rated capacities of selected models of water coolers.
- B. Wiring Diagrams: Submit manufacturer's electrical requirements and wiring diagrams for power supply to units. Clearly differentiate between portions of wiring that are factory installed and field installed portions.
- C. Maintenance Data: Include data in Maintenance Manual specified in Division 1 and Section 15010.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Store fixtures where environmental conditions are uniformly maintained within the manufacturer's recommend temperatures to prevent damage.
- B. Store fixtures and trim in the manufacturer's original shipping containers. Do not stack containers or store in such a manner that may cause damage to the fixture on trim.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturer uniformity shall be as specified in Section 15010: Basic Mechanical Requirements under Product Options.
- B. Subject to compliance with specified requirements, provide plumbing fixtures of one of the following:

Lavatories, Service Sinks, Water Closets:

American Standard; U.S. Plumbing Products.
Crane Co.
Eljer Plumbingware Div.; Household International Co.
Kohler Co.

Faucets:

American Standard; U.S. Plumbing Products.
Artistic Brass.
Chicago Faucet Co.
Delta Faucet Co.; Div. Of Masco Corp.
Eljer Plumbingware Div.; Household International Co.
Kohler Co.

Water Closet Seats:

Bemis Mfg. Co.
Beneke Corp.
Forbes-Wright Industries, Inc.; Church Products.
Olsonite Corp.; Olsonite Seats.

Water Coolers:

Ebco Mfg. Co.
Elkay Mfg. Co.
Filtrine Manufacturing Co.
Halsey Taylor Div.; Household International Co.
Haws Drinking Faucet Co.
Western Drinking Fountains; Div. Of Sunroc Corp.

Service Sinks:

American Standard; U.S. Plumbing Products.
Crane Co.
Eljer Plumbingware Div.; Household International Co.
Kohler Co.

2.02 FIXTURES

- A. Lavatory (L-1): 19" X 17" enameled cast iron lavatory, with 14½" X 8 7/8" rectangular basin, splash lip, front overflow, fabricated for concealed wall hanger, and soap depression. Drill lavatories for 8" center faucets. Provide concealed wall hanger, "Type-A" faucet, trap, and supplies and stops as specified in the Articles below.
- B. Service Sinks (S-1): 24" X 20" acid-resisting enameled inside, cast iron service sink with back wall hanger and with stainless steel rim guard. Provide complete with service sink cast iron trap standard to wall, having acid resisting enamel finish inside, painted outside, with cleanout plug and strainer, and outlet for 3" iron pipe. Provide "Type-B" faucet as specified in the Articles below.

- C. Water Closet (WC-1): Vitreous china, close-coupled, shelf-top tank/closet combination; bottom outlet, floor mounted, siphon jet elongated closet bowl, with self-draining jets and large passageway; complete with anti-siphon float valve and flush valve unit. Provide mounting bolt covers same color as fixture. Provide inside calk or threaded bronze floor flange with impregnated felt gasket. Provide seat, and supplies and stops as specified in the Articles below.

2.03 WATER COOLERS

A. Wall Mounted Water Coolers:

1. Units shall be factory assembled and tested, listed and labeled in compliance with UL Standard 399, and have capacities rated in accordance with ASHRAE Standard 18, and ARI Standard 1010.
2. Cabinet: Heavy gauge, welded steel cabinet, with removable vinyl front panel and hanger bracket for wall mounting. Cabinet finish and vinyl color as selected by the Architect/Engineer.
3. Top: Deep basin, anti-splash, smoothly contoured stainless steel with raised bubbler mount, chrome plated brass strainer, and 1¼" tailpiece.
4. Bubbler and Valve: Chrome plated brass, automatic stem control, push-button valve with bubbler designed to provide uniform steam without spurting.
5. Refrigeration System: Refrigerant per latest EPA standards, hermetically sealed, capillary tube. All joints silver soldered.
6. Compressor: heretically sealed, with automatic reset overload protection.
7. Condenser: Air-cooled.
8. Cooling Unit: Tube type, self-cleaning, continuous coil of seamless copper.
9. Temperature Control: Thermostat with adjustable range of 42 deg. F. to 53 deg F.

10. Electrical Characteristics: 120 volts, 60 Hz, 1/5 HP, 5.2 amperes, provide 3-prong power lead-in cord.
11. Capacity: 8.2 GPH of 50 deg F water, with ambient temperature of 90 deg f, and 80 deg F entering water temperature.
12. Connections: Provide trap and supply and stop as speified in the articles below.

2.04 FAUCETS

- A. Lavatory Faucet (Type-A): Polished chrome plated cast brass, 8" center set, 4" spout with chrome-plated constant flow aerator, crown handles indexed "HOT" and "COLD" and 1¼" chrome-plated pop-up waste.
- B. Service Sink Faucet (Type-B): Rough chrome plated cast brass, combination service sink fitting with vacuum breaker, ¾" threaded hose spout, metal lever handles indexed "HOT" and "COLD" plus red and blue index tables, pail hook and flanged female supply arms and having integral stops.

2.05 FITTINGS, TRIM, AND ACCESSORIES

- A. Toilet Seats: elongated, solid white plastic, closed back/open front, less cover.
- B. Supplies and Stops for Lavatories and Sinks: polished chrome-plated, loose-keyed angle stop having ½" inlet and 3/8" O.D. x 12" long flexible tubing outlet, and wall flange and escutcheon.
- C. Supplies and Stops for Water Closets: polished chrome-plated, loose-keyed angle stop having ½" inlet and 3/8" O.D. x 12" long flexible tubing outlet with collar, and wall flange and escutcheon.
- D. Traps: cast brass, 1¼" adjustable "P" trap with cleanout and waste to wall.
- E. Escutcheons: chrome-plated sheet steel with friction clips.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Verify all dimensions by field measurements. Verify that all plumbing fixtures may be installed in accordance with pertinent codes and regulations, the original design, and the referenced standards.
- B. Examine rough-in for potable water and waste piping systems to verify actual locations of piping connections prior to installing fixtures.
- C. Examine walls, floors for suitable conditions where fixtures are to be installed.
- D. Do not proceed until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Install plumbing fixtures level and plumb, in accordance with fixture manufacturer's written instructions, rough-in drawings, and pertinent codes and regulations, the original design, and the referenced standards.
- B. Fasten plumbing fixtures securely to supports or building structure. Secure supplies behind or within wall construction to provide rigid installation.
- C. Install a stop valve in an accessible location in the water connection to each fixture.
- D. Install escutcheons at each wall, floor and ceiling penetration in exposed finished locations and within cabinets and millwork.
- E. Seal fixtures to walls and floors using silicone sealant. Match sealant color to fixture color.

3.03 FIELD QUALITY CONTROL

- A. Test fixtures to demonstrate proper operation upon completion of installation and after units are water pressurized. Replace malfunctioning units, then retest.
- B. Inspect each installed unit for damage. Replace damaged fixtures.

3.04 ADJUSTING

- A. Adjust water pressure at drinking fountains, faucets, shower valves, and flush valves to provide proper flow and stream.
- B. Replace washers of leaking or dripping faucets and stops.
- C. Clean fixtures, trim, and strainers using manufacturer's recommended cleaning methods and materials.

END OF SECTION

SECTION 15458

WATER HEATERS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. Division-15 Basic Mechanical Materials and Methods sections apply to work of this section.

1.02 DESCRIPTION OF WORK

- A. Extend of water heater work required by this section is indicated on drawings and schedules, and by requirements of this section.
- B. Electrical Work: Provide the following wiring as work of this section, in accordance with requirements of Division 16:
- C. Provide factory-mounted and factory-wired controls and electrical devices as specified in this section.
- D. Refer to Division-16 sections for other electrical wiring including motor starters, disconnects, wires/cables, raceways, and other required electrical devices; not work of this section.

1.03 QUALITY ASSURANCE

- A. Codes and Standards:
 - 1. UL Compliances: Construct water heaters in accordance with the following UL standards:
 - UL 174, "Household Electric Storage-Tank Water Heaters".
- B. Provide water heater components which are UL-listed and labeled.
- C. NEC Compliance: Install electric water heaters in accordance with requirements of NFPA 70, "National Electrical Code".

- D. ASME code Symbol Stamps: Provide water heaters and safety relief valves which comply with ASME Boiler and Pressure Vessel Code, and are stamped with appropriate code symbols.

1.04 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data including rated capacities and efficiencies of selected model clearly indicated; operating weights; furnished specialties and accessories; and installation and start-up instructions.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Handle water heaters and components carefully to prevent damage, breaking, denting and scoring. Do not install damaged water heaters or components; remove from site and replace with new.
- B. Store water heaters and components in clean dry place. Protect from weather, dirt, fumes, water, construction debris, and physical damage.

PART 2 – PRODUCTS

2.01 ELECTRIC WATER HEATERS

- A. General: Provide electric water heater of sizes, capacities, and electrical characteristics as indicated on the drawings.
- B. Heater: Construct for working pressure of 150 PSI; magnesium anode rod; glass lining on internal surfaces exposed to water.
- C. Heating Elements: Low watt density with zinc plated copper sheath; double element, non-simultaneous operation.
- D. Safety Controls: Equip with high temperature cutoff for each element, factory wired.
- E. Jacket: Equip with full size control compartments with front panel opening. Insulate tank with vermin-proof glass fiber insulation. Provide outer steel jacket with baked enamel finish.
- F. Accessories: Provide brass drain valve; $\frac{3}{4}$ " relief valve; cold and water dip tube.
- G. Controls: Provide thermostat for each element, factory wired.

- H. Manufacturers: Subject to compliance with requirements, provide residential electric water heaters of one of the following:

Lockinvar Water Heater Corp.
Rheem Water Heater Div; City Investing Co.
Ruud Water Heater Div; City Investing Co.
Smith Corp. (A.O.); Consumer Products Div.
State Industries, Inc.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Examine areas and conditions under which water heater is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.02 INSTALLATION OF WATER HEATERS

- A. General: Install water heaters in accordance with manufacturer's installation instructions. Install units plumb and level and maintain manufacturer's recommended clearances.
- B. Piping: Connect hot and cold water piping to units with shutoff valves and unions. Extend relief valve discharge to closest floor drain, or as indicated.

3.03 ELECTRIC WATER HEATERS

- A. Electrical Wiring: Install electrical devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer's wiring diagram submittal to Electrical Installer.
- B. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division-16 sections. Do not proceed with water heater start-up until wiring installation is acceptable to water heater Installer.

3.04 FIELD QUALITY CONTROL

- A. Start-up: Start-up, test, and adjust electric water heaters in accordance with manufacturer's start-up instructions. Check and calibrate controls.

END OF SECTION

SECTION 15488
NATURAL GAS SYSTEMS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to this section.

The requirements of the following Division-15 Sections apply to this Section:

“Basic Mechanical Requirements”;
“Basic Piping Materials and Methods”;
“Supports and Anchors.”

1.02 SUMMARY

- A. This Section specifies distribution piping systems for natural gas and manufactured gas within the building and extending from the point of delivery to the connections with gas utilization devices. Piping materials and equipment specified in this Section include:
- Pipes, fittings, and specialties;
Special duty valves.
- B. This Section does not apply to LP-gas piping; industrial gas applications using such gases as acetylene and acetylenic compounds, hydrogen, ammonia, carbon monoxide, oxygen and nitrogen; gas piping, meters, gas pressure regulators and other appurtenances used by the serving gas supplier in distribution of gas.
- C. Gas pressures for systems specified in this section are limited to 5 psig.
- D. Products installed but not furnished under this Section include gas meters which may be provided by the utility company, to the site, ready for installation. The contractor shall coordinate with the local utility company to verify requirements.

1.03 Related Sections: The following Sections contain requirements that relate to this Section:

- A. Division-2 Section: "Fuel Gas Service Piping." For fuel gas service piping which is underground, outside the building, and connecting the "Gas Distribution Piping" to public utilities (or connecting groups of buildings on the same site).
- B. Division-2 Section: "Earthwork." For trenching and backfilling for installation of gas piping.
- C. Division-15 Section: "Mechanical Identification." For labeling and identification of gas piping systems.

1.04 DEFINITIONS

- A. Pipe sizes used in this Specification are Nominal Pipe Size (NPS).
- B. Gas Distribution Piping: A pipe within the building which conveys gas from the point of delivery to the points of usage.
- C. Gas Service Piping: The pipe from the gas main or other source of supply including the meter, regulating valve, or service valve to the gas distribution system of the building served.
- D. Point of Delivery is the outlet of the service meter assembly, or the outlet of the service regulator (service shutoff valve when no meter is provided).

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Installation and replacement of gas piping, gas utilization equipment or accessories, and repair and servicing of equipment shall be performed only by a qualified installer. The term qualified means experienced in such work (experienced shall mean having a minimum of 5 previous projects similar in size and scope to this project), familiar with precautions required, and has complied with the requirements of the authority having jurisdiction. Upon request, submit evidence of such qualifications to the Architect.
- B. Regulatory Requirements: Comply with the requirements of the following codes:

NFPA 54 – National Fuel Gas Code, for gas piping materials and components, gas piping installations, and inspection, testing, and purging of gas piping systems.

Local code requirements or BOCA Basic National Mechanical Code.

1.06 SEQUENCING AND SCHEDULING

- A. Coordinate the installation of pipe sleeves for wall penetrations.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturer: Subject to compliance with requirements, provide gas piping system products from one of the following:
- B. Gas Cocks:

Jenkins Bros.
Lunkenheimer Co.
NIBCO, Inc.
Powell Co.
Stockham.

2.02 PIPE AND TUBING MATERIALS

- A. General: Refer to Part 3, Article “PIPE APPLICATION” for identification of systems where the below specified pipe and fitting materials are used.
- B. Steel Pipe: ASTM A 120, Schedule 40, seamless, black steel pipe, beveled ends.

2.03 FITTINGS

- A. Malleable-Iron Threaded Fittings: ANSI B16.3, Class 150, standard pattern, for threaded joints. Threads shall conform to ANSI B1.20.1
- B. Joint Compound: suitable for the gas being handled.

2.04 PIPING SPECIALTIES

- A. Unions: ANSI B16.39, Class 150, black malleable iron; female pattern; brass to iron seat; ground joint.
- B. Protective Coating: When piping will be in contact with material or atmosphere exerting a corrosive action, pipe and fittings shall be factory-coated with polyethylene tape.
- C. Prime pipe and fittings with a compatible primer prior to application of tape.

2.05 VALVES

- A. General duty valves (i.e., gate, globe, check, ball, and butterfly valves) are specified in Division-15 Section "Valves." Special duty valves are specified in this Article by their generic name; refer to Part 3 below, Article "VALVE APPLICATION" for specific uses and applications for each valve specified.
- B. Gas Cocks 2 Inch and Smaller: 150 psi WOG, bronze body, straightaway pattern, square head, threaded ends.

PART 3 – EXECUTION

3.01 PREPARATION

- A. Conform with the requirements in NFPA 54, for the prevention of accidental ignition.

3.02 PIPE APPLICATIONS

- A. Use steel pipe with threaded joints and fittings for 2 inch and smaller, and with welded joints for 2½ inch and larger.

3.03 PIPING INSTALLATIONS

- A. General: Install piping to conform with the requirements of NFPA 54 – National Fuel Gas Code.
- B. Locations and Arrangements: Drawings (plans, schematics, and diagrams) indicated the general location and arrangement of piping systems. Design locations and arrangements of piping take into consideration pipe sizing, flow direction, slope of pipe, expansion, and other design considerations. So far as practical, install piping as indicated.

- C. Above-Ceiling Locations: Gas piping may be installed in accessible above-ceiling spaces (subject to the approval of the authority having jurisdiction), whether or not such spaces are used as a plenum.
- D. Prohibited Locations: Do not install gas piping in or through a circulating air duct, chimney or gas vent or ventilating duct. This does not apply to accessible above-ceiling space specified above.
- E. Hanger, supports, and anchors are specified in Division-15 Section "SUPPORTS AND ANCHORS." Conform to the table below for maximum spacing of supports:

Steel Pipe:

<u>SIZE (NPS)</u>	<u>SPACING IN FEET</u>
$\frac{1}{2}$	6
$\frac{3}{4}$ to 1	8
1 $\frac{1}{4}$ and larger (horizontal)	10

- F. Install gas piping at a uniform grade of $\frac{1}{4}$ inch in 15 feet, upward to risers, and from the risers to the meter or the equipment.
- G. Make reductions in pipe sizes using eccentric reducer fittings installed with the level side down.
- H. Make changes in directions and branch connections using fittings.
- I. Install unions in pipes 2 inch and smaller, adjacent to each valve, at final connections each piece of equipment, and elsewhere as indicated.

3.04 PIPE JOINTS

- A. Threaded Joints: conform to ANSI B1.20.1, tapered pipe threads for field cut threads. Join pipe, fittings, and valves as follows:
- B. Note the internal length of threads in fittings or valve ends, and proximity of internal seat or wall, to determine how far pipe should be threaded into joint. Refer to NFPA 54, for guide for number and length of threads for field threading steel pipe.
- C. Align threads at point of assembly.

- D. Apply appropriate tape or thread compound to the external pipe threads.
- E. Assemble joint to appropriate thread depth. When using a wrench on valves place the wrench on the valve and into which the pipe is being threaded.
- F. Damaged Threads: Do not use pipe with threads which are stripped, chipped, corroded, or otherwise damaged. If a weld opens during cutting or threading operations, that portion of pipe shall not be used.

3.05 VALVE APPLICATIONS

- A. General: The Drawings indicate valve types, locations, and arrangements.
- B. Shut-off duty: Use gas cocks specified in Part 2 above.

3.06 VALVE INSTALLATIONS

- A. Install valves in accessible locations, protected from physical damage.
- B. Install a gas cock upstream of each gas pressure regulator. Where two gas pressure regulators are installed in series in a single gas line, a manual valve is not required at the second regulator.

3.07 TERMINAL EQUIPMENT CONNECTIONS

- A. Install gas cock upstream and within 6 feet of gas appliance. Install a union connection downstream from the gas cock to permit removal of controls.
- B. Sediment Traps: Install a tee fitting with the bottom outlet plugged or capped as close to the inlet of the gas appliance as practical. Drip leg shall be a minimum of 3 pipe diameters in length.

3.08 FIELD QUALITY CONTROL

- A. Piping Tests: Inspect, test, and purge natural gas systems in accordance with NFPA 54, and local utility requirements.

END OF SECTION

SECTION 15620
FUEL-FIRED HEATERS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.02 DESCRIPTION OF WORK

- A. Extent of fuel-fired heater work required by this section is indicated on drawings and schedules, and by requirements of this section.
- B. Types of fuel-fired heaters specified in this section include the following:

Gas-Fired Propeller Unit Heaters.

- C. Refer to appropriate Division-15 sections for fuel piping in connection with fuel-fired heaters; not work of this section.

1.03 Provide the following electrical work as work of this section, complying with requirements of Division-16 sections:

- A. Control wiring between field-installed controls, indicating devices, and heater control panels.

1.04 CODES AND STANDARDS

UL Compliance: Construct and install oil-fired unit heaters in accordance with UL 731 "Oil-Fired Unit Heaters."

ANSI Compliance: construct and install gas-fired unit heaters in accordance with ANSI Z83.8 "Gas Unit Heaters."

NFPA Compliance: Install fuel gas piping and gas-fired heaters in accordance with NFPA 54 "National Fuel Gas Code."

1.05 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data, including rated capacities of selected model clearly indicated, weights, furnished specialties and accessories; and installation and start-up instructions.
- B. Maintenance Data: Submit maintenance data and parts list for each type of fuel-fired heater, control, and accessory; including "trouble-shooting" maintenance guide. Include this data and product data in maintenance manual; in accordance with requirements of Division 1.

1.06 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Handle fuel-fired heaters and components carefully to prevent damage, breaking, denting and scoring. Do not install damaged fuel-fired heaters or components; replace with new.
- B. Store fuel-fired heaters and components in lean dry place. Protect from weather, dirt, fumes, water, construction debris, and physical damage.
- C. Comply with Manufacturer's rigging and installation instructions for unloading fuel-fired heaters, and moving them to final location.

PART 2 – PRODUCTS

2.01 GAS-FIRED PROPELLER UNIT HEATERS

- A. General: Provide gas-fired propeller unit heaters as indicated, of type and minimum capacity as scheduled, and as specified herein.
- B. Construct casing of galvanized steel, with baked enamel finish. Provide integral inserts for hanger rods.

Provide 4-way air diffusion louvers mounted on face of unit.
- C. Construct heat exchanger of stainless steel. Provide draft diverter or collector box and integral power exhauster as required, construct integral to each heat exchanger section. Provide oval or round flue collar.
- D. Construct burner of same material as heat exchanger, and include integral burner crossover. Design burner to be suitable for propane or natural gas.

- E. Construct fan of aluminum, direct drive propeller type, and factory-balance.
- F. Provide motor, totally enclosed sleeve or ball-bearing type, with built-in thermal overload protection, designed for 115 volts, 60 cycle, single phase. Mount motor on resilient mount and provide heavy-duty fan guard.
- G. Provide the following controls, factory-piped and prewired to electrical junction box mounted on unit:
 - 115 or 24 volt automatic gas valve.
 - Safety pilot with 100% shutoff.
 - Pressure regulator with leak limiting device.
 - High limit switch.
- H. Certify units are in conformance with AGA applicable regulations.
- I. Provide the following accessories, factory-mounted, and prewired to electrical junction box:
 - Electric spark ignition.
- J. Provide temperature controls consisting of line or low voltage room thermostat with thermostat guard.
- K. Manufacturer: Subject to compliance with requirements, provide gas-fired propeller unit heaters of one of the following:
 - Hastings Industries, Inc.
 - ITT Reznor
 - Lennox Industries, Inc.
 - Modine Manufacturing Co.

PART 3 – EXECUTION

3.01 INSPECTION

- A. Examine areas and conditions under which fuel-fired heaters are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.02 INSTALLER OF GAS-FIRED PROPELLER UNIT HEATERS

- A. General: Install gas-fired propeller unit heaters as indicated, and in accordance with manufacturer's published installation instructions.
- B. Hang units from substrate using threaded rods and building attachments, secure rods to unit hanger attachments. Adjust hangers so unit is plumb and level.
- C. Extend gas piping to within 5' from unit, provide drop with manual gas shutoff valve, 1/8" NPT plugged test connection, tee, and drip pocket. Locate piping drop so as to not interfere with service of unit. Extend gas piping runout, full size of gas train inlet, from tee to gas train connection, provide union with sufficient clearance for unit removal and service.
- D. Extend power wiring from fused disconnect to electrical junction box on unit. Install thermostat in indicated location, provide line or low voltage wiring as required from thermostat to electrical junction box on unit. Comply with requirements of Division 16 for wiring.
- E. Extend breeching from flue to unit heater, make gas tight connection.

3.03 START-UP

- A. Start-up, test, and adjust fuel-fired heaters in accordance with manufacturer's published start-up instructions. Adjust air diffusion louvers for proper air flow. Verify proper line and manifold gas pressure. Check and calibrate controls, adjust burner for maximum efficiency.

END OF SECTION

SECTION 15782

ROOFTOP HEATING AND COOLING UNITS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

Division-15 Basic Mechanical Materials and Methods sections apply to work of this section.

1.02 SUMMARY

- A. Section includes package rooftop heating and cooling units.
- B. Related Sections:

Section 15488 – Natural Gas Systems

Section 15891 – Ductwork

Section 15990 – Testing, Adjusting, and Balancing

Section 16142 – Electrical Connections for Equipment

1.03 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data, including rated capacities of selected model clearly indicated, dimensions, required clearances, weights, furnished specialties and accessories; and installation and start-up instructions.

- B. Shop Drawings:

Submit shop drawings detailing the manufacturer's electrical requirements for power supply wiring for rooftop cooling units. Submit manufacturer's ladder-type wiring diagrams for interlock and control wiring. Clearly differentiate between portions of wiring that are factory-installed and portions to be field-installed.

Submit shop drawings detailing the mounting, securing, and flashing of the roof curb to the roof structure. Indicate coordinating requirements with roof membrane system.

- C. Operation and Maintenance Data: Submit maintenance data and parts list for each rooftop units, including "trouble-shooting" maintenance guide, servicing guide and preventative maintenance schedule and procedures. Include this data in maintenance manual; in accordance with requirements of Division 1.

1.04 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of rooftop heating and cooling units, of types and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years.

- B. Codes and Standards:

Testing and rating of rooftop units under 135,000 btu/hr capacity shall be in accordance with ARI 210 "Standard for Unitary Air-Conditioning Equipment", and provide Certified Rating Seal. Sound testing and rating of units shall be in accordance with ARI 270 "Standard for Sound Rating of Outdoor Unitary Equipment". Units shall bear Certified Rating Seal.

Refrigerating system construction of rooftop units shall be in accordance with ASHRAE 15 "Safety Code for Mechanical Refrigeration".

Energy Efficiency Ratio (EER) of rooftop units shall be equal to or greater than prescribed by ASHRAE 90A "Energy Conservation in New Building Design".

Rooftop units shall be designed, manufactured, and tested in accordance with UL requirements.

Gas-fired furnace section construction shall be in accordance with AGA safety standards. Furnace section shall bear the AGA label.

Testing and rating of rooftop units of 135,000 btu/hr capacity or over shall be in accordance with ARI 360 "Standard for Commercial and Industrial Unitary Air-Conditioning Equipment".

Testing and rating of rooftop units under 135,000 btu/hr capacity shall be in accordance with ARI 210 "Standard for Unitary Air-Conditioning Equipment", and provide Certified Rating Seal. Sound testing and rating of units shall be in accordance with ARI 270

“Standard for Sound Rating of Outdoor Unitary Equipment”. Units shall bear Certified Rating Seal.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Handle rooftop units and components carefully to prevent damage. Replace damaged rooftop units or components with new.
- B. Store rooftop units and components in clean dry place, off the ground, and protect from weather, water, and physical damage.
- C. Rig rooftop units to comply with manufacturer’s rigging and installation instructions for unloading rooftop units, and moving them to final location.

1.06 SCHEDULING AND SEQUENCING

- A. Coordinate installation of roof mounting curb with roof structure.
- B. Coordinate roof opening locations and for mechanical and electrical connections.

1.07 MAINTNANCE

- A. Extra Materials: Furnish to Owner, with receipt, the following spare parts for each rooftop cooling unit:

One set of matched fan belts for each belt-driven fan.

One set filters for each unit.

PART 2 – PRODUCTS

2.01 ROOFTOP UNITS LESS THAN 20 TONS

- A. Manufacturers: Subject to compliance with requirements, provide rooftop units of one of the following:

Carrier Air Conditioning; Div of Carrier Corp.
Lennox Industries, Inc.
Trane (The) Co.; Div of American Standard Inc.
Armstrong Air Conditioning, Inc.

- B. General Description: Units shall be factory-assembled and tested, designed for roof or slab installation, and consisting of compressors, condensers, evaporator coils, condenser and

evaporator fans, refrigeration and temperature controls, filters, and dampers. Capacities and electrical characteristics are scheduled on the Drawings.

- C. Casing: manufacturer's standard casing construction, having corrosion protection coating, and exterior finish. Casings shall have removable panels or access doors for inspection and access to internal parts, a minimum of ½" thick thermal insulation, knockouts for electrical and piping connections and an exterior condensate drain connection and lifting lugs.
- D. Roof Curbs: manufacturer's standard construction, insulated and having corrosive protective coating, complete with factory-installed wood nailer and drain nipple. Construction shall be in accordance with NRCA Standards.
- E. Evaporator fans: forward-curved, centrifugal, belt-driven fans with adjustable sheaves or direct-driven fans; and permanently lubricated motor bearings.
- F. Condenser fans: propeller-type, direct-driven fans with permanently lubricated bearings.

2.02 COILS

- A. General: Aluminum plate fin and seamless copper tube type. Fins shall have collars drawn, belled and firmly bonded to the tubes by means of mechanical expansion of the tubes. No soldering or tinning shall be used in the bonding process. Coils shall be mounted in the coil casing with same and connections accessible for service. Coils shall be removable from the unit through the roof or through the piping enclosure. Coil section shall be completely insulated.
- B. Refrigerant cooling coils: have an equalizing type vertical distributor to ensure each coil circuit receives the same amount of refrigerant. Coils shall be proof (450 psig) and leak (300 psig) tested with air pressure under water, then cleaned, dehydrated, and sealed with a holding charge of nitrogen.

2.03 Compressors: fully hermetic compressors, complete with integral vibration isolators and crankcase heaters.

2.04 Economizer control: return and outside air dampers, outside air filter, fully modulating electric control system with enthalpy control, and adjustable mixed-air thermostat. System shall have 100 percent outside air

capability. Provide automatic changeover through adjustable enthalpy control device.

- 2.05 Heat exchangers: manufacturer's standard construction for gas-fired heat exchangers and burners.

Controls:

redundant gas valve;
electronic spark ignition system;
high limit cutout;
forced draft proving switch.

- 2.06 Accessories: Units shall include the following accessories as indicated or scheduled:

Thermostat: Assembly shall provide for cooling on standard subbase.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Examine areas and conditions under which rooftop units are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.02 INSTALLATION

- A. General: Install rooftop units in accordance with manufacturer's installation instructions. Install units plumb and level, firmly anchored in locations indicated, and maintain manufacturer's recommended clearances.

END OF SECTION

SECTION 15880
MECHANICAL AIR DISTRIBUTION

PART 1 - GENERAL

1.01 RELATED SECTIONS

- A. The General Conditions of the Contract, Supplementary Conditions, and General Requirements are a part of and apply to this Section. Consult them for additional conditions and requirements.

1.02 SECTION INCLUDES

- A. Air filters
- B. Duct accessories
- C. Ductwork
- D. Grilles, registers, and diffusers
- E. Louvers

1.03 CONTENT SUMMARY

- A. Access panels
- B. Fan Powered Boxes
- C. Control dampers
- D. Duct liner
- E. Elbows and turning vanes
- F. Flexible connections
- G. Flexible duct and fittings
- H. Grilles, registers and diffusers
- I. HVAC ductwork
- J. Sealants

1.04 SUBMITTALS

- A. Comply with Section 15010.
- B. Product Data:
 - 1. Access Panels
 - 2. Fan Powered Boxes
 - 3. Dampers
 - 4. Duct Liner
 - 5. Flexible Duct And Fittings
 - 6. Grilles, Registers, Diffusers
 - 7. Louvers
 - 8. Sealants

PART 2 - PRODUCTS

2.01 ACCESS PANELS IN DUCTS AND EQUIPMENT

- A. Access panels shall consist of three, one piece stampings: the door frame, the door, and the pan. Space between door and pan shall be filled with 1/2-inch thick insulation. The door shall be hung with loose-pin hinges.

- B. Access panel sizes shall be as follows unless otherwise indicated on drawings:

SIZE OF DUCT TO BE ACCESSED Inches	PANEL SIZE Inches	METAL FRAME	GAUGES OF		NUMBER OF	
			DOOR	PAN	HINGES	LATCHES
6 – 8	6 x 8	24	26	28	2	1
10 - 12	10 x 12	22	24	28	2	1
12 - 16	12 x 16	20	24	28	2	2
18 and larger	16 x 24	20	22	28	3	2

- C. Access doors shall be fabricated in accordance with the details in the SMACNA duct manuals. Latches and hinges shall be equal to Ventlok of appropriate type and size.
- D. Acceptable Manufacturers:
1. Ventfabrics Inc.
 2. C. E. Sparrow Company

2.02 DUCT LINER

- A. General:
1. Duct liner shall comply with the requirements of NFPA 90A and the "Duct Liner Materials Standard" of the Thermal Insulation Manufacturers Association.
- B. Square and Rectangular Duct Liner:
1. Flexible blanket with factory coated edges conforming to ASTM C1071.
 2. K value: 0.25 at 75 degrees Fahrenheit.
 3. Noise reduction coefficient: Minimum of 0.65 based on type-A mounting.
 4. Velocity rating: Minimum of 5000 feet per minute.
 5. Adhesive: UL listed waterproof type.
 6. Fasteners: Duct liner galvanized steel pins.
 7. Manville Permacote, Linacastic HP, or equal by Certain-teed or Owens Corning.
- C. Duct Liner Schedule:

<u>APPLICATION</u>		<u>LINER DENSITY</u> Pounds per Cubic Foot	<u>LINER THICKNESS</u> Inches
1.	All exterior rectangular supply ducts	1.5	1.5
2.	All interior rectangular supply ducts	1.5	1.0

- D. Duct sizes shown on drawings are interior clear dimensions.

2.03 ELBOWS AND TURNING VANES

- A. Elbows shall have radius equal to duct depth wherever possible. Where necessary, mitered elbows may be used with turning vanes.
- B. Turning vanes shall be single-walled and formed to assure that any joint on one blade is equidistant from the same point on an adjacent blade. Double-walled turning vanes shall

be used only where shown on the drawings or where required for strength of vanes and shall be approved by engineer and owner prior to installation. Construction of all turning vanes shall conform to SMACNA standards. Vanes longer than 86" shall be provided with intermediate supports. Edges of vanes shall be parallel with sides of elbow.

C. Acceptable Manufacturers:

1. Tuttle & Bailey
2. Barber-Colman

2.04 FLEXIBLE CONNECTIONS

A. Exposed to weather: Ventlon

B. Not exposed to weather: Ventglas

C. Acceptable Manufacturers:

1. Ventfabrics, Inc.

2.05 FLEXIBLE DUCT AND FITTINGS

A. Flexible duct shall conform to Class I requirements of NFPA Bulletin No. 90A with a flame spread rating of 25 or less and a smoke developed rating not higher than 50.

B. Ducts shall be either corrugated aluminum or fabric supported by helically wound steel wire or flat steel strips. Ducts shall have a minimum working pressure of six inches WG positive pressure, two inches WG negative pressure, and 2500 FPM velocity.

C. All flexible ducts shall be insulated unless otherwise indicated. Insulation shall be minimum one-inch thick fiberglass with K value of 0.23 at 75 degrees Fahrenheit.

D. Takeoff fittings shall be conical with quadrant damper unless otherwise indicated.

E. Acceptable Manufacturers:

1. Wiremold
2. Omni-Air
3. Flexmaster Type 5-Insulated
4. Thermaflex

2.06 GRILLES, REGISTERS, AND DIFFUSERS

A. Provide frames and mounting hardware appropriate to the installation.

B. Grilles, registers, and diffusers shall have baked off-white finish unless otherwise indicated. Coordinate special colors with general contractor.

C. Acceptable Manufacturers:

1. Titus
2. Carnes
3. Tuttle & Bailey
4. Barber-Colman
5. Anemostat
6. Price

- 7. Krueger
- 8. Metal Aire

2.07 SHEET METAL DUCTWORK

- A. Sheet metal used for duct and plenum construction shall be galvanized steel unless otherwise specified. Galvanized steel shall be of lock forming quality with a zinc coating of 1.25 ounces per square foot on each side.
- B. Ducts and plenums shall be constructed in accordance with the applicable SMACNA duct manuals. Gauge of metal, type of joint, and reinforcing shall be in accordance with SMACNA standards.
- C. Duct construction and installation shall be in accordance with the provisions of the Uniform Mechanical Code.
- D. Factory-made air ducts shall be either Class 0 or Class 1.
- E. Round duct, fittings, and couplings shall be fabricated of prime G90 galvanized steel.

2.08 SEALANTS

- A. Duct sealer shall be a metal-to-metal air pressure sealant which is flexible and self-curing.
- B. Sealant shall be water-resistant and fire resistive when dry in accordance with NFPA 90.

PART 3 - EXECUTION

3.01 DUCT FABRICATION AND INSTALLATION

- A. Exercise the utmost care to obtain a smooth surface inside of all ductwork, absolutely free from small fins, imperfect joints or other obstructions which cause noise and increase friction. Internal ends of slip joints shall be made in the direction of airflow. Ducts shall be securely attached to the building construction in an approved manner.
- B. All ducts and plenums shall be constructed in accordance with the applicable SMACNA duct manuals including gauge of metal, type of joint, and reinforcing.
- C. Factory-made air ducts shall be approved for the use intended or shall conform to the requirements of UMC Standard No. 10-1.
- D. All ductwork shall be fabricated and installed so that no undue vibration or noise results. All joints shall be airtight with additional taping and caulking provided if necessary.
- E. Hang ducts with strap iron attached to bottom of ducts spaced not over five feet center-to-center and according to the SMACNA manual.
- F. Curved elbows shall have a center line radius equal to 1-1/2 times the duct width. Square elbows shall have turning vanes. Job fabricated turning vanes will not be accepted without prior approval. Elbows with square throat and radius heel are not acceptable.
- G. Provide dampers as necessary for proper adjustment and control of air distribution. All dampers shall have rigid bearings and locking quadrants which allow no rattling. All damper rods shall be marked to indicate the relative position of the damper blade with respect to the rod.

- H. Provide 1-inch angle collars for all exposed ducts passing through walls, ceilings, or floors. Anchor collars in position after installation is complete.
- I. Provide flexible connections at inlet and discharge connections of fans and air-handling equipment to prevent mechanical noises from being transmitted to connecting ductwork. Isolators shall be Class 0 or Class 1 and shall not exceed 10 inches in length in accordance with UMC, but shall provide at least 1" slack.
- J. At all places where inside of duct will be visible through return air grilles, louvers, registers, or diffusers, paint normally visible inside portion of duct with flat black paint.
- K. Install hinged access panels on ductwork and housing to provide access to all parts of every automatic damper, fire damper, turning vanes, and all other items requiring maintenance or inspection.
- L. Transitions in ductwork, for changing shapes and sizes, shall be made with angles not exceeding 15 degrees per side wherever possible. Indicate any deviation from this on shop drawings or obtain approval from Engineer.
- M. Where horizontal ducts pass through walls and vertical ducts pass through floors, opening shall be tightly sealed to provide a tight seal between duct and opening.
- N. Ensure that work of other trades do not penetrate ducts. Piping, conduits and similar items shall not pass through ducts.
- O. Provide supports for horizontal flexible ducts at maximum of 36 inches on center using a minimum 3/4-inch wide flat banding material. Joints and connections in flexible ducts shall be made with 1/2-inch wide positive locking steel straps. Length of flexible ducts shall not exceed 6 feet.
- P. Supply connections to terminal boxes shall be straight for a distance of at least 3 duct diameters.
- Q. Ductwork shall be in accordance with the following:

APPLICATION	DUCTWORK REQUIREMENTS	SMACNA PRESSURE CLASS (Pos. or Neg., Note 1)
All rectangular supply and return ductwork	Lined sheet metal	2"
All round supply and return ductwork	Sheet metal, externally wrapped	2"
Note: 1. Based on 1985 edition of SMACNA HVAC duct construction standards.		

3.02 INSTALLATION OF DUCT LINER

- A. Velocities up to 2000 FPM:
 - 1. Duct liner shall be secured with 100 percent coverage of UL listed fire retardant adhesive. In addition to the adhesive, secure liner with mechanical fasteners in accordance with SMACNA to compress the liner and hold it firmly in place. Fasteners shall start within three inches of the leading edge of each duct section and any line transverse joints within the duct section, and shall be spaced no more than 12 inches OC around the perimeter of the duct, except that they need to be no closer than 9 inches to a corner break. Elsewhere, they shall be a

maximum of 18 inches OC, except that they shall be placed not more than 6 inches from a cut edge nor 12 inches from a corner break.

2. Install liner so that exposed edges and leading edges are factory coated.
3. Fit liner snugly into corners.
4. Coated or most dense surface of the liner shall face the airstream.
5. Repair liner surface penetrations with UL listed adhesive.
6. Interrupt duct linings at fire dampers and fire doors.
7. Interrupt duct coverings and linings in the immediate area of operation of heat sources in a duct system using electric resistance or fuel burning heaters.

3.03 SEALING OF DUCTS

A. General:

1. Supply ducts shall be sealed with sealant.
2. Metal surfaces to be joined shall be clean, dry, and grease free.
3. Apply a heavy brush coat of sealant to the interior metal surface of the duct slip joint, then interlock securely the duct sections and position into place.
4. Apply a heavy brush coat finish of sealant to the exterior metal surface duct joint or seam covering heads of lock joint screws. Ensure that all voids are completely filled to provide a continuous air pressure sealant.
5. Where ducts are subject to excessive vibration or mechanical abuse, the exterior joint finish shall consist of a heavy coat of brush applied sealant reinforced with 2-inch wide glass fabric. Press the reinforcing fabric into the wet sealant and cover with a second coat of brush applied sealant.

B. Low Pressure Ducts:

1. Seal in accordance with SMACNA standards for Class B seals.

3.04 ACCESS PANELS

- A. Install access panels for inspection, maintenance, and cleaning of all automatic dampers, fire and smoke dampers, duct turning vanes, before and after all coils, and at other locations where equipment will require service.
- B. Access panels to fire dampers shall be labeled with letters not less than 1/2-inch in height reading "Fire Damper." For locations where access panels are insulated, provide identifying labels on the exterior of the insulation.

3.05 FILTER INSTALLATION

- A. Systems and equipment using medium efficiency filters:
 - 1. Provide two (2) complete sets of medium efficiency filters for use during construction, testing, and balancing periods, and at end of project.
 - 2. Provide a complete set of new spare filters after completion of testing and balancing.
 - 3. A total of three (3) complete sets of filters are required.

END OF SECTION 15880

SECTION 15891

METAL DUCTWORK

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.02 DESCRIPTION OF WORK

- A. Extent of metal ductwork is indicated on the drawings and by requirements of this section.
- B. Exterior insulation of metal ductwork is specified in other Division-15 sections, and is included as work of this section.
- C. Refer to other Division-15 sections for ductwork accessories; not work of this section.
- D. Refer to other Division-15 sections for testing, adjusting, and balancing of metal ductwork systems; not work of this section.

1.03 CODES AND STANDARDS

- A. SMACNA Standards: Comply with SMACNA “HVAC Duct Construction Standards, Metal and Flexible” for fabrication and installation of metal ductwork.
- B. NFPA Compliance: comply with NFPA 90A “Standard for the Installation of Air Conditioning and Ventilating Systems” and NFPA 90B “Standard for the Installation of Warm Air Heating and Air Conditioning Systems”.

1.04 SUBMITTALS

- A. Product Data: Submit manufacturer’s technical product data and installation instructions for metal ductwork materials and products.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Protection: Protect shop fabricated and factory fabricated ductwork, accessories and purchase products from damage during shipping, storage and handling. Prevent end damage and prevent dirt and moisture from entering ducts and fittings.
- B. Storage: Where possible, store ductwork inside and protect from weather. Where necessary to store outside, store above grade and enclose with waterproof wrapping.

PART 2 – PRODUCTS

2.01 DUCTWORK MATERIALS

- A. Sheet Metal: Except as otherwise indicated, fabricate ductwork from galvanized sheet steel complying with ASTM A 527, lockforming quality, with G 90 zinc coating in accordance with ASTM A 525; and mill phosphatized for exposed locations.

2.02 MISCELLANEOUS DUCTWORK MATERIALS

- A. General: Provide miscellaneous materials and products of types and sizes indicated and, where not otherwise indicated, provide type and size required to comply with ductwork system requirements including proper connection of ductwork and equipment.
- B. Fittings: Provide radius type fittings fabricated of multiple sections with maximum 15 deg change of direction per section. Unless specifically detailed otherwise, use 45 deg laterals and 45 deg elbows for branch takeoff connections. Where 90 deg branches are indicated, provide conical type tees.
- C. Duct Liner: Fibrous glass, complying with Thermal Insulation Manufacturers Association (IITIMA) AHC-101; of thickness indicated.
- D. Duct Liner Adhesive: Comply with ASTM C 916 "Specifications for Adhesives for Duct Thermal Insulation".
- E. Duct Liner Fasteners: Comply with SMACNA HVAC Duct Construction Standards, Article S2.11.
- F. Duct Sealant: non-hardening, non-migrating mastic or liquid elastic sealant, type applicable for fabrication/installation detail, as

compounded and recommended by manufacturer specifically for sealing joints and seams in ductwork.

- G. Duct Cement: Non-hardening migrating mastic or liquid neoprene based cement, type applicable for fabrication/installation detail, as compounded and recommended by manufacturer specifically for cementing fitting components, or longitudinal seams in ductwork.
- H. Ductwork Support Materials: Except as otherwise indicated, provide hot-dipped galvanized steel fasteners, anchors, rods, straps, trim and angles for support of ductwork.
- I. Flexible Ducts: Either spiral-wound spring steel with flameproof vinyl sheathing, or corrugated aluminum; complying with UL 181. Where installed in unconditioned spaces other than return air plenums, provide 1" thick continuous flexible fiberglass sheath with vinyl vapor barrier jacket.

2.03 FABRICATION

- A. Shop fabricate ductwork in 4, 8, 10 or 12-foot lengths, unless otherwise indicated or required to complete runs. Pre-assemble work in shop to greatest extent possible, so as to minimize field assembly of systems. Disassemble systems only to extent necessary for shipping and handling. Match-mark sections for reassembly and coordinated installation.
- B. Shop fabricate ductwork of gages and reinforcement complying with SMACNA "HVAC Duct Construction Standards".
- C. Shop fabricate ductwork of gages and reinforcement complying with SAHRAE Handbook, Equipment Volume, Chapter 1 "Duct Construction".
- D. Fabricate duct fittings to match adjoining ducts, and to comply with duct requirements as applicable to fittings. Except as otherwise indicated, fabricate elbows with center-line radius equal to associated duct width; and fabricate to include turning vanes in elbows where shorter radius is necessary. Limit angular tapers to 30 degrees for contracting tapers and 20 degrees for expanding tapers.
- E. Fabricate ductwork with accessories installed during fabrication to the greatest extent possible. Refer to Division-15 section "Ductwork Accessories" for accessory requirements.

- F. Fabricate ductwork with duct liner in each section of duct where indicated. Laminate liner to internal surfaces of duct in accordance with instructions by manufacturers of lining and adhesive, and fasten with mechanical fasteners.

2.04 FACTORY-FABRICATED LOW PRESSURE DUCTWORK

- A. General: At installer's option, provide factory-fabricated duct and fittings, in lieu of shop-fabricated duct and fittings.

PART 3 – EXECUTION

3.01 INSPECTION

- A. General: Examine areas and conditions under which metal ductwork is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.02 INSTALLATION OF METAL DUCTWORK

- A. General: Assemble and install ductwork in accordance with recognized industry practices which will achieve air tight (5% leakage for systems rated 3" and under; 1% for systems rated over 3") and noiseless (no objectionable noise) systems, capable of performing each indicated service. Install each run with minimum number of joints. Align ductwork accurately at connections, within 1/8" misalignment tolerance and with internal surfaces smooth. Support ducts rigidly with suitable ties, braces, hangers and anchors of type which will hold ducts true-to-shape and to prevent buckling. Support vertical ducts at every floor.
- B. Field Fabrication: complete fabrication of work at project as necessary to match shop-fabricated work and accommodate installation requirements.
- C. Routing: Locate ductwork runs, except as otherwise indicated, vertically and horizontally and avoid diagonal runs wherever possible. Locate runs as indicated by diagrams, details and notations or, if not otherwise indicated, run ductwork in shortest route which does not obstruct useable space or block access for servicing building and its equipment. Hold ducts close to walls, overhead construction, columns, and other structural and permanent – enclosure elements of building. Limit clearance to 1/2" where furring is shown for enclosure or concealment of ducts, but allow for insulation thickness, if any. Where possible, locate

insulated ductwork for 1" clearance outside of insulation. Wherever possible in finished and occupied spaces, conceal ductwork from view, by locating in mechanical shafts, hollow wall construction or above suspended ceilings. Do not encase horizontal runs in solid partitions, except as specifically shown. Coordinate layout with suspended ceiling and lighting layouts and similar finished work.

- D. Penetrations: Where ducts pass through interior partitions and exterior walls, conceal space between construction opening and duct or duct insulation with sheet metal flanges of same gage as duct. Overlap opening on 4 sides by at least 1½". Fasten duct and substrate.
- E. Coordination: coordinate duct installations with installation of accessories, dampers, coil frames, equipment, controls and other associated work of ductwork system.
- F. Installation: Install metal ductwork in accordance with SMACNA HVAC Duct Construction Standards.

3.03 INSTALLATION OF FLEXIBLE DUCTS

- A. Maximum Length: For any duct run using flexible ductwork, do not exceed 5' – 0" extended length.
- B. Installation: Install in accordance with Section III of SMACNA's "HVAC Duct construction Standards, Metal and Flexible".

3.04 EQUIPMENT CONNECTIONS

- A. General: Connect metal ductwork to equipment as indicated, provide flexible connection for each ductwork connection to equipment mounted on vibration isolators, and/or equipment containing rotating machinery. Provide access doors as indicated.

3.05 ADJUSTING AND CLEANING

- A. Clean Ductwork internally, unit-by-unit as it is installed, of dust and debris. Clean external surfaces of foreign substances which might cause corrosive deterioration of metal or, where ductwork is to be painted, might interfere with painting or cause paint deterioration.
- B. Balancing: Refer to Division-15 section "Testing, Adjusting, and Balancing" for air distribution balancing of metal ductwork; not work of this section. Seal any leaks in ductwork that become apparent in balancing process.

END OF SECTION

SECTION 15910
DUCTWORK ACCESSORIES

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specifications sections, apply to work of this section.

Division-15 Basic Mechanical Materials and methods sections apply to work of this section.

1.02 DESCRIPTION OF WORK

- A. Extent of ductwork accessories work is indicated on drawings and in schedules, and by requirements of this section.
- B. Types of ductwork accessories work required for project include the following:

Dampers.
Low pressure manual dampers.
Counterbalanced relief dampers.
Turning vanes.
Duct hardware.
Flexible connections.

- C. Refer to other Division15 sections for testing, adjusting, and balancing of ductwork accessories; not work of this section.

1.03 CODES AND STANDARDS

- A. SMACNA Compliance: Comply with applicable portions of SMACNA "HVAC Duct Construction Standards, metal and Flexible".
- B. NFPA Compliance: Comply with applicable provisions of MFPA 90A "Air Conditioning and Ventilating Systems", pertaining to installation of ductwork accessories.

1.04 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data for each type of ductwork accessory, including dimensions, capacities, and materials of construction; and installation instructions.

PART 2 – PRODUCTS

2.01 DAMPERS

- A. Low Pressure Manual Dampers: Provide dampers of single blade type or multiblade type, constructed in accordance with SMACNA "Low Pressure Duct Standards".
- B. Counterbalanced Relief Dampers: Provide dampers with parallel blades, counterbalanced and factory-set to relieve at indicated static pressure. Construct blades of 16 ga. Aluminum, provide $\frac{1}{2}$ " diameter ball bearings, $\frac{1}{2}$ " diameter steel axles spaced on 9" centers. Construct frame of 2" X $\frac{1}{2}$ " x $\frac{1}{8}$ " steel channel for face areas 25 sq. ft. and under; 4" x $1\frac{1}{4}$ " x 16 ga channel for face areas over 25 sq. ft. Provide galvanized steel finish on frame with aluminum touch-up.
- C. Manufacturer: Subject to compliance with requirements, provide dampers of one of the following:

Air Balance Inc.
Airguide Corp.
American Warming & Ventilating, Inc.
Arrow Louver and Damper; Div. Of Arrow United Industries, Inc.
Louvers & Dampers, Inc.
Penn Ventilator Co.
Ruskin Mfg. Co.

2.02 TURNING VANES

- A. Manufactured Turning Vanes: Provide turning vanes constructed of $1\frac{1}{2}$ " wide curved blades set at $\frac{3}{4}$ " o.c., supported with bars perpendicular to blades set at 2" o.c., and set into side strips suitable for mounting in ductwork.
- B. Manufacturer: Subject to compliance with requirements, provide turning vanes of one of the following:

Aero Dyne Co.
Airsan Corp.

Anemostat Products Div.; Synamics Corp. of America.
Barber-Colman Co.
Duro Dyne Corp.
Environmental Elements Corp.; Subs. Koppers Co., Inc.
Hart & Cooley Mfg. Co.
Register & Grille Mfg. Co., Inc.

2.03 DUCT HARDWARE

- A. General: Provide duct hardware, manufactured by one manufacturer for all items on project, for the following:
- B. Quadrant Locks: Provide for each damper, quadrant lock device on one end of shaft; and end bearing plate on other end for damper lengths over 12". Provide extended quadrant locks and end extended bearing plates for externally insulated ductwork.
- C. Manufacturer: Subject to compliance with requirements, provide duct hardware of one of the following:

Ventfabrics, Inc.
Young Regulator Co.

2.04 FLEXIBLE CONNECTIONS

- A. General: Provide flexible duct connections wherever ductwork connects to vibration isolated equipment. Construct flexible connections of neoprene-coated flameproof fabric crimped into duct flanges for attachment to duct and equipment. Make airtight joint. Provide adequate joint flexibility to allow for thermal, axial, transverse, and torsional movement, and also capable of absorbing vibrations of connected equipment.
- B. Manufacturer: Subject to compliance with requirements, provide flexible connections of one of the following:

Ventfabrics, Inc.
Duro Dyne Corp.

PART 3 – EXECUTION

3.01 INSPECTION

- A. Examine areas and conditions under which ductwork accessories will be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.02 INSTALLATION OF DUCTWORK ACCESSORIES

- A. Install duct accessories in accordance with manufacturer's installation instructions, with applicable portions of details of construction as shown in SMACNA standards, and in accordance with recognized industry practices to ensure that products serve intended function.
- B. Install turning vanes in square or rectangular 90 deg elbows in supply and exhaust air systems, and elsewhere as indicated.
- C. Coordinate with other work, including ductwork, as necessary to interface installation of duct accessories properly with other work.

3.03 ADJUSTING AND CLEANING

- A. Adjusting: Adjust duct work accessories for proper settings, install fusible links in fire dampers and adjust for proper action.
- B. Final positioning of manual dampers is specified in Division-15 section "Testing, Adjusting, and Balancing".

END OF SECTION

SECTION 15932

AIR OUTLETS AND INLETS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including general and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.02 DESCRIPTION OF WORK

- A. Extent of outlets and inlets work is indicated by drawings and schedules, and by requirements of this section.
- B. Types of outlets and inlets required for project include the following:

Ceiling air diffusers.
- C. Refer to other Division-15 sections for ductwork and duct accessories required in conjunction with air outlets and inlets; not work of this section.
- D. Refer to other Division-15 sections for balancing of air outlets and inlets; not work of this section.

1.03 QUALITY ASSURANCE

- A. Manufacturers Qualifications: Firms regularly engaged in manufacture of outlets and inlets of types and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years.

1.04 CODES AND STANDARDS

- A. ARI Compliance: Test and rate air outlets and inlets in accordance with ARI 650 "Standard for Air Outlets and Inlets".
- B. ASHRAE Compliance: Test and rate air outlets and inlets in accordance with ASHRAE 70 "method of Testing for Testing the Air Flow Performance of Outlets and Inlets."

- C. NFPA Compliance: Install air outlets and inlets in accordance with NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems".

1.05 SUBMITTALS

- A. Product Data: Submit manufacturer's data on outlets and inlets including the following:

Data Sheet for each type of air outlet and inlet, and accessory furnished; indicating construction, finish, and mounting details.

1.06 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver air outlets and inlets wrapped in factory fabricated fiber-board type containers. Identify on outside of container type of outlet or inlet and location to be installed. Avoid crushing or bending and prevent dirt and debris from entering and settling in devices.
- B. Store outlets and inlets in original cartons and protect from weather and construction work traffic. Where possible, store indoors; when necessary to store outdoors, store above grade and enclose with waterproof wrapping

PART 2 – PRODUCTS

2.01 CEILING AIR DIFFUSERS

- A. General: Except as otherwise indicated, provide manufacturer's standard ceiling air diffusers where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and as required for complete installation.
- B. Performance: Provide ceiling air diffusers that have, as minimum, temperature and velocity traverses, throw and drop, and noise criteria ratings for each size device as listed in manufacturer's current data.
- C. Ceiling Compatibility: Provide diffusers with border styles that are compatible with adjacent ceiling systems, and that are specifically manufactured to fit into ceiling module with accurate fit and adequate support. Refer to general construction drawings and specifications for types of ceiling systems which will contain each type of ceiling air diffuser.

- D. Types: Provide ceiling diffusers of type, capacity, and with accessories and finishes as listed.

Diffuser Faces:

Square: Square housing, core of square concentric louvers, square or round duct connection.

Rectangular: Rectangular housing, core of rectangular concentric louvers, square or round duct connection.

Panel: Square or rectangular housing extended to form panel to fit in ceiling system module, core of square or rectangular concentric louvers, square or round duct connection.

Diffuser Mountings:

Lay-in: Diffuser housing sized to fit between ceiling exposed suspension tee bars and rest on top surface of tee bar.

Diffuser Dampers:

Opposed Blade (O – B): Adjustable opposed blade damper assembly, key operated from face of diffuser.

Diffuser Finishes:

White Enamel (W – E): Semi-gloss white enamel prime finish.

- 2.02 Manufacturer: Subject to compliance with requirements, provide diffusers of one of the following:

Anemostat Products Div., Dynamics Corp. of America.
Carnes Co., Div. Of Wehr Corp.
Krueger Mfg. Co.
Titus Products Div.; Philips Industries, Inc.
Tuttle & Bailey Div. Of Interpace Corp.

PART 3 – EXECUTION

3.01 INSPECTION

- A. Examine areas and conditions under which air outlets and inlets are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. General: Install air outlets and inlets in accordance with manufacturer's written instructions and in accordance with recognized industry practices to insure that products serve intended functions.
- B. Coordinate with other work, including ductwork and duct accessories, as necessary to interface installation of air outlets and inlets with other work.
- C. Locate ceiling air diffusers, registers, and grilles, as indicated on Sheet M1.0.

END OF SECTION

SECTION 15990
TESTING, BALANCING AND ADJUSTING

PART 1 – GENERAL

1.1 RELATED

“General Requirements”, Division 1 and Mechanical Basic Materials and Methods Spec Section 15050 of the Specification Manual pertain to and are hereby made part of the work of the Spec Section.

1.2 DESCRIPTION OF WORK

- A. This section covers testing, balancing and adjusting (TBA) of Division 15 environmental systems, including, but not limited to, heating/cooling units, air distribution systems, hydronic distribution systems, and dynamic balance testing of the equipment and apparatus connected thereto.
- B. Related Work Specified Elsewhere:
 - a. Submittals: Section 01300
 - b. Project Closeout: Section 01700

1.3 REFERENCES

- A. Comply with procedural standards for Testing, Balancing and adjusting of environmental systems as outlined in the latest edition of SMACNA, NEBB and/or AABC procedural manuals.
- B. Applicable sections and paragraphs as published in ASHRAE 1991 Applications Handbook, Chapter 34, Testing, Adjusting and Balancing.

1.4 QUALIFICATIONS

- A. Qualified firms desiring to furnish services for this project shall submit for written approval, during bid time, a brochure listing the qualifications of personnel in the organization, instruments available to be use, an outline of system balancing procedures that is intended to be followed, and a list of projects successfully balanced within the last two years. Information regarding additional qualifications listed below must be in the office of the Engineer at least fourteen calendar days prior to the date set for receiving bids.
- B. TBA firm shall have at least one NEBB or AABC certified TAB supervisor, or this work shall be supervised by a registered Professional Engineer (PE). Certify that this person has been associated with the TBA firm for at least two years.

- C. TBA firm shall have a minimum of three permanent employees who have been actively engaged in balancing work for a minimum of three (3) years. Provide names and experience resumes.
 - a. Pre-qualified firms are as follows:
 - i. Midwest Engineering Service
 - ii. Griffith Engineering
 - iii. Tab, Inc.
 - iv. Finn and Associates
 - v. Balance Technologies
 - vi. Complete Mechanical Balancing
 - vii. Checkpoint Balance
 - viii. Air Rite, Inc.
 - ix. Controlled Air, Inc.
 - x. Western Air Balance
 - b. TBA Firm shall own or rent and have available for this project all necessary balancing instruments as required to maintain NEBB certification. Instrument calibration shall have been checked and verified as per NEBB requirements. Provide instrument list with calibration date for each instrument listed.

1.5 RETAINAGE

Contract payment retainage may be withheld against the General Contractor until the final completion of this section of work has been demonstrated by the submission of the TBA report and an evaluation of its contents has been made by the Owner or his representative.

1.6 QUALITY ASSURANCE

- A. Testing, balancing and adjusting shall be done by a NEBB or AABC certified firm, or by an independent firm specializing in this work. A definition of independent shall mean the firm is not associated with the mechanical contractor performing work under Division 15; the firm derives its income solely from testing, balancing and adjusting and/or commissioning mechanical systems, and the work is performed in a professional manner per Item B.
- B. The balancing work, including air and hydronic portions, shall be performed by the same firm having total professional responsibility for the final testing, balancing and adjusting of the entire systems.

All balancing shall be performed under the direction of a registered Professional Engineer who has had at least five years of balancing experience in the state in which the work is being done, or under direction of an NEBB or AABC certified TAP Supervisor per Item 1.03-E.

1.7 SUBMITTALS

- A. Refer to Section 01300 General Requirements.
- B. Within 30 days after contract award, submit the name(s) of the professional engineer and/or the NEBB or AABC certified supervisor who will be supervising this work.
- C. Submit proposed TAB forms and report formats to Owner or his representative for approval at least 120 days prior to commencing field work.

PART 2 – PRODUCTS

2.1 EQUIPMENT

- A. Provide all necessary tools, scaffolding, and ladders.
- B. Provide all necessary instruments. Calibration and maintenance of instruments shall be in accordance with SMACNA, NEBB, AABC and/or manufacturer's standards and recommendations.
- C. Provide all sheaves, dampers, and belts for replacement required to completely balance systems.
- D. Calibration histories for each instrument shall be available for examination.

PART 3 – EXECUTION

3.1 SCHEDULING OF WORK

- A. Coordinate scheduling of work with the General Contractor and appropriate subcontractors.

Schedule TAB work to coincide with testing and verification of control systems where practical.
- B. Provide written notification (within 24 hours) to General Contractor, Engineer and Owner or his representative of any component and/or system deficiencies.

3.2 STATUS OF SYSTEMS

- A. Put heating, ventilating and air conditioning systems and equipment into full operation and continue operation of same during each working day of testing and balancing. Preliminary TBA requirements shall be ascertained prior to the commencement of work through a review of

available plans and specifications for the project. In addition, visual observations at the site during construction shall have been made to determine the location of required balancing devices, that they are being installed properly, and access is provided for.

3.3 GENERAL

At the completion of the Mechanical installation, including all piping, ducting, control, and power wiring components, the various systems shall be placed in operation and the Testing and Adjusting Contractors crew shall proceed with the final "Balance" of the various systems.

3.4 SUPPLY SYSTEMS

- A. General: Before any adjustments are made, the system is to be checked for items such as dirty filters, filter leakage, equipment vibrations, damper operation, etc. Zones, etc., are to be adjusted to deliver design air and hydronic quantities within plus or minus 10%. Individual air outlets when one of three or more are serving one space may have a tolerance of 15% of average.
- B. Air systems shall be opened by the Mechanical Contractor. The Balancing Contractor shall be responsible for all drive changes and overload heater changes required to put the system into proper balance. Total air volume for each system shall be adjusted by drive speed changes and not outlet or duct dampers.
- C. All fan systems including furnace units: Level and proportion air volume at all registers, diffusers, louvers, filters, hoods, coils, etc. Adjust to design capacities.
- D. Fan Systems: Are to be checked for motorized mixing damper leakage. Air quantities are to be adjusted with all mixing dampers set for cooling. When this has been done, all mixing dampers are to be set for heating and the total flow to each zone again determined and adjusted. Finally, the zone mixing dampers are to be placed in modulating positions and the total air flow determined. If it is significantly higher than for either heating or cooling, motor current is to be measured and fan speed adjusted as required to prevent motor overload.

3.5 EXHAUST AND RECIRCULATING AIR SYSTEMS

To be adjusted to same tolerance as SUPPLY SYSTEMS, then each space is to be checked to see that it is positive, neutral, or negative as indicated by quantities of supply and exhaust shown on plans. Any discrepancies are to be investigated and corrected and the proper pressure relationship established. Finally, building pressure is to be checked at outside doors, and exhaust fan speeds revised as required to leave building neutral or under slight positive pressure.

3.6 SYSTEM PERFORMANCE

To be checked when outside weather is at or near design conditions if practical. (heating and/or Cooling) thermometers are to be placed in the areas served by each fan system temperature readings taken at half hour intervals and further adjustments or corrections made as required to obtain uniform temperatures. All occupied spaces are to be checked for drafts and noises caused by the ventilating systems, and any unsatisfactory conditions corrected.

3.7 DOMESTIC HOT CIRCULATION

Adjust circuit setters or balance valves to (gpm) gallons per minute as noted on drawings or set each circuit setter or balance valve to have a temperature drop of 20E F between supply source and flow control valve.

3.8 MISCELLANEOUS

When final adjustments have been made, temperature readings are to be taken at half hour intervals for a three hour period minimum, all manual damper positions are to be marked, and access covers replaced. The adjusting crew is to measure and set any special conditions such as minimum outside air quantities; check and adjust outside and return air quantities; check and adjust outside and return air intakes so that the system will deliver substantially the same volume on either; make tests and record data as required in "Report" below.

3.9 REPORT

A complete report of the system and its operation is to be made to the Engineer, and is to include the following:

- A. A set of black and white or blue line prints with all air openings marked to correspond with data sheets, and with thermometer locations clearly marked.
- B. Data sheets giving log of room temperature.
- C. Data sheets showing amount of air handled at each opening.
- D. Equipment data sheets giving make, size, etc. of fans, motors and drives. Include supply fans, exhaust and recirculating fans, etc.
- E. Cooling equipment data including air wet bulb and dry bulb temperatures entering and leaving cooling coils (maximum air temperature drop) together with corresponding air flow and air pressure drop.
- F. Heating equipment operating data including air temperatures entering and leaving heating sections (maximum air temperatures rise) together with corresponding air flow and air pressure drop.
- G. Operating data including fan RPM, inlet and outlet pressures drop across filters, measured motor current and voltage, and total fan static pressure. Both design and test conditions shall be tabulated. Where practical a pitot

tube traverse of the duct will be taken indicating proper air quantities are being delivered. Where pitot tube traverse is not practical, other approved testing method shall be used.

- H. A report outlining any abnormal or notable conditions not covered in the above outline.

END OF SECTION 15990

DIVISION 16

ELECTRICAL

SECTION 16010

BASIC ELECTRICAL REQUIREMENTS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this and the other sections of Division 16.

1.02 SUMMARY

- A. This Section includes general administrative and procedural requirements for electrical installations. The following administrative and procedural requirements are included in this Section to expand the requirements specified in Division 1:
 - 1. Submittals.
 - 2. Maintenance manuals.
 - 3. Rough-ins.
 - 4. Electrical installations.
- B. Related Sections: The following sections contain requirements that relate to this section:
 - 1. Division 15 Section "ELECTRICAL REQUIREMENTS FOR MECHANICAL EQUIPMENT," for factory-installed motors, controllers, accessories, and connections.
 - 2. Division 16 Section "BASIC ELECTRICAL MATERIALS AND METHODS," for materials and methods common to the remainder of Division 16, plus general related specifications.

1.03 SUBMITTALS

- A. General: Follow the procedures specified in Division 1 Section "SUBMITTALS."

1.04 MAINTENANCE MANUALS

- A. Prepare maintenance manuals in accordance with Division 1 Section "PROJECT CLOSEOUT."

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification.

PART 2 – PRODUCTS

NOT APPLICABLE

PART 3 – EXECUTION

3.01 ROUGH-IN

- A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.
- B. Refer to equipment specifications in Divisions 2 through 16 for rough-in requirements.

3.02 ELECTRICAL INSTALLATIONS

- A. General: Sequence, coordinate, and integrate the various elements of electrical systems, materials, and equipment. Comply with the following requirements:
 - 1. Coordinate electrical systems, equipment, and materials installation with other building components.
 - 2. Verify all dimensions by field measurements.
 - 3. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for electrical installations.
 - 4. Coordinate the installation of required supporting devices and sleeves to be set in poured
 - 5. Sequence, coordinate, and integrate installations of electrical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.

6. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.
7. Coordinate connection of electrical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.
8. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Architect.
9. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.
10. Install electrical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.
11. Install systems, materials and equipment giving right-of-way priority to systems required to be installed at a specified slope.

END OF SECTION

SECTION 16050

BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Requirements specified in Division 16 Section “Basic Electrical Requirements” apply to this section.

1.02 SUMMARY

- A. This Section includes limited scope general construction materials and methods for application with electrical installations as follows:
 - 1. Joint sealers for sealing around electrical materials and equipment; and for sealing penetrations in fire and smoke barriers, floors, and foundation walls.

1.03 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
- B. Product data for the following products:
 - 1. Fire resistant joint sealer.

1.04 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced Installer for the installation and application joint sealers.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver joint sealer materials in original unopened containers or bundles with labels informing about manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multi-component materials.

- B. Store and handle joint sealer materials in compliance with the manufacturers' recommendations to prevent their deterioration and damage.

1.06 PROJECT CONDITIONS

- A. Environmental Conditions: Apply joint sealers under temperature and humidity conditions within the limits permitted by the joint sealer manufacturer. Do not apply joint sealers to wet substrates.

PART 2 – PRODUCTS

2.01 JOINT SEALERS

- A. General: Joint sealers, joint fillers, and other related materials compatible with each other and with joint substrates under conditions of service and application.
- B. Fire-Resistant Joint Sealers: Two-part, foamed-in-place, silicone sealant formulated for use in through-penetration fire-stopping around cables, conduit, pipes, and duct penetrations through fire rated walls and floors. Sealants and accessories shall have fire-resistance ratings indicated, as established by testing identical assemblies in accordance with ASTM E 814, by Underwriter's Laboratories, Inc., or other testing and inspection agency acceptable to authorities having jurisdiction.
 - 1. Available Products: Subject to compliance with requirements, products which may be incorporated in the Work include, but are not limited to, the following:
 - a. "Dow Corning Fire Stop Foam," Dow Corning Corp.
 - b. "Pensil 851," General Electric Co.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting installation and application of joint sealers. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 PREPARATION FOR JOINT SEALERS

- A. Surface Cleaning for Joint Sealers: Clean surfaces of joints immediately before applying joint sealers to comply with recommendations of joint sealer manufacturer.

3.03 APPLICATION OF JOINT SEALERS

- A. General: Comply with joint sealer manufacturers' printed application instructions applicable to products and applications indicated, except where more stringent requirements apply.
- B. Installation of Fire-Stopping Sealant: Install sealant, including forming, packing, and other accessory materials, to fill openings around electrical services penetrating floors and walls, to provide fire-stops with fire-resistance ratings indicated for floor or wall assembly in which penetration occurs. Comply with installation requirements established by testing and inspecting agency.

END OF SECTION

SECTION 16110

RACEWAYS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. This section is a Division-16 Basic Electrical Materials and Methods section, and is part of each Division-16 section making reference to electrical raceways specified herein.

1.02 DESCRIPTION OF WORK

- A. Extent of raceway work is indicated by drawings.
- B. Types of raceways specified in this section include the following:
 - 1. Electrical metallic tubing (EMT).
 - 2. Flexible metal conduit.
 - 3. Liquid-tight flexible metal conduit.
 - 4. Rigid metal conduit.
 - 5. Rigid nonmetallic conduit.

1.03 QUALITY ASSURANCE

- A. Manufacturers: Firms regularly engaged in manufacture of raceway systems of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Installer's Qualifications: Firm with at least 3 years of successful installation experience on projects with electrical raceway work similar to that required for this project.
- C. Codes and Standards:
 - 1. NEMA Compliance: Comply with applicable portions of NEMA Standards Publications pertaining to raceways.

2. UL Compliance and Labeling: comply with applicable requirements of UL safety standards pertaining to electrical raceway systems. Provide raceway products and components which have been UL-listed and labeled.
3. NEC Compliance: Comply with applicable requirements of NEC pertaining to construction and installation of raceway systems.

PART 2 – PRODUCTS

2.01 METAL CONDUIT AND TUBING

- A. General: Provide metal conduit, tubing and fittings of types, grades, sizes and weights (wall thicknesses) for each service indicated. Where types and grades are not indicated, provide proper selection determined by Installer to fulfill wiring requirements, and comply with applicable portions of NEC for raceways.
- B. Rigid Steel Conduit: Provide rigid steel, zinc-coated threaded type conforming to FS WW-C-581, ANSI C80.1 and UL 6.
 1. Provide zinc coating fused to inside and outside walls.
- C. Flexible Metal Conduit: FS WW-C-566 and UL 1. Formed from continuous length of spirally wound, interlocked zinc-coated strip steel.
- D. Liquid-Tight Flexible Metal Conduit: Provide liquid-tight flexible metal conduit; construct of single strip, flexible, continuous, interlocked, and double-wrapped steel; galvanized inside and outside; coat with liquid-tight jacket of flexible polyvinyl chloride (PVC).
- E. Rigid Metal Conduit Fittings: Cast malleable iron, galvanized or cadmium plated, conforming to FS W-F-408.
 1. Use Type 1 fittings for raintight connections.
 2. Use Type 2 fittings for concrete tight connections.
 3. Use Type 3 fittings for other miscellaneous connections.
- F. Flexible Metal Conduit Fittings: Provide conduit fittings for use with flexible steel conduit of threadless hinged clamp type.

1. Straight Terminal Connectors: One piece body, female end with clamp and deep slotted machine screw for securing conduit, and male threaded end provided with locknut.
 2. 45 or 90 Degree Terminal Angle Connectors: Two-piece body construction with removable upper section, female end with clamp and deep slotted machine screw for securing conduit, and male threaded and provided with locknut.
- G. Liquid-Tight Flexible Metal Conduit Fittings: FS W-F-406, Type 1, Class 3, Style G. Provide cadmium plated, malleable iron fittings with compression type steel ferrule and neoprene gasket sealing rings, with insulated, or non-insulated throat.
- H. Electrical Metallic Tubing (EMT): FS WW-C-563, ANSI C80.3 and UL 797.
- I. EMT Fittings: FS W-F-408.
1. Use Type 1 fittings for raintight connections.
 2. Use Type 2 fittings for concrete tight connections.
 3. Use Type 3 fittings for miscellaneous connections.

2.02 NONMETALLIC CONDUIT AND DUCTS

- A. General: Provide nonmetallic conduit, ducts and fittings of types, sizes and weights for each service indicated. Where types and grades are not indicated, provide proper selection determined by Installer to fulfill wiring requirements which comply with provisions of NEC for raceways.
- B. Electrical Plastic Conduit:
1. Heavy Wall Conduit: Schedule 40, 90 C, UL-rated, construct of polyvinyl chloride and conforming to NEMA TC-2, for direct burial, or normal above ground use, UL-listed and in conformity with NEC Article 347.
 2. PVC Conduit and Tubing Fittings: NEMA TC 3, mate and match to conduit or tubing type and material.
 3. Conduit, and Tubing Accessories: Provide conduit, tubing and duct accessories of types, sizes and materials,

complying with manufacturer's published product information, which mate and match conduit and tubing.

4. Conduit Bodies: Provide galvanized cast-metal conduit bodies of types, shapes and sizes as required to fulfill job requirements and NEC requirements. Construct conduit bodies with threaded – conduit –entrance ends, removable covers, either cast or of galvanized steel, and corrosion-resistant screws.
5. Manufacturers: Subject to compliance with requirements, provide conduit bodies of one of the following:
 - a. Appleton Electric; Div of Emerson Electric Co.
 - b. Arrow-Hart Div; Crouse-Hinds Co.
 - c. Bell Electric Div; Square D Co.
 - d. Gould, Inc.
 - e. Killark Electric Mfg. Co.
 - f. O-Z/Gedney Div; General Signal Co.

PART 3 – EXECUTION

3.01 INSTALLATION OF CONDUITS

- A. General: Install concealed conduits in new construction work, either in walls, slabs, or above hung ceilings. Run conduits concealed in existing work where practicable.
 1. Mechanically fasten together metal conduits, enclosures, and raceways for conductors to form continuous electrical conductor. Connect to electrical boxes, fittings and cabinets to provide electrical continuity and firm mechanical assembly.
 2. Avoid use of dissimilar metals throughout system to eliminate possibility of electrolysis. Where dissimilar metals are in contact, coat surfaces with corrosion inhibiting compound before assembling.
 3. Use roughing-in dimensions of electrically operated unit furnished by supplier. Set conduit and boxes for connection to units only after receiving review of dimensions and after checking location with other trades.

B. Conduit Installation

1. Provide PVC Schedule 40 conduit where embedded in concrete, masonry, earth. Provide code sized ground wire if PVC conduit is used.
2. Use steel zinc-coated EMT in all other areas, except use rigid galvanized steel conduit where there is a chance for mechanical damage.
3. Use flexible conduit from outlet boxes to recessed lighting fixtures, and final 24" of connection to motors, or control items subject to movement or vibration.
4. Use liquid-tight flexible conduit where subjected to one or more of the following conditions:
 - a. Exterior location.
 - b. Moist or humid atmosphere where condensate can be expected to accumulate.
 - c. Subjected to water spray or dripping oil, water or grease.
5. Cut conduits straight, properly ream, and cut threads for heavy wall conduit deep and clean.
6. Field-bend conduit with benders designed for purpose so as not to distort nor vary internal diameter.
7. Size conduits to meet NEC, except no conduit smaller than $\frac{3}{4}$ inch shall be embedded in concrete or masonry.
8. Fasten conduit terminations in sheet metal enclosures by 2 locknuts, and terminate with bushing. Install locknuts inside and outside enclosure.
9. Conduits are not to cross pipe shafts, or ventilating duct openings.
10. Use of running threads at conduit joints and terminations is prohibited. Where required, use 3-piece union or split coupling.
11. Complete installation of electrical raceways before starting installation of cables/wires within raceways.

C. Concealed Conduits:

1. Metallic raceways installed outside are to have conduit threads painted with corrosion inhibiting compound before couplings are assembled. Draw up coupling and conduit sufficiently tight to ensure water tightness.
2. For floors-on-grade, install conduits under concrete slabs.
3. Install underground conduits minimum of 24" below finished grade.

D. Exposed Conduits:

1. Install exposed conduits and extensions from concealed conduit systems neatly, parallel with, or at right angles to walls of building.
2. Install exposed conduit work as not to interfere with ceiling inserts, lights or ventilation ducts or outlets.
3. Support exposed conduits by use of hangers, clamps, or clips. Support conduits on each side of bends and on spacing not to exceed following: up to 1": 6'0"; 1¼" and over: 8'0".
4. Above requirements for exposed conduits also apply to conduits installed in space above hung ceilings.

E. Non-Metallic Conduits:

1. Make solvent cemented joints in accordance with recommendations of manufacturer.
2. Install PVC conduits in accordance with NEC and in compliance with local utility practices.

F. Conduit Fittings:

1. Construct locknuts for securing conduit to metal enclosure with sharp edge for digging into metal, and ridged outside circumference for proper fastening.
2. Bushings for terminating conduits smaller than 1¼" are to have flared bottom and ribbed sides, with smooth upper edges to prevent injury to cable insulation.

3. Install insulated type bushings for terminating conduits 1¼" and larger. Bushings are to have flared bottom and ribbed sides. Upper edge to have phenolic insulating ring molded into bushing.
4. Bushing of standard or insulated type to have screw type grounding terminal.
5. Miscellaneous fittings such as reducers, chase nipples, 3-piece unions, split couplings, and plugs to be specifically designed for their particular application.

END OF SECTION

SECTION 16120
WIRES AND CABLES

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. This section is a Division-16 Basic Electrical Materials and Methods section, and is part of each Division-15 and –16 section making reference to wires and cables specified herein.

1.02 DESCRIPTION OF WORK

- A. Extent of electrical wire and cable work is indicated by drawings.
- B. Types of electrical wire and connectors specified in this section include the following:
 - 1. Copper conductors.
 - 2. Tap type connectors.
 - 3. Split-bolt connectors.
 - 4. Wirenut connectors.

1.03 QUALITY ASSURANCE

- A. Manufacturers: Firms regularly engaged in manufacture of electrical wire and cable products of types, sizes and ratings required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Installer's Qualifications: Firm with at least 3 years of successful installation experience with projects utilizing electrical wiring and cabling work similar to that required for this project.
- C. NEC Compliance: Comply with NEC requirements as applicable to construction, installation and color coding of electrical wires and cables.

- D. UL Compliance: Comply with applicable requirements of UL Std 83, "Thermoplastic-Insulated Wires and Cables", and Std 486A, "Wire connectors and Soldering Lugs for Use with Copper Conductors".
- E. UL Compliance: Provide wiring/cabling and connector products which are UL-listed and labeled.
- F. NEMA/ICEA Compliance: Comply with NEMA/ICEA Std Pub/No.'s WC 5, "Thermoplastic-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy", and WC-30, "Color Coding of Wires and Cables", pertaining to electrical power type wires and cables.
- G. ASTM Compliance: Comply with applicable requirements of ASTM B1, 2, 3, 8 and D-753. Provide copper conductors with conductivity of not less than 98% at 20 deg C (68 deg F).

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Deliver wire and cable properly packaged in factory-fabricated type containers, or wound on NEMA-specified type wire and cable reels.
- B. Store wire and cable in clean dry space in original containers. Protect products from weather, damaging fumes, construction debris and traffic.
- C. Handle wire and cable carefully to avoid abrasing, puncturing and tearing wire and cable insulation and sheathing. Ensure that dielectric resistance integrity of wires/cables is maintained.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products of one of the following (for each type of wire, cable, and connector):
 - 1. Wire and Cable:
 - a. Advance Wire and Cable Corp.
 - b. American Insulated Wire corp.
 - c. American wire and Cable Co.
 - d. Anaconda-Ericsson Inc; Wire and Cable Div.
 - e. Belden Div; Cooper Industries

- f. Brand-Rex Div; Pyle National Co.
- g. Cerro Wire and Cable Corp.
- h. Cleveland Insulated Wire Co.
- i. General Cable Corporation.
- j. Helix Wire Corporation.
- k. Hitemp Wires, Inc.
- l. Indiana Insulated Wire Inc.
- m. Madison wire and Cable Corp.
- n. Phelps Dodge Cable and Wire Co.
- o. Pirelli Cable Corp.
- p. Radix Wire Co.
- q. Rome Cable Corp.
- r. Southwire Company.
- s. Triangle PWC, Inc.

2. Connectors:

- a. AMP, Inc.
- b. Appleton Electric Co; Emerson Electric Co.
- c. Burndy Corporation.
- d. Brand-Rex Div, Pyle National Co.
- e. Electrical Products Div; Midland-Ross Corp.
- f. General Electric Co.
- g. Gould, Inc.
- h. Ideal Industries, Inc.
- i. Leviton Mfg Company
- j. 3M Company
- k. O-Z/Gedney Co.
- l. Southport Industries Inc.
- m. Square D company
- n. Thomas and Betts Corp.

2.02 WIRE AND CONNECTORS

- A. General: Provide electrical wires and connectors of manufacturer's standard materials, as indicated by published product information; designed and constructed as recommended by manufacturer for a complete installation, and for application indicated. Except as otherwise indicated, provide copper conductors with conductivity of not less than 98% at 20 deg C (68 deg F).
- B. Building Wires: Provide factory-fabricated wire of sizes, ampacity ratings, and materials for applications and services indicated. Where not indicated, provide proper selection as determined by installer to comply with project's installation requirements, NEC and

NEMA standards. Select from the following UL types, those wires with construction features which fulfill project requirements:

1. Type THWN: For dry and wet locations; max operating temperature 75 deg C (167 deg F). Insulation, flame-retardant, moisture- and heat-resistant, thermoplastic; outer covering, nylon jacket; conductor, annealed copper.

C. Connectors:

1. General: Provide UL-type factory-fabricated, metal connectors of sizes, ampacity ratings, materials, types and classes for applications and for services indicated. Where not indicated, provide proper selection as determined by Installer to comply with project's installation requirements, NEC and NEMA standards. Select from the following, those types, classes, kinds and styles of connectors to fulfill project requirements:
 - a. Type: Pressure.
 - b. Type: Crimp.
 - c. Type: Threaded.
 - d. Class: Insulated.
 - e. Class: Noninsulated.
 - f. Kind: Copper (for Cu to Cu connection).
 - g. Style: Butt connection.
 - h. Style: Elbow connection.
 - i. Style: Combined "T" and straight connection.
 - j. Style: "T" connection.
 - k. Style: Split-bolt parallel connection.
 - l. Style: Tap connection.
 - m. Style: Pigtail connection.
 - n. Style: Wirenut connection.

PART 3 – EXECUTION

3.01 INSTALLATION OF WIRES AND CABLES

- A. General: Install electrical cables, wires and connectors as indicated, in compliance with applicable requirements of NEC, NEMA, UL, and NECA's "Standard of Installation", and in accordance with recognized industry practices.

- B. Coordinate wire/cable installation work including electrical raceway and equipment installation work, as necessary to properly interface installation of wires/cables with other work.
- C. Install UL Type THWN wiring in conduit, for feeders and branch circuits.
- D. Pull conductors simultaneously where more than one is being installed in same raceway.
- E. Use pulling compound or lubricant, where necessary; compound used must not deteriorate conductor or insulation.
- F. Use pulling means, including fish tape, cable, rope and basket weave wire/cable grips which will not damage cables or raceway.
- G. Keep conductor splices to minimum.
- H. Install splices and tapes which possess equivalent-or-better mechanical strength and insulation ratings than conductors being spliced.
- I. Use splice and tap connectors which are compatible with conductor material.
- J. Tighten electrical connectors and terminals, including screws and bolts, in accordance with manufacturer's published torque tightening values. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Std 486A and B.

3.02 FIELD QUALITY CONTROL

- A. Prior to energization, test wires and cables for electrical continuity and for absence of short-circuits.
- B. Subsequent to wire and cable hook-ups, energize circuitry and demonstrate functioning in accordance with requirements. Where necessary, correct malfunctioning units, and then retest to demonstrate compliance.

END OF SECTION

SECTION 16135
ELECTRICAL BOXES AND FITTINGS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. This section is a Division-16 Basic Materials and Methods section, and is a part of each Division-16 section making reference to electrical wiring boxes and fittings specified herein.

1.02 DESCRIPTION OF WORK

- A. Extent of electrical box and associated electrical fitting work is indicated by drawings.
- B. Types of electrical boxes and fittings in this section include the following:
 - 1. Outlet boxes.
 - 2. Junction boxes.
 - 3. Pull boxes.
 - 4. Bushings.
 - 5. Locknuts.
 - 6. Knockout closures.

1.03 QUALITY ASSURANCE

- A. Manufacturers: Firms regularly engaged in manufacture of electrical boxes and fittings, of types, sizes and capacities required, whose products have been in satisfactory use in similar service for not less than 3 years.
- B. Installer's Qualifications: Firm with at least 3 years of successful installation experience on projects utilizing electrical boxes and fittings similar to those required for this project.

- C. NEC Compliance: Comply with NEC as applicable to construction and installation of electrical wiring boxes and fittings.
- D. UL Compliance: Comply with applicable requirements of UL 50, UL 514-Series, and UL 886 pertaining to electrical boxes and fittings. Provide electrical boxes and fittings which are UL-listed and labeled.
- E. NEMA Compliance: Comply with applicable requirements of NEMA Std's/Pub no.'s OS1, OS2, and Pub 250 pertaining to outlet and device boxes, covers and box supports.

PART 2 – PRODUCTS

2.01 FABRICATED MATERIALS

- A. Outlet Boxes: Provide galvanized coated flat rolled sheet-steel outlet wiring boxes, of shapes, cubic inch capacities, and sizes, including box depths as indicated, suitable for installation at respective locations. Construct outlet boxes with mounting holes, and with cable and conduit-size knockout openings in bottom and sides. Provide boxes with threaded screw holes, with corrosion-resistant cover and grounding screws for fastening surface and device type box covers, and for equipment type grounding.
- B. Outlet Box Accessories: Provide outlet box accessories as required for each installation, including box supports, mounting ears and brackets, wallboard hangers, box extension rings, fixture studs, cable clamps and metal straps for supporting outlet boxes, which are compatible with outlet boxes being used to fulfill installation requirements for individual wiring situations. Choice of accessories is Installer's code-compliance option.
- C. Device Boxes: Provide galvanized coated flat rolled sheet-steel non-gangable device boxes, of shapes, cubic inch capacities, and sizes, including box depths as indicated, suitable for installation at respective locations. Construct device boxes for flush mounting with mounting holes, and with cable-size knockout openings in bottom and ends, and with threaded screw holes in end plates for fastening devices. Provide cable clamps and corrosion-resistant screws for fastening cable clamps, and for equipment type grounding.
- D. Device Box Accessories: Provide device box accessories as required for each installation, including mounting brackets, device box extensions, switch box supports, plaster ears, and plaster

board expandable grip fasteners, which are compatible with device boxes being utilized to fulfill installation requirements for individual wiring situations. Choice of accessories is Installer's code-compliance option.

- E. Manufacturer: Subject to compliance with requirements, provide interior outlet boxes of one of the following:
 - 1. Adalet-PLM Div, Scott Fetzer Co.
 - 2. Appleton Electric; Emerson Electric Co.
 - 3. Bell Electric; Square D Co.
 - 4. Eagle Electric Mfg Co., Inc.
 - 5. Midland-Ross Corp.
 - 6. OZ/Gedney; General Signal Co.
 - 7. Pass and Seymour, Inc.
 - 8. RACO Div; Harvey Hubbell Inc.
 - 9. Thomas & Betts Co.
- F. Raintight Outlet Boxes: Provide corrosion-resistant cast-metal raintight outlet wiring boxes, of types, shapes and sizes, including depth of boxes, with threaded conduit holes for fastening electrical conduit, cast-metal face plates with spring-hinged watertight caps suitably configured for each application, including face plate gaskets and corrosion-resistant plugs and fasteners. Use for surface mounted receptacles and junction boxes in Bay area.
- G. Manufacturers: Subject to compliance with requirements, provide raintight outlet boxes of one of the following:
 - 1. Appleton Electric; Emerson Electric Co.
 - 2. Arrow-Hart Div; Crouse-Hinds Co.
 - 3. Bell Electric; Square D Company
 - 4. Eagle Electric Mfg Co., Inc.
 - 5. Gould, Inc.
 - 6. Harvey Hubbell, inc.
 - 7. OZ/Gedney; General Signal Co.
 - 8. Pass and Seymour, Inc.
- H. Junction and Pull Boxes: Provide galvanized code-gage sheet steel junction and pull boxes, with screw-on covers; of types, shapes and sizes, to suit each respective location and installation; with welded seams and equipped with stainless steel nuts, bolts, screws and washers.
- I. Manufacturer: Subject to compliance with requirements, provide junction and pull boxes of one of the following:

1. Adalet-PLM Div, Scott Fetzer Co.
 2. Appleton Electric; Emerson Electric Co.
 3. Arrow-hart Div; Crouse-Hinds Co.
 4. Bell Electric; Square D Compnay
 5. GTE Corporation.
 6. Keystone Columbia, Inc.
 7. OZ/Gedney Co.; General Signal Co.
 8. Spring City Electrical Mfg. Co.
- J. Bushings, Knockout Closures, and Locknuts: Provide corrosion-resistant box knockout closures, conduit locknuts and malleable iron conduit bushings, offset connectors, of types and sizes, to suit respective installation requirements and applications.
- K. Manufacturers: Subject to compliance with requirements, provide bushings, knockout closures, locknuts and connectors of one of the following:
1. Adalet-PLM Div; Scott Fetzer Co.
 2. AMP, Inc.
 3. Arrow-Hart Div; Crouse-Hinds Co.
 4. Bell Electric; Square D Co.
 5. Midland-Ross Corp.
 6. Midwest Electric; Cooper Industries Inc.
 7. OZ/Gedney Co.; General Signal Co.
 8. RACO Div; Harvey Hubbell Inc.
 9. Thomas & Betts Co., Inc.

PART 3 – EXECUTION

3.01 INSTALLATION OF ELECTRICAL BOXES AND FITTINGS

- A. General: Install electrical boxes and fittings as indicated, in accordance with manufacturer's written instructions, applicable requirements of NEC and NECA's "Standard of Installation", and in accordance with recognized industry practices to fulfill project requirements.
- B. Coordinate installation of electrical boxes and fittings with wire/cable, wiring devices, and raceway installation work.
- C. Provide weathertight outlets for interior and exterior locations exposed to weather or moisture.

- D. Provide knockout closures to cap unused knockout holes where blanks have been removed.
- E. Install electrical boxes in those locations which ensure ready accessibility to enclosed electrical wiring.
- F. Position recessed outlet boxes accurately to allow for surface finish thickness.
- G. Fasten electrical boxes firmly and rigidly to substrates, or structural surfaces to which attached, or solidly embed electrical boxes in concrete or masonry.
- H. Provide electrical connections for installed boxes.
- I. Subsequent to installation of boxes, protect boxes from construction debris and damage.

END OF SECTION

SECTION 16142

ELECTRICAL CONNECTIONS FOR EQUIPMENT

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. This section is a Division-16 Basic Materials and Methods section, and is part of each Division-15 and –16 section making reference to electrical connections specified herein.

1.02 DESCRIPTION OF WORK

- A. Extent of electrical connections for equipment is indicated by drawings and schedules. Electric connections are hereby defined to include connections used for providing electrical power to equipment.
- B. Applications of electrical power connections specified in this section includes the following:
 - 1. From electrical source to motor starters.
 - 2. To lighting fixtures.
 - 3. To grounds including earthing connections.
- C. Electrical connections for equipment, not furnished as integral part of equipment, are specified in Division-15 and other Division-16 sections, and are work of this section.
- D. Refer to Division-15 sections for motor starters and controllers furnished integrally with equipment; not work of this section.
- E. Refer to other Division-16 sections for junction boxes and disconnect switches required for connecting motors and other electrical units of equipment; not work of this section.

- F. Refer to Division-15 sections for control system wiring; not work of this section.
- G. Refer to sections of other Divisions for specific individual equipment power requirements; not work of this section.

1.03 QUALITY ASSURANCE

- A. Manufacturers: Firms regularly engaged in manufacture of electrical connectors and terminals, of types and ratings required, and ancillary connection materials, including electrical insulating tape, electrical flux, and cable ties, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Installer's Qualifications: Firms with at least 2 years of successful installation experience on projects utilizing electrical connection for equipment similar to that required for this project.
- C. NEC Compliance: Comply with applicable portions of NEC as to type products used and installation of electrical power connections (terminals and splices), for junction boxes, motor starters, and disconnect switches.
- D. IEEE Compliance: comply with Std 241, "IEEE Recommended Practice for Electric Power Systems in Commercial Buildings" pertaining to connections and termination.
- E. ANSI Compliance: Comply applicable requirements of ANSI/NEMA and ANSI/EIA standards pertaining to products and installation of electrical connections for equipment.
- F. UL Compliance: Comply with UL Std 486A, "Wire Connectors and Soldering Lugs for Use With Copper Conductors" including, but not limited to, tightening of electrical connectors to torque values indicated. Provide electrical connection products and materials which are UL-listed and -labeled.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Manufacturer: Subject to compliance with requirements, provide products of one of the following (for each type of product):
 - 1. Adalet-PLM Div, Scott and Fetzer Co.
 - 2. Allen-Stevens Conduit Fittings Corp.

3. Appleton Electric Co.
4. Arrow-Hart Div, Crouse-Hinds Co.
5. Atlas Technologies, Inc.
6. Burndy Corporation.
7. Eagle Electric Mfg. Co., Inc.
8. General Electric Co.
9. Gould, Inc.
10. Harvey Hubbell Inc.
11. Ideal Industries, Inc.
12. Pyle National Co.
13. Reliable Electric Co.
14. Square D Company.
15. Thomas and Betts Corp.

2.02 MATERIALS AND COMPONENTS

- A. General: For each electrical connection indicated, provide complete assembly of materials, including but not necessarily limited to, pressure connectors, terminals (lugs), electrical insulating tape heat-shrinkable insulating tubing, cable ties, solderless wire- nuts, and other items and accessories as needed to complete splices and termination of types indicated.
- B. Metal Conduit, Tubing and Fittings:
 1. General: Provide metal conduit, tubing and fittings of types, grades, sizes and weights (wall thicknesses) indicated for each type service. Where types and grades are not indicated, provide proper selection as determined by Installer to fulfill wiring requirements and comply with NEC requirements for raceways. Provide products complying with Division-16 basic electrical materials and methods section "Raceways", and in accordance with the following listing of metal conduit, tubing and fittings:
 - a. Rigid steel conduit.
 - b. Rigid metal conduit fittings.
 - c. Electrical metallic tubing.
 - d. EMT fittings.
 - e. Flexible metal conduit.
 - f. Flexible metal conduit fittings.
 - g. Liquid-tight flexible metal conduit.
 - h. Liquid-tight flexible metal conduit fittings.

C. Wire, Cable and Connectors:

1. General: Provide wires, cables, and connectors complying with Division-16 basic materials and methods section "Wires and Cables".
2. Wires/Cables: Unless otherwise indicated, provide wires/cables (conductors) for electrical connections which match, including sizes and ratings, of wires/cables which are supplying electrical power. Provide copper conductors with conductivity of not less than 98% at 20 deg C (68 deg F).
3. Connectors and Terminals: Provide electrical connectors and terminals which mate and match, including sizes and ratings with equipment terminals and are recommended by equipment manufacturer for intended applications.
4. Electrical Connection Accessories: Provide electrical insulating tape, heat-shrinkable insulating tubing and boots, wirenuts and cable ties as recommended for use by accessories manufacturers for type service indicated.

PART 3 – EXECUTION

3.01 INSPECTION:

- A. Inspect area and conditions under which electrical connections for equipment are to be installed and notify Contractor in writing of conditions detrimental to proper completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

3.02 INSTALLATION OF ELECTRICAL CONNECTIONS

- A. Install electrical connections as indicated; in accordance with connector manufacturer's written instructions and with recognized industry practices, and complying with applicable requirements of UL, NEC and NECA's "Standard of Installation" to ensure that products fulfill requirements.
- B. Coordinate with other work, including wires/cables, raceway and equipment installation, as necessary to properly interface installation of electrical connections for equipment with other work.
- C. Connect electrical power supply conductors to equipment conductors in accordance with equipment manufacturer's written

instructions and wiring diagrams. Mate and match conductors of electrical connections for proper interface between electrical power supplies and installed equipment.

- D. Cover Splices with electrical insulating material equivalent to, or of greater insulation resistivity rating, than electrical insulation rating of those conductors being spliced.
- E. Prepare wires, by cutting and stripping insulation properly to ensure uniform and neat appearance where wires are terminated. Exercise care to avoid cutting through tapes which will remain on conductors. Also avoid “ringing” copper conductors while skinning wire.
- F. Trim cables and wires as short as practicable and arrange routing to facilitate inspection, testing and maintenance.
- G. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturers published torque tightening values for equipment connectors. Accomplish tightening by utilizing proper torquing tools, including torque screwdriver, beam-type torque wrench, and ratchet wrench with adjustable torque settings. Where manufacturer’s torquing requirements are not available, tighten connectors and terminals to comply with torquing values contained in UL’s 486A.
- H. Provide flexible conduit for motor connections, and other electrical equipment connections, where subject to movement and vibration.
- I. Provide liquid-tight flexible conduit for connection of motors and for other electrical equipment where subject to movement and vibration, and also where subjected to one or more of the following conditions:
 - a. Exterior location.
 - b. Dripping oil, grease, or water.

3.03 FIELD QUALITY CONTROL

- A. Upon completion of installation of electrical connections, and after circuitry has been energized with rated power source, test connections to demonstrate capability and compliance with requirements. Ensure that direction of rotation of each motor fulfills requirement. Correct malfunctioning units at site, then retest to demonstrate compliance.

END OF SECTION

SECTION 16143
WIRING DEVICES

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. This section is a Division-16 Basic Electrical Materials and Methods section, and is a part of each Division-16 section making reference to wiring devices specified herein.

1.02 DESCRIPTION OF WORK

- A. The extent of wiring device work is indicated by drawings. Wiring devices are defined as single discrete units of electrical distribution systems which are intended to carry but not utilize electric energy.
- B. Types of electrical wiring devices in this section include the following:
 - 1. Receptacles.
 - 2. Switches.
 - 3. Wallplates.

1.03 QUALITY ASSURANCE

- A. Manufacturers: Firms regularly engaged in manufacture of electrical wiring devices, of types, sizes, and ratings required, whose products have been in satisfactory use in similar service for not less than 3 years.
- B. Installer's Qualifications: Qualified with at least 2 years of successful installation experience on projects utilizing wiring devices similar to those required for this project.
- C. NEC Compliance: Comply with NEC as applicable to installation and wiring of electrical wiring devices.

- D. UL Compliance: Comply with applicable requirements of UL 20, 486A, 498 and 943 pertaining to installation of wiring devices. Provide wiring devices which are UL-listed and labeled.
- E. IEEE Compliance: Comply with applicable requirements of IEEE Std 241, "Recommended Practice for Electric Power Systems in Commercial Buildings", pertaining to electrical wiring systems.
- F. NEMA Compliance: Comply with applicable portions of NEMA Stds Pub/No. WD 1, "General-Purpose Wiring Devices", WD 2, "Semiconductor Dimmers for Incandescent Lamps", and WD 5, "Specific-Purpose Wiring Devices".

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Manufacturer: Subject to compliance with requirements, provide wiring devices of one of the following (for each type of wiring device):
 - 1. Appleton Electric Co.
 - 2. Arrow-Hart Div, Crouse-Hinds Co.
 - 3. Bryant Electric Co.
 - 4. Cutler-Hammer Inc.
 - 5. Eagle Electric Mfg. Co.
 - 6. General Electric Co.
 - 7. Harvey Hubbell Inc.
 - 8. Ideal Industries, Inc.
 - 9. Leviton Mfg. Co.
 - 10. P & S/Le Grand
 - 11. Slater Electric Co.
 - 12. Square D Co.
 - 13. Thomas and Betts Corp.

2.02 FABRICATED WIRING DEVICES

- A. General: Provide factory-fabricated wiring devices, in types, colors, and electrical ratings for applications indicated and which comply with NEMA Stds Pub/No. WD 1. Provide ivory color devices and wallplates except as otherwise selected; color selection to be verified by Contractor with Owner.

B. Receptacles:

1. General-Duty Duplex: Provide duplex general-duty type receptacles, 2-pole, 3-wire grounding, with green hexagonal equipment ground screw, ground terminals and poles internally connected to mounting yoke, 15-amperes, 125-volts, with metal plaster ears; design for side and back wiring with spring loaded, screw activated pressure plate, with NEMA configuration 5-15R unless otherwise indicated.
2. Ground-Fault Interrupter: Provide "feed-thru" type ground-fault circuit interrupters, with heavy-duty duplex receptacles, capable of protecting connected downstream receptacles on single circuit, and of being installed in a 2³/₄" deep outlet box without adapter, grounding type UL-rated Class A, Group 1, rated 20-amperes rating, 120-volts, 60 Hz; with solid-state ground-fault trip level; equip with NEMA configuration 5-15R.

C. Switches:

1. Snap: Provide general-duty flush single-pole toggle switches, 15-ampere 120-volts AC, with mounting yoke insulated from mechanism, equip with plaster ears, switch handle, and side-wired screw terminals.

2.03 WIRING DEVICE ACCESSORIES

- A. Wallplates: Provide wallplates for single and combination wiring devices, of types, sizes, and with ganging and cutouts as indicated. Select plates which mate and match wiring devices to which attached. Construct with metal screws for securing plates to devices; screw heads colored to match finish of plates; wallplates and wiring devices shall be colored ivory. Provide plates possessing the following additional construction features:

1. Material and Finish (Finished Areas):
 - a. Steel plate with wrinkled finish, baked- on ivory insulating enamel.
2. Material and Finish (Unfinished Areas):
 - a. Steel plate, galvanized.

PART 3 – EXECUTION

3.01 INSTALLATION OF WIRING DEVICES

- A. Install wiring devices as indicated, in compliance with manufacturer's written instructions, applicable requirements of NEC and NECA's "Standard of Installation", and in accordance with recognized industry practices to fulfill project requirements.
- B. Coordinate with other work, including painting, electrical box and wiring work, as necessary to interface installation of wiring devices with other work.
- C. Install wiring devices only in electrical boxes which are clean; free from excess building materials, dirt, and debris.
- D. Install galvanized steel wall plates in unfinished spaces.
- E. Install wiring devices after wiring work is completed.
- F. Install wallplates after painting work is completed.
- G. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for wiring devices. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Stds 486A and B.

3.02 PROTECTION OF WALLPLATES AND RECEPTACLES

- A. Upon installation of wallplates and receptacles, advise Contractor regarding proper and cautious use of convenience outlets. At time of Substantial Completion, replace those items which have been damaged, including those burned and scored by faulty plugs.

3.03 GROUNDING:

- A. Provide equipment grounding connections for wiring devices, unless otherwise indicated. Tighten connections to comply with tightening torques specified in UL Std 486A to assure permanent and effective grounds.

3.04 TESTING

- A. Prior to energizing circuitry, test wiring devices for electrical continuity and for short-circuits. Ensure proper polarity of connections is maintained. Subsequent to energization, test wiring devices to demonstrate compliance with requirements.

END OF SECTION

SECTION 16170

CIRCUIT AND MOTOR DISCONNECTS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.02 DESCRIPTION OF WORK

- A. Extent of circuit and motor disconnect switch work is indicated on drawings.
- B. Types of circuit and motor disconnect switches in this section include the following:
 - 1. Equipment disconnects.
 - 2. Motor-circuit disconnects.
- C. Refer to other Division-16 sections for wires/cables, raceways, and electrical boxes and fittings work requires in connection with circuit and motor disconnect work, and work of this section.

1.03 QUALITY ASSURANCE

- A. Manufacturers: Firms regularly engaged in manufacturer of motor and circuit disconnect switches of types and capacities required, whose products have been in satisfactory use in similar service for not less than 3 years.
- B. Installer's Qualifications: Qualified with at least 3 years of successful installation experience with project utilizing circuit and motor disconnect work similar to that required for this project.
- C. NEC Compliance: Comply with NEC requirements pertaining to construction and installation of electrical circuit and motor disconnect switches.

- D. UL Compliance: Comply with requirements of UL 98, "Enclosed and Dead-Front Switches". Provide circuit and motor disconnect switches which have been UL-listed and labeled.
- E. NEMA compliance: comply with applicable requirements of NEMA Std's Pub No. KS 1, "Enclosed Switches" and 250, "Enclosures for Electrical Equipment (1000 Volts Maximum).

1.04 SUBMITTALS

- A. Product Data: Submit manufacturer's data on circuit and motor disconnect switches.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Manufacturer: Subject to compliance with requirements, provide circuit and motor disconnects of one of the following (for each type of switch):
 - 1. Crouse-Hinds Co.
 - 2. Cutler-Hammer Inc.
 - 3. Federal Pacific Electric Co.
 - 4. General Electric Co.
 - 5. General Switch Corp.
 - 6. GTE Sylvania Inc.
 - 7. Square D Company
 - 8. Westinghouse Electric Corp.

2.02 FABRICATED SWITCHES

- A. General-Duty disconnect Switches: Provide surface-mounted, general-duty type, sheet-steel enclosed switches, of types, sizes, and electrical characteristics indicated; rated 240 volts, amperes as shown on drawings, 60 hertz, with 3-blades, 3-poles; incorporating spring assisted, quick-make, quick-break switches which are so constructed that switch blades are visible in OFF position with door open. Equip with operating handle which is integral part of enclosure base and whose operating position is easily recognizable, and is capable of being padlocked in OFF position. Construct current carrying parts of high-conductivity copper, with silver-tungsten type switch contacts, and stamped enclosure knockouts. Provide NEMA Type enclosure as shown on drawings. Provide neutral feed thru as required.

- B. Fuses: Provide fuses for safety switches as shown on drawings.

PART 3 – EXECUTION

3.01 INSTALLATION OF MOTOR AND CIRCUIT DISCONNECT SWITCHES

- A. Install circuit and motor disconnect switches where indicated, complying with manufacturer's written instructions, applicable requirements of NEC, NEMA, and NECA's "Standard of Installation", and in accordance with recognized industry practices
- B. Install disconnect switches used with motor-driven appliances, and motors and controllers within sight of controller position unless otherwise indicated.

3.02 GROUNDING

- A. Provide equipment grounding connections, sufficiently tight to assure a permanent and effective ground, for electrical disconnect switches where indicated.

3.03 FIELD QUALITY CONTROL

- A. Subsequent to completion of installation of electrical disconnect switches, energizing circuitry and demonstrate capability and compliance with requirements. Where possible, correct malfunctioning units at project site then retest to demonstrate compliance; otherwise remove and replace with new units and retest.

END OF SECTION

SECTION 16420
SERVICE ENTRANCE

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. Division-16 Basic Mechanical Materials and Methods sections apply to work specified in this section.

1.02 SUMMARY

- A. Extent of service-entrance work is indicated by drawings.
- B. Types of service-entrance equipment in this section including the following:
 - 1. Fuses.
 - 2. Meter sockets.
 - 3. Switches.
- C. Refer to other Division-16 sections for wires/cables, raceways, and electrical boxes and fittings work required in connection with service-entrance equipment.

1.03 SUBMITTALS

- A. Product Data: Submit manufacturer's data on service-entrance equipment and accessories.

1.04 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of service-entrance equipment, of types, sizes, and ratings required, whose products have been in satisfactory use in similar service for not less than 5 years.

- B. Installer Qualifications: Firm with at least 5 years of successful installation experience with projects utilizing service-entrance work similar to that required for this project.
- C. Codes and Standards:
 - 1. Electrical Code Compliance: comply with applicable local code requirements of the authority having jurisdiction and NEC, including Articles 230, 250, and 338, as applicable to installation, and construction of service-entrances.
 - 2. NEMA Compliance: Comply with applicable construction and installation requirements of the following NEMA standards for service-entrance equipment and accessories:
 - a. Stds Pub/No. KS 1: Enclosed Switches.
 - 3. UL Compliance: Comply with construction and installation requirements of the following UL standards for service-entrance equipment and accessories.
 - a. UL 50: Electrical Cabinets and Boxes.
 - b. UL 869: Electrical Service Equipment.
 - c. Provide service-entrance equipment and accessories which are UL- listed and labeled, and marked, "SUITABLE FOR USE AS SERVICE EQUIPMENT".
 - 4. IEEE Compliance: Comply with applicable requirements of IEEE Std 241 pertaining to service entrances.
 - 5. ANSI Compliance: Comply with ANSI C2, "National Electrical Safety Code", installation requirements for above ground service- entrance conductors.

PART 2 – PRODUCTS

2.01 SERVICE-ENTRANCE EQUIPMENT

- A. General: Provide service-entrance equipment and accessories; of types, sizes, ratings and electrical characteristics indicated, which comply with manufacturer's standard materials, design and construction in accordance with published product information, and as required for complete installation, and as herein specified.

- B. Fuses: Provide fuses complying with Division-16 Service and Distribution section entitled "Fuses," in accordance with the following listed electrical characteristics:
 - 1. Class RK5 time-delay (FRN-R)
- C. Meter Sockets:
 - 1. General: Provide meter sockets which comply with requirements of local utility company supplying electrical power to service- entrance equipment of building project.
 - 2. Manufacturers: Subject to compliance with requirements, provide meter sockets of one of the following:
 - a. Circle AW Products Co.
 - b. Duncan Electric Co. Inc.
 - c. Federal Pacific Electric Co.
 - d. General Electric Co.
 - e. GTE Sylvania Inc.
 - f. Square D Co.
- D. Switches:
 - 1. General: Provide fused disconnect complying with Division-16 "Circuit and Motor Disconnects", in accordance with the following listing:
 - a. General Duty Disconnect Switches, provide with NEMA type 3R enclosure.
- E. Raceways:
 - 1. General: Provide raceways complying with Division-16 Basic Electrical materials and Methods section "Raceways", in accordance with the following listing:
 - a. Rigid Steel Conduit, and fittings.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Examine areas and conditions under which service-entrance equipment and components are to be installed, and notify Contractor in writing of conditions detrimental to proper completion of the work. Do not proceed with the work until satisfactory conditions have been corrected in a manner acceptable to Installer.

3.02 INSTALLATION OF SERVICE-ENTRANCE EQUIPMENT

- A. Install service-entrance equipment as indicated, in accordance with equipment manufacturer's written instructions, and with recognized industry practices, to ensure that service-entrance equipment fulfills requirements. Comply with applicable installation requirements of NEC and NEMA standards.
- B. Install fuses, if any, in service-entrance equipment.
- C. Tighten electrical connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Stds 486A and B, and the National Electrical Code.

3.03 FIELD QUALITY CONTROL

- A. Prior to energization of service-entrance equipment, check accessible connections for compliance to manufacturer's torque tightening specifications.
- B. Prior to energization, check circuitry for electrical continuity, and for absence of short-circuits.

3.04 GROUNDING

- A. Provide equipment grounding connections for service-entrance equipment as indicated. Tighten connections to comply with tightening torques specified in UL Std 486A to assure permanent and effective grounding.

3.05 ADJUSTING AND CLEANING

- A. Adjust operating mechanisms for free mechanical movement.
- B. Touch-up scratched or marred enclosure surfaces to match original finishes.

END OF SECTION

SECTION 16452

GROUNDING

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.02 SUMMARY

- A. Extent of electrical grounding and bonding work is indicated by One-Line drawing and as specified herein. Grounding and bonding work is defined to encompass systems, circuits, and equipment.
- B. Type of electrical grounding and bonding work specified in this section includes the following:
 - 1. Solidly grounded.
- C. Applications of electrical grounding and bonding work in this section includes the following:
 - 1. Underground metal water piping.
 - 2. Grounding electrodes.
 - 3. Service equipment.
 - 4. Enclosures.
- D. Refer to other Division-16 sections for wires/cables, electrical raceways, boxes and fittings, and wiring devices which are required in conjunction with electrical grounding and bonding work; not work of this section.

1.03 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of grounding and bonding products, of types, and ratings required, and ancillary grounding materials, including stranded cable, copper braid and bus grounding electrodes and plate electrodes, and bonding jumpers whose products have been in satisfactory use in similar service for not less than 5 years.

- B. Installer's Qualifications: Firm with at least 3 years of successful installation experience on projects with electrical grounding work similar to that required for project.
- C. Codes and Standards:
 - 1. Electrical Code Compliance: comply with applicable local electrical code requirements of the authority having jurisdiction, and NEC as applicable to electrical grounding and bonding, pertaining to systems, circuits and equipment.
 - 2. UL Compliance: Comply with applicable requirements of UL Standards No.'s 467, "Electrical Grounding and bonding Equipment", pertaining to grounding and bonding of systems, circuits and equipment. In addition, comply with UL Std 486A, "Wire Connectors and Soldering Lugs for Use with Copper Conductors." Provide grounding and bonding products which are UL-listed and labeled for their intended usage.
 - 3. IEEE Compliance: Comply with applicable requirements and recommended installation practices of IEEE Standards 80, 81, 141 and 142 pertaining to grounding and bonding of systems, circuits and equipment.

PART 2 – PRODUCTS

2.01 MANUFACTURERS:

- A. Manufacturers: Subject to compliance with requirements, provide grounding and bonding products of one of the following (for each type of product):
 - 1. Adalet-PLM Div; Scott Fetzer Co.
 - 2. Burndy Corporation.
 - 3. Cadweld Div; Erico Products Inc.
 - 4. Crouse-Hinds Div; Cooper Industries.
 - 5. Ideal Industries, Inc.
 - 6. Okonite Company.
 - 7. OZ Gedney Div; General Signal Corp.
 - 8. Thomas and Betts Corp.

2.02 GROUNDING AND BONDING

A. Materials and Components:

1. General: Except as otherwise indicated, provide electrical grounding and bonding systems indicated; with assembly of materials, including, but not limited to, wired, connectors, solderless lug terminals, grounding electrodes, and additional accessories needed for a complete installation. Where more than one type component product meets indicated requirements, selection is Installer's option. Where materials or components are not indicated, provide products which comply with NEC, UL, and IEEE requirements and with established industry standards for those applications indicated.

B. Conductors: Unless otherwise indicated, provide electrical grounding conductors for grounding system connections that match power supply wiring materials and are sized according to NEC.

C. Ground Electrodes:

1. Grounding Electrodes: Steel with copper welded exterior, $\frac{3}{4}$ " dia. By 10 feet.
2. Electrical Grounding Connection Accessories: provide exothermic welding materials, ground clamps, and bonding straps for connections.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Examine areas and conditions under which electrical grounding and bonding connections are to be made and notify Contractor in writing of conditions detrimental to proper completion of work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

3.02 INSTALLATION OF ELECTRICAL GROUNDING AND BONDING SYSTEMS

- A. General: Install electrical grounding and bonding systems as indicated, in accordance with manufacturer's instructions and applicable portions of NEC, NECA's "Standard of Installation, and

in accordance with recognized industry practices to ensure that products comply with requirements.

- B. Coordinate with other electrical work as necessary to interface installation of electrical grounding and bonding system work with other work.
- C. Weld (exothermic) grounding conductors to underground grounding electrodes.
- D. Ground electrical service system neutral at service entrance equipment to grounding electrodes.
- E. Connect together system neutral, service equipment enclosures, exposed noncurrent carrying metal parts of electrical equipment, metal raceway systems, grounding conductor in raceways and cables, receptacle ground connectors, and plumbing systems.
- F. Terminate feeder and branch circuit insulated equipment grounding conductors with grounding lug, bus, or bushing.
- G. Connect grounding electrode conductors to metallic cold water pipe using a suitably sized ground clamp. Provide connections to flanged piping at street side of flange.
- H. Tighten grounding and bonding connectors and terminals, including screws and bolts, in accordance with manufacturer's published torque tightening values for connectors and bolts. Where manufacturer's torquing requirements are not indicated, tighten connections to comply with tightening torque values specified in UL 486A to assure permanent and effective grounding.
- I. Install braided type bonding jumpers with code-sized ground clamps on water meter piping to electrically bypass water meters.
- J. Route grounding connections and conductors to ground and protective devices in shortest and straightest paths as possible to minimize transient voltage rises.
- K. Apply corrosion-resistant finish to field-connections, buried metallic grounding and bonding products, and places where factory applied protective coatings have been destroyed, which are subjected to corrosive action.
- L. Install clamp-on connectors on clean metal contact surfaces, to ensure electrical conductivity and circuit integrity.

END OF SECTION

SECTION 16470

PANELBOARDS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 specification sections, apply to work of this section.

1.02 SUMMARY

- A. Extent of panelboard, and enclosure work is indicated by drawings and schedules and as specified herein.
- B. Types of panelboards and enclosures required for the project include the following:
 - 1. Lighting and Equipment panelboards.
- C. Refer to other Division-16 sections for wires, electrical boxes and fittings, and raceway work required in conjunction with installation of panelboards and enclosures.

1.03 SUBMITTALS

- A. Product Data: Submit manufacturer's data on panelboards and enclosures.

1.03 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of panelboards and enclosures, of types, sizes, and ratings required, whose products have been in satisfactory use in similar services for not less than 5 years.
- B. Installer's Qualifications: A firm with at least 3 years of successful installation experience on projects utilizing panelboards similar to those required for this project.
- C. Codes and Standards:

1. Electrical Code Compliance: Comply with applicable local code requirements of the authority having jurisdiction and NEC Article 384 as applicable to installation, and construction of electrical panelboards and enclosures.
2. UL Compliance: Comply with applicable requirements of UL 67, "Electric Panelboards", and UL's 50, 869, 486A, 486B, and 1053 pertaining to panelboards, accessories and enclosures. Provide panelboard units which are UL-listed and labeled.
3. NEMA Compliance: Comply with NEMA Stds Pub/No. 250, "Enclosures for Electrical Equipment (1000 volts Maximum)", " Pub/No. PB , "Panelboards," and Pub/No. PB 1.1, "Instructions for Safe Installation, Operation and maintenance of Panelboards Rated 600 Volts or Less."

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements,, provide panelboard products of on eof the following (for each type and rating of panelboard and enclosure):
 1. Cutler-Hammer Products, Eaton Corp.
 2. Federal Pacific Electric Co.
 3. General Electric Company.
 4. ITE Siemens
 5. Square D Company.
 6. Westinghouse Electric Corp.

2.02 PANELBOARDS

- A. General: Except as otherwise indicated, provide panelboards, enclosures and ancillary components, of types, sizes, and ratings indicated, which comply with manufacturer's standard materials; with the design and construction in accordance with published product information; equip with proper number of unit panelboard devices as required for complete installation. Where types, sizes, or ratings are not indicated, company with NEC, UL and established industry standards for those applications indicated.
- B. Lighting and Equipment Panelboards: Provide dead-front safety type lighting and equipment panelboards as indicated, with

switching and protective devices in quantities, ratings, types and arrangements shown; with anti-burn solderless pressure type lug connectors approved for use with copper conductors; equip with copper bus bars, full-sized neutral bar, with bolt-in type heavy-duty, quick-make, quick-break circuit-breakers, with toggle handles that indicate when tripped. Provide suitable lugs on neutral bus for each outgoing feeder required; and provide bare uninsulated grounding bars suitable for bolting to enclosures. Select enclosures fabricated by same manufacturer as panelboards, which mate and match properly with panelboards.

- C. Panelboard Enclosures: Provide galvanized sheet steel cabinet type enclosures, NEMA 1, in sizes as indicated, code-gage, minimum 16-gage thickness. Construct with multiple knockouts and wiring gutters. Provide fronts with adjustable trim clamps,, and doors with flush locks and keys, all panelboard enclosures keyed alike, with concealed piano door hinges and door swings as indicated. Equip with interior circuit-directory frame, and card with clear plastic covering. provide baked gray enamel finish over a rust inhibitor coating. Design enclosures for mounting as shown. Provide enclosures which are fabricated by same manufacturer as panelboards, which mate and match properly with panelboards to be enclosed.
- D. Molded-Case Circuit Breakers: Provide factory-assembled, molded-case circuit breakers of frame sizes, characteristics, and ratings as shown on Panel Schedules, including 10,000 amps minimum RMS symmetrical interrupting ratings. Select breakers with permanent thermal and instantaneous magnetic trip with ampere ratings as indicated. Construct with overcenter, trip-free, toggle-type operating mechanisms with quick-make, quick-break action and positive handle trip indication. Construct breakers for mounting and operating in any physical position, and operating in an ambient temperature of 40 deg C. Provide breakers with mechanical screw type removable connector lugs, AL/CU rated.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Examine areas and conditions under which panelboards and enclosures are to be installed, and notify Contractor in writing of conditions detrimental to proper completion of work. do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

3.02 INSTALLATION OF PANELBOARDS

- A. Install panelboards and enclosures as indicated, in accordance with manufacturer's written instructions, applicable requirements of NEC standards and NECA's "Standards of Installation", and in compliance with recognized industry practices to ensure that products fulfill requirements.
- B. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Stds 486A and B.
- C. Fasten enclosures firmly to walls and structural surfaces, ensuring that they are permanently and mechanically anchored.
- D. Provide properly wired electrical connections for panelboards within enclosures.
- E. Fill out panelboard's circuit directory card upon completion of installation work.

3.03 GROUNDING

- A. Provide equipment grounding connections for panelboard enclosures as indicated. Tighten connections to comply with tightening torques specified in UL 486A to assure permanent and effective grounds.

3.04 FIELD QUALITY CONTROL

- A. Prior to energization, check panelboards for electrical continuity of circuits, and for short-circuits.

3.05 ADJUSTING AND CLEANING

- A. Adjust operating mechanisms for free mechanical movement.
- B. Touch-up scratched or marred surfaces to match original finishes.

END OF SECTION

SECTION 16477

FUSES

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary conditions and Division-1 Specification sections, apply to the work of this section.

1.02 SUMMARY

- A. Extent of fuse work required by this section is indicated by drawings, and by requirements of this section.
- B. Refer to other Division-16 sections for the following items; not work of this section.
 - 1. Switchgear.

1.03 SYSTEM DESCRIPTION

- A. Types of fuses specified in this section include the following:
 - 1. Class RK 5 time-delay (FRN-R).

1.04 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of fuses of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Codes and Standards:
 - 1. UL Compliance and Labeling: comply with applicable provisions of UL 198D, "High-Interrupting-Capacity Class K Fuses". Provide overcurrent protective devices which are UL-listed and labeled.
 - 2. NCE compliance: Comply with NEC as applicable to construction and installation of fuseable devices.

3. ANSI Compliance: Comply with applicable requirements of ANSI C97.1 "Low-Voltage Cartridge Fuses 600 Volts or Less".

1.05 MAINTENANCE

A. Extra Materials:

1. Maintenance Stock, Fuses: For types and ratings required, furnished 3 additional fuses.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide fuses of one of the following:

1. Bussmann Div; Cooper Industries.
2. Commercial Enclosed Fuse co.
3. Shawmut Div; Gould Inc.
4. Reliance Fuse Div; Federal Pacific Electric Co.

2.02 FUSES:

- ##### A. General: Provide fuses of types, sizes, ratings, and average time-current and peak let-through current characteristics indicated, which comply with manufacturer's standard design, materials, and constructed in accordance with published product information, and with industry standards and configurations.

PART 3 – EXECUTION

3.01 EXAMINATION

- ##### A. Examine areas and conditions under which fuses are to be installed, and notify Contractor in writing of conditions detrimental to proper completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

3.02 INSTALLATION OF FUSES:

- ##### A. Install fuses as indicated, in accordance with manufacturer's written instructions and with recognized industry practices to ensure that

protective devices comply with requirements. Comply with NEC, and NEMA standards for installation of fuses.

- B. Coordinate with other work, including electrical wiring, as necessary, to interface installation of fuses with other work.
- C. Install fuses in fused switches.

END OF SECTION

SECTION 16480
MOTOR CONTROLLERS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. Division-16 Basic Electrical Materials and Methods sections apply to work specified in this section.

1.02 SUMMARY

- A. Extent of motor controller work is indicated by drawings.
- B. Types of motor controllers specified in this section include the following:
 - 1. Fractional HP manual.
 - 2. Combination Starters.
- C. Refer to applicable Division-16 Basic Electrical Materials and Methods sections for wires/cables, electrical raceways, and boxes and fittings required in connection with motor controllers.

1.03 SUBMITTALS

- A. Product Data: Submit manufacturer's data and installation instructions on motor controllers.

1.04 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacturer of motor controllers of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Codes and Standards:

1. Electrical Code Compliance: Comply with applicable local electrical code requirements of the authority having jurisdiction and NEC Articles 220, 250, and 430, as applicable to installation, and construction of motor controllers.
2. NFPA Compliance: Comply with applicable requirements of NFPA 70E, "Standard for Electrical Safety Requirements for Employee Workplaces."
3. UL Compliance: Comply with applicable requirements of UL 486A and B, and UL 508, pertaining to installation of motor controllers. Provide controllers and components which are UL-listed and labeled.

1.05 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver motor controllers and components properly packaged in factory-fabricated type containers.
- B. Store motor controllers and components in original packaging and in a clean dry space; protect from weather and construction traffic.
- C. Handle motor controllers and components carefully to avoid breakages, impacts, denting and scoring finishes. Do not install damaged equipment; replace and return damaged units to equipment manufacturer.

1.06 MAINTENANCE

- A. Maintenance Data: Submit maintenance data and parts list for each motor controller and component; including "trouble shooting" maintenance guide. Include that data, product data and shop drawings in a maintenance manual; in accordance with requirements of Division 1.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide motor controllers of one of the following (for each type and rating of motor controller):

1. Allen-Bradley Co.
2. Appleton Electric Co.; Subsidiary of Emerson Electric Co.
3. Crouse-Hinds Co.
4. Cutler Hammer Products, Eaton Corp.
5. Furnas Electric Co.
6. General Electric Co.
7. GTE Products Corp.
8. Gould, Inc.
9. Square D Co.
10. Westinghouse Corp.

2.02 MOTOR CONTROLLERS

- A. General: Except as otherwise indicated, provide motor controllers and ancillary components which comply with manufacturer's standard materials, design and construction in accordance with published product information, and as required for a complete installation.
- B. Fractional HP Manual Controllers: Provide single-phase fractional HP manual motor controllers, of sizes and ratings indicated. Equip with manually operated quick-make, quick-break toggle mechanisms; and with one-piece melting alloy type thermal units. Controller to become inoperative when thermal unit is removed. Provide controllers with double break silver alloy contacts, visible from both sides of controller; green pilot lights, and switch capable of being padlocked-OFF. Enclose controller unit in NEMA Type 1 general purpose enclosure, coat with manufacturer's standard color finish. Provide units as required to comply with NEC requirements.
- C. Combination Non-Reversing Controllers: Provide full-voltage alternating-current combination non-reversing controllers, consisting of controller and disconnect switch mounted in common enclosure, of types, sizes, ratings, and NEMA sizes indicated on drawing. Equip controllers with block type manual reset overload relays and with non-fusible disconnect switches. Provide operating handle for disconnect switch mechanism with indication and control of switch position, with enclosure door either opened or closed, and capable of being locked in OFF position with three padlocks. Construct and mount controllers with disconnect switches in single NEMA type 3R enclosure; coat with manufacturer's standard color finish.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Examine areas and conditions under which motor controllers are to be installed, and notify Contractor in writing of conditions detrimental to proper completion of the work. do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

3.02 INSTALLATION OF MOTOR CONTROLLERS

- A. Install motor controllers where indicated, in accordance with equipment manufacturer's written instruction and with recognized industry practices; complying with applicable requirements of NEC, UL and NEMA standards, to insure that products fulfill requirements.
- B. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Standards 486A and B, and the National Electrical Code.

3.03 FIELD QUALITY CONTROL

- A. Prior to energization, check circuitry for electrical continuity, and for short-circuits.
- B. Ensure that direction of rotation of each motor fulfills requirements.

3.04 GROUNDING

- A. Provide equipment grounding connections for motor controller equipment as indicated. Tighten connections to comply with tightening torques specified in UL Standard 486A to assure permanent and effective grounding.

3.05 ADJUSTING AND CLEANING

- A. Adjust operating mechanisms, where necessary, for free mechanical movement.
- B. Touch-up scratched or marred enclosure surfaces to match original finishes.

END OF SECTION

SECTION 16515
INTERIOR LIGHTING FIXTURES

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.02 SUMMARY

- A. Extent, location, and details of interior lighting fixture work are indicated on drawings and in schedules.
- B. Types of interior lighting fixtures in this section include the following:
 - 1. Fluorescent.
 - 2. Incandescent.

1.03 SUBMITTALS

- A. Product Data: Submit manufacturer's product data and installation instruction on each type interior building lighting fixture and component.

1.04 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of interior lighting fixtures of sizes, types and ratings required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Installer's Qualifications: Firms with at least 3 years of successful installation experience on projects with interior lighting fixture work similar to that required for this project.
- C. Codes and Standards:
 - 1. Electrical Code Compliance: Comply with applicable local code requirements of the authority having jurisdiction and

NEC Articles 220, 410, and 510 as applicable to installation, and construction of interior building lighting fixtures.

2. NEMA Compliance: Comply with applicable requirements of NEMA Stds Pub/No.'s LE 1 and LE 2 pertaining to lighting equipment.
3. IES compliance: comply with IES RP-1 pertaining to office lighting practices and RP-15, regarding selection of illuminance values for interior office lighting.
4. UL Compliance: Comply with UL standards, including UL 486A and B, pertaining to interior lighting fixtures. Provide interior lighting fixtures. Provide interior lighting fixtures and components which are UL-listed and labeled.
5. CBM Labels: Provide fluorescent lamp ballasts which comply with Certified Ballast Manufacturers Association standards and carry the CBM label.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver interior lighting fixtures in factory-fabricated containers or wrappings, which properly protect fixtures from damage.
- B. Store interior lighting fixtures in original packaging. Store inside well-ventilated area protected from weather moisture, soiling, extreme temperatures, humidity, laid flat and blocked off ground.
- C. Handle interior lighting fixtures carefully to prevent damage, breaking, and scoring of finishes. Do not install damaged units or components; replace with new.

1.06 SEQUENCING AND SCHEDULING

- A. Coordinate with other work including wires/cables, electrical boxes and fittings, and raceways, to properly interface installation of interior lighting fixtures with other work.
- B. Sequence interior lighting installation with other work to minimize possibility of damage and soiling during remainder of construction.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. General: Provide lighting fixtures, of sizes, types and ratings indicated; complete with, but not limited to, housings, energy efficient lamps, lamp holders, reflectors energy efficient ballasts, starters and wiring. Ship fixtures factory-assembled, with those components required for a complete installation. Design fixtures with concealed hinges and catches, with metal parts grounded as common unit, and so constructed as to dampen ballast generated noise.
- B. Fluorescent Lamp Ballast:
 - 1. Provide energy saving fluorescent lamp ballasts, capable of operating lamp types indicated; with high power factor rapid-start, and low-noise features; Type 1; Class P; sound-rated A.
- C. Lamps:
 - 1. Provide fluorescent lamps as indicated on Light Fixture Schedule, Sheet E2.0.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Examine areas and conditions under which lighting fixtures are to be installed, and substrate for supporting lighting fixtures. Notify Contractor in writing of conditions detrimental to proper completion of the work. do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.02 INSTALLATION OF INTERIOR LIGHTING FIXTURES

- A. Install interior lighting fixtures at locations and heights as indicated, in accordance with fixture manufacturer's written instructions, applicable requirements of NEC, NECA's "Standard of Installation", NEMA standards, and with recognized industry practices to ensure that lighting fixtures fulfill requirements.
- B. Provide fixtures and/or fixture outlet boxes with hangers to properly support fixture weight.

- C. Install flush mounted fixtures properly to eliminate light leakage between fixture frame and finished surface.
- D. Fasten fixtures securely to structural supports; and ensure that pendant fixtures are plumb and level. Mount continuous rows of fixtures with an additional stem hanger greater than number of fixtures in the row.
- E. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Std 486A and B, and the National Electrical Code.
- F. Support surface mounted fixtures greater than 2 feet in length at a point in addition to the outlet box fixture stud.

3.03 FIELD QUALITY CONTROL

- A. Furnish stock or replacement lamps amounting to 15%, but not less than 4 lamps in each case, of each type and size lamp used in each type fixture. Deliver replacement stock as directed to owner's storage space.

3.04 ADJUSTING AND CLEANING

- A. Clean interior lighting fixtures of dirt and construction debris upon completion of installation. Clean fingerprints and smudges from lenses.
- B. Protect installed fixtures from damage during remainder of construction period.

3.05 GROUNDING

- A. Provide equipment grounding connections for interior lighting fixtures as indicated. Tighten connections to comply with tightening torques specified in UL Std 486A to assure permanent and effective grounds.

3.06 DEMONSTRATION

- A. Upon completion of installation of interior lighting fixtures, and after building circuitry has been energized, apply electrical energy to demonstrate capability and compliance with requirements. Where possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units, and proceed with retesting.

END OF SECTION

SECTION 16535
EMERGENCY LIGHTING

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.02 DESCRIPTION OF WORK

- A. Extent of emergency lighting work is indicated by drawings and schedules.
- B. types of emergency lighting fixtures in this section include the following:
 - 1. Unitized battery powered fixtures.
 - 2. Exit fixtures.
 - 3. Emergency fluorescent lamp power supply.

1.03 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacturer of emergency lighting fixtures of types and ratings required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Installer's Qualifications: Firm with at least 3 years of successful installation experience on projects with emergency lighting work similar to that required for project.
- C. Codes and Standards:
 - 1. NEC Compliance: Comply with NEC as applicable to installation and construction of emergency lighting.
 - 2. NEMA Compliance: Comply with applicable requirements of NEMA Std Pub No.'s 1B 4, 1B 5, and FA 1 pertaining to emergency lighting.

3. UL Compliance: Provide emergency lighting fixtures which are UL-listed and labeled.

1.04 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data on emergency lighting fixtures.

1.05 DELIVERY, STORAGE, AND HANDLING:

- A. Handle lighting fixtures carefully to prevent damage, breaking, and scoring. Do not install damaged fixtures or components; replace with new.
- B. Store lighting fixtures in clean dry place. protect from weather, dirt, fumes, water, construction debris, and physical damage.

PART 2 – PRODUCT

2.01 ACCEPTABLE MANUFACTURERS

- A. Manufacturers: Lithonia or approved equal. See Fixture Schedule, Sheet E2.0.

2.02 EMERGENCY LIGHTING FIXTURES

- A. General: Provide lighting fixtures, of sizes, types and ratings indicated; complete with, but not limited to, housings, energy efficient lamps, lamp holders, reflectors, energy-efficient ballasts, starters and wiring.
- B. Unitized Battery Powered Fixtures:
 1. General: Various fixture types are indicated below. Fixtures must comply with minimum requirements as stated herein.
 2. Emergency Units: Provide battery powered, self-contained units with solid-state, fully automatic charger and transfer/brownout circuit and low-voltage battery disconnect. Provide enclosure constructed in accordance with NEMA 1 standards. Supply maintenance-free nickel-calcium battery for 6-volt operation. Provide two, unit mounted 6-volt 8 watt sealed beam fixtures (Halogen Lamps).
 - a. Accessories: Provide following accessories mounted on unit cabinet:

- 1) Unit test switch.
 - 2) AC "ON" pilot light.
3. Exit Fixtures – Emergency Powered: Provide ceiling mounted fixtures as indicated. Select cast aluminum fixture with no external hardware, black aluminum exterior finish and white baked enamel interior, with capability for adjusting exit arrows as indicated. Provide two, 20 –watt, T-6W ½ incandescent lamps with lamp life multiplier for normal operation, and two, 8 watt lamps for operation on 6-volts. Graphics colors as required by Local requirements.
 - a. Furnish battery powered unit with automatic charging, complete with nickel-cadmium battery which automatically connects 6-volt lamp to battery power upon loss, and disconnects upon restoration of normal AC supply.

2.03 EMERGENCY FLUORESCENT LAMP POWER SUPPLY

- A. General: Provide self-contained battery powered inverter unit for direct mounting in designated fluorescent fixtures. provide unit with fully automatic tow rate charger, nickel-cadmium battery, AC "ON" pilot light, and test switch. Design unit to automatically transfer to battery supply on loss of normal AC power and to operate fluorescent lamp with minimum output of 600 lumens.

PART 3 – EXECUTION

3.01 INSPECTION

- A. Examine areas and conditions under which lighting is to be installed, and substrate which will support lighting fixtures. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.02 INSTALLATION OF EMERGENCY LIGHTING FIXTURES

- A. Install emergency lighting fixtures at locations and heights as indicated, in accordance with fixture manufacturer's written instructions, applicable requirements of NEC, NECA's "Standard of Installation", NEMA standards, and with recognized industry practices to ensure that lighting fixtures fulfill requirements.
- B. Coordinate with other electrical work as appropriate to properly interface installation of emergency lighting fixtures with other work.

3.03 ADJUSTING AND CLEANING

- A. Clean emergency lighting fixtures of dirt and debris upon completion of installation.
- B. Protect installed fixtures from damage during remainder of construction period.

3.04 GROUNDING

- A. Provide equipment grounding connections for emergency lighting fixtures as indicated. Tighten connections to comply with tightening torques specified in UL Std 486A to assure permanent and effective grounds.

3.05 FIELD QUALITY CONTROL

- A. Upon completion of installation of emergency lighting fixtures, and after building circuitry has been energized with normal power source, apply electrical energy to demonstrate capability and compliance with requirement.
- B. Test emergency lighting to demonstrate operation under emergency conditions. Where possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units, and proceed with retesting.

END OF SECTION

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