ISSUED FOR REVIEW

FOR

DEPARTMENT OF PUBLIC SAFETY

WILLIAMSON COUNTY

CANINE TRAINING FACILITY

FLORENCE, TEXAS

PARKHILL
11902 Burnet Road, Suite 100, Austin, Texas 78758
512.676.2100

Owner	Department of Public Safety 5805 North Lamar Blvd. Austin, Texas 78752	**Professional Seal**
Architect	Kory Murphy Parkhill 11902 Burnet Road Austin, Texas 78758 512.676.2100	 04/08/2026

PROJECT TEAM

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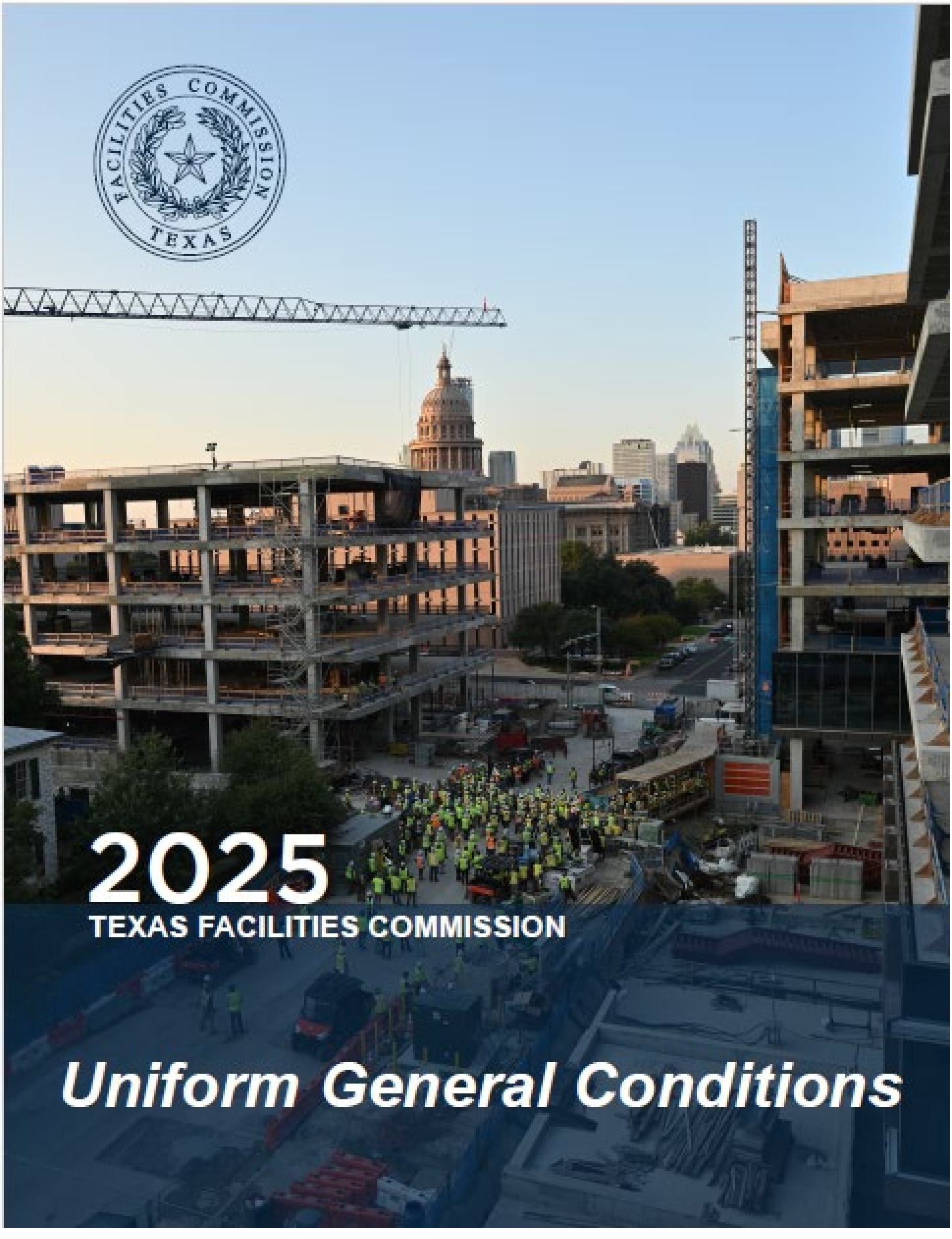

2025

TEXAS FACILITIES COMMISSION

Uniform General Conditions

Uniform General Conditions for Construction Contracts

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Article 1. Definitions

Unless the context clearly requires another meaning, the following terms have the meaning assigned herein.

1.1 *Addendum/Addenda* means formally issued written or graphic modifications and/or interpretations of the Construction Documents that may add to, delete from, clarify or correct the description and/or scope of the Work. Addenda are issued during the bidding phase of the project.

1.2 *Application for Payment* means Contractor's monthly partial invoice for payment that includes any portion of the Work that has been completed for which an invoice has not been submitted and performed in accordance with the requirements of the Contract Documents. The Application for Payment accurately reflects the progress of the Work, is itemized based on the Schedule of Values, bears the notarized signature of Contractor, and shall not include subcontracted items for which Contractor does not intend to pay.

1.3 *Application for Final Payment* means Contractor's final invoice for payment that includes any portion of the Work that has been completed for which an invoice has not been submitted, amounts owing to adjustments to the final Contract Sum resulting from approved change orders, and release of remaining Contractor's retainage.

1.4 *Architect/Engineer (A/E)* means a person registered as an architect pursuant to Tex. Occ. Code Ann., Ch. 1051, as a landscape architect pursuant to Tex. Occ. Code Ann., Ch. 1052, a person licensed as a professional engineer pursuant Tex. Occ. Code Ann., Ch. 1001, and/or a firm employed by Owner or Design-Build Contractor to provide professional architectural or engineering services and to exercise overall responsibility for the design of a Project or a significant portion thereof, and to perform the contract administration responsibilities set forth in the Contract.

1.5 *Authority Having Jurisdiction* means a federal, state, local, or other regional department, or an individual such as a fire marshal, building official, electrical inspector, utility provider or other individual having statutory authority.

1.6 *Baseline Schedule* means the initial time schedule prepared by Contractor for Owner's information and acceptance that conveys Contractor's and Subcontractors' activities (including coordination and review activities required in the Contract Documents to be performed by A/E and ODR), durations, and sequence of work related to the entire Project to the extent required by the Contract Documents. The schedule clearly demonstrates the critical path of activities, durations and necessary predecessor conditions that drive the end date of the schedule. The Baseline Schedule shall not exceed the time limit current under the Contract Documents.

1.7 *Certificate of Final Completion* means the certificate issued by A/E that documents, to the best of A/E's knowledge and understanding Contractor's completion of all Contractor's Punchlist items and pre-final Punchlist items, final cleanup and Contractor's provision of Record Documents, operations and maintenance manuals,

and all other closeout documents required by the Contract Documents.

1.8 *Certificate of Substantial Completion* means the certificate executed by the A/E, ODR and Contractor that documents to the best of A/E's and ODR's knowledge and understanding, Contractor's sufficient completion of the work in accordance with the Contract, so as to be operational and fit for the use intended.

1.9 *Change Order* means a written modification of the Contract between Owner and Contractor, signed by Owner, Contractor, and A/E.

1.10 *Close-out Documents* mean the product brochures, submittals, product/equipment maintenance and operations instructions, manuals, and other documents/warranties, record documents, affidavit of payment, release of lien and claim, and as may be further defined, identified, and required by the Contract Documents.

1.11 *Contract* means the entire agreement between Owner and Contractor, including all of the Contract Documents.

1.12 *Contract Date* is the date when the agreement between Owner and Contractor becomes effective.

1.13 *Contract Documents* mean those documents identified as a component of the agreement (Contract) between Owner and Contractor. These may include, but are not limited to, Drawings; Specifications; the Uniform General Conditions, Supplementary General Conditions, and Special Conditions; and all pre-bid and/or pre-proposal addenda.

1.14 *Contract Sum* means the total compensation payable to Contractor for completion of the Work in accordance with the terms of the Contract.

1.15 *Contract Time* means the period between the start date identified in the Notice to Proceed with construction and the Substantial Completion date identified in the Notice to Proceed or as subsequently amended by a Change Order.

1.16 *Contractor* means the individual, corporation, limited liability company, partnership, firm, or other entity contracted to perform the Work, regardless of the type of construction contract used, so that the term as used herein includes a Construction Manager-at-Risk or a Design-Build firm as well as a general or prime Contractor. The Contract Documents refer to Contractor as if singular in number.

1.17 *Construction Documents* mean the Drawings, Specifications, and other documents issued to build the Project. Construction Documents become part of the Contract Documents when listed in the Contract or any Change Order.

1.18 *Construction Manager-at-Risk*, in accordance with Tex. Gov't Code, Ch. 2166, means a sole proprietorship, partnership, corporation, or other legal entity that assumes the risk for construction, rehabilitation, alteration, or repair of a facility at the contracted price as a general contractor and provides consultation to Owner regarding construction during and after the design of the facility.

1.19 *Date of Commencement* means the date designated in the Notice to Proceed for Contractor to commence the Work.

1.20 *Day* means a calendar day unless otherwise specifically stipulated.

1.21 *Design-Build* means a project delivery method in which the detailed design and subsequent construction is provided through a single contract with a Design-Build firm; a team, partnership, or legal entity that includes design professionals and a builder. The Design-Build Project delivery shall be implemented in accordance with Tex. Gov't Code § 2166.2531.

1.22 *Drawings* mean that product of A/E which graphically depicts the Work.

1.23 *Final Completion* means the date determined and certified by A/E and Owner on which the Work is fully and satisfactorily complete in accordance with the Contract.

1.24 *Final Payment* means the last and final monetary compensation made to Contractor for any portion of the Work that has been completed and accepted for which payment has not been made, amounts owing to adjustments to the final Contract Sum resulting from approved change orders, and release of Contractor's retainage.

1.25 *Historically Underutilized Business (HUB)* pursuant to Tex. Gov't Code Ch. 2161, means a business that is at least 51% owned by an Asian Pacific American, a Black American, a Hispanic American, a Native American, an American Woman and/or a Service Disabled Veteran with a Service related disability of 20% or greater; is an entity with its principal place of business in Texas; and has an owner residing in Texas with proportionate interest that actively participates in the control, operations, and management of the entity's affairs.

1.26 *Notice to Proceed* means written document informing Contractor of the dates beginning Work and the dates anticipated for Substantial Completion.

1.27 *Open Item List* means a list of work activities, Punchlist items, changes or other issues that are not expected by Owner and Contractor to be complete prior to Substantial Completion.

1.28 *Owner* means the State of Texas, and any agency of the State of Texas, acting through the responsible entity of the State of Texas identified in the Contract as Owner.

1.29 *Owner's Designated Representative (ODR)* means the individual assigned by Owner to act on its behalf and to undertake certain activities as specifically outlined in the Contract. ODR is the only party authorized to direct changes to the scope, cost, or time of the Contract.

1.30 *Project* means all activities necessary for realization of the Work. This includes design, contract award(s), execution of the Work itself, and fulfillment of all Contract and warranty obligations.

1.31 *Progress Assessment Report (PAR)* means the monthly compliance report to Owner verifying compliance with the HUB subcontracting plan (HSP).

1.32 *Proposed Change Order (PCO)* means a document that informs Contractor of a proposed change in the Work and appropriately describes or otherwise documents such change including Contractor's response of pricing for the proposed change.

1.33 *Punchlist* means a list of items of Work to be completed or corrected by Contractor after Substantial Completion. Punch lists indicate items to be finished, remaining Work to be performed, or Work that does not meet quality or quantity requirements as required in the Contract Documents.

1.34 *Record Documents* mean the drawing set, Specifications, and other materials maintained by Contractor that documents all addenda, Architect's Supplemental Instructions, Change Orders and postings and markings that record the as-constructed conditions of the Work and all changes made during construction.

1.35 *Request for Information (RFI)* means a written request by Contractor directed to A/E or ODR for a clarification of the information provided in the Contract Documents or for direction concerning information necessary to perform the Work that may be omitted from the Contract Documents.

1.36 *Samples* mean representative physical examples of materials, equipment, or workmanship used to confirm compliance with requirements and/or to establish standards for use in execution of the Work.

1.37 *Schedule of Values* means the detailed breakdown of the cost of the materials, labor, and equipment necessary to accomplish the Work as described in the Contract Documents, submitted by Contractor for approval by Owner and A/E.

1.38 *Shop Drawings* mean the drawings, diagrams, illustrations, schedules, performance charts, brochures, and other data prepared by Contractor or its agents which detail a portion of the Work.

1.39 *Site* means the geographical area of the location of the Work.

1.40 *Special Conditions* mean the documents containing terms and conditions which may be unique to the Project. Special Conditions are a part of the Contract Documents and have precedence over the Uniform General Conditions and Supplementary General Conditions.

1.41 *Specifications* mean the written product of A/E that establishes the quality and/or performance of products utilized in the Work and processes to be used, including testing and verification for producing the Work.

1.42 *Subcontractor* means a business entity that enters into an agreement with Contractor to perform part of the Work or to provide services, materials, or equipment for use in the

Work.

1.43 *Submittal Register* means a list provided by Contractor of all items to be furnished for review and approval by A/E and Owner and as identified in the Contract Documents including anticipated sequence and submittal dates.

1.44 *Substantial Completion* means the date determined and certified by Contractor, A/E, and Owner when the Work, or a designated portion thereof, is sufficiently complete, in accordance with the Contract, so as to be operational and fit for the use intended.

1.45 *Supplementary General Conditions* mean procedures and requirements that modify the Uniform General Conditions. Supplementary General Conditions, when used, have precedence over the Uniform General Conditions.

1.46 *Unit Price Work* means the Work, or a portion of the Work, paid for based on incremental units of measurement.

1.47 *Unilateral Change Order (ULCO)* means a Change Order issued by Owner without the complete agreement of Contractor, as to cost and/or time.

1.48 *Work* means the administration, procurement, materials, equipment, construction and all services necessary for Contractor, and/or its agents, to fulfill Contractor's obligations under the Contract.

1.49 *Work Progress Schedule* means the continually updated time schedule prepared and monitored by Contractor that accurately indicates all necessary appropriate revisions as required by the conditions of the Work and the Project while maintaining a concise comparison to the Baseline Schedule.

Article 2. Wage Rates and Other Laws Governing Construction

2.1 Environmental Regulations. Contractor shall conduct activities in compliance with applicable laws and regulations and other requirements of the Contract relating to the environment and its protection at all times. Unless otherwise specifically determined, Owner is responsible for obtaining and maintaining permits related to stormwater run-off. Contractor shall conduct operations consistent with stormwater run-off permit conditions. Contractor is responsible for all items it brings to the Site, including hazardous materials, and all such items brought to the Site by its Subcontractors and suppliers, or by other entities subject to direction of Contractor. Contractor shall not incorporate hazardous materials into the Work without prior approval of Owner, and shall provide an affidavit attesting to such in association with request for Substantial Completion inspection.

2.2 Wage Rates. Contractor shall not pay less than the wage scale of the various classes of labor as shown on the prevailing wage schedule provided by Owner in the bid or proposal specifications. The specified wage rates are minimum rates only. Owner is to pay any claims for additional compensation made by any Contractor because the Contractor pays wages in excess of the applicable minimum rate contained in the

Contract. The prevailing wage schedule is not a representation that qualified labor adequate to perform the Work is available locally at the prevailing wage rates.

2.2.1 Notification to Workers. Contractor shall post the prevailing wage schedule in a place conspicuous to all workers on the Project Site When requested by Owner, Contractor shall furnish evidence of compliance with the Texas Prevailing Wage Law and the addresses of all workers.

2.2.1.1 Pursuant to Tex. Gov't Code § 2258.024, Contractor shall keep on site, true and accurate records showing the name and occupation of each worker employed by the Contractor or subcontractors and the actual per diem wages paid to each worker. The record shall be open to inspection by the ODR and their agents at all reasonable hours for the duration of the contract.

2.2.1.2 With each application for progress payment, Contractor shall make available upon request certified payroll records, including from subcontractors of any tier level, on Form WH-347 as promulgated by the U.S. Department of Labor, as may be revised from time to time and in unlocked and unprotected Excel format, along with copies of any and all Contract Documents between Contractor and any Subcontractors. Pursuant to Tex. Penal Code §§ 37.02 and 37.10, Employees of Contractor and subcontractors, including all tier levels, shall be subject to prosecution for submitting certified payroll records that contain materially false information.

2.2.1.3 The prevailing wage schedule is determined by Owner in compliance with Tex. Gov't Code, Ch. 2258. Should Contractor at any time become aware that a particular skill or trade not reflected on Owner's prevailing wage schedule will be or is being employed in the Work, whether by Contractor or by Subcontractor, Contractor shall promptly inform ODR of the proposed wage to be paid for the skill along with a justification for same and ODR shall promptly concur with or reject the proposed wage and classification.

2.2.1.4 Contractor is responsible for determining the most appropriate wage for a particular skill in relation to similar skills or trades identified on the prevailing wage schedule. In no case, shall any worker be paid less than the wage indicated for laborers.

2.2.1.5 Pursuant to Tex. Labor Code § 214.008, Misclassification of Workers; Penalty. The Owner requires Contractor and all subcontractors properly classify individuals as Employees or Independent Contractors.

2.2.2 Penalty for Violation. Contractor, and any Subcontractor, will pay to the State a penalty of sixty dollars ($60) for each worker employed for each day, or portion thereof, that the worker is paid less than the wage rates stipulated in the

prevailing wage schedule.

2.2.3 Complaints of Violations.

2.2.3.1 Owner's Determination of Good Cause. Upon receipt of information concerning a violation, Owner will conduct an investigation in accordance with Tex. Gov't Code, Ch. 2258 and make an initial determination as to whether good cause exists that a violation occurred. Upon making a good cause finding, Owner will retain the full amounts claimed by the claimant or claimants as the difference between wages paid and wages due under the prevailing wage schedule and any supplements thereto, together with the applicable penalties in accordance with Tex. Gov't Code § 2258.023, such amounts being subtracted from successive progress payments pending a final decision on the violation.

2.2.3.2 No Extension of Time. If Owner's determination proves valid that good cause existed to believe a violation had occurred, Contractor is not entitled to an extension of time for any delay arising directly or indirectly from the arbitration procedures.

2.2.3.3 Cooperation with Owner's Investigation. Contractor shall cooperate with Owner during any investigations hereunder. Such cooperation shall include, but not necessarily be limited to, timely providing the information and/or documentation requested by Owner, which may include certified payroll records on Form WH-347 as promulgated by the U.S. Department of Labor, as may be revised from time to time and in unlocked and unprotected Excel format; and copies of any and all Contract Documents between Contractor and any Subcontractors.

2.2.3.4 Notification to Owner. In the event Contractor or Subcontractor elects to appeal an initial determination made pursuant to Paragraph 2.2.3.1, the Contractor and/or Subcontractor, as applicable, shall deliver notice thereof to Owner.

2.3 Venue for Suits. Unless mandatory venue is otherwise required by law, the venue for any suit arising from the Contract will be in a court of competent jurisdiction in Travis County, Texas, or as may otherwise be designated in the Supplementary General Conditions within the state of Texas.

2.4 Licensing of Trades. Contractor shall comply with all applicable provisions of State law related to license requirements for skilled tradesmen, contractors, suppliers and or laborers, as necessary to accomplish the Work. In the event Contractor, or one of its Subcontractors, loses its license during the term of performance of the Contract, Contractor shall promptly hire or contract with a licensed provider of the service at no additional cost to Owner.

2.5 Royalties, Patents, and Copyrights. Contractor shall pay all royalties and license fees,

defend suits or claims for infringement of copyrights and patent rights, and shall hold Owner harmless from loss on account thereof, but shall not be responsible for such defense or loss when a particular design, process or product of a particular manufacturer or manufacturers is required by the Contract Documents, or where the copyright violations are contained in Drawings, Specifications or other documents prepared by Owner or A/E. However, if Contractor has reason to believe that the required design, process, or product is an infringement of a copyright or a patent, Contractor shall be responsible for such loss unless such information is promptly furnished to A/E.

2.6 State Sales and Use Taxes. Owner qualifies for exemption from certain State and local sales and use taxes pursuant to the provisions of Tex. Tax Code, Ch. 151. Upon request from Contractor, Owner shall furnish evidence of tax exempt status. Contractor may claim exemption from payment of certain applicable State taxes by complying with such procedures as prescribed by the State Comptroller of Public Accounts. Owner acknowledges not all items qualify for exemption. Owner is not obligated to reimburse Contractor for taxes paid on items that qualify for tax exemption.

2.7 Buy America Requirements for Iron and Steel Used in Construction. In accordance with Texas Government Code Section 2252.202, all iron or steel products (i.e., rolled structural shapes including wide flange beams and columns, angles, bars, plates, sheets, hollow structural sections, pipe, etc.) shall be produced, manufactured and fabricated in the United States. Request for exceptions as provided in the Texas Government Code 2252.203 shall be submitted to and approved by the ODR. Refer to the Special Conditions and/or Supplemental General Conditions for any project-specific requirements.

Article 3. General Responsibilities of Owner and Contractor

3.1 Owner's General Responsibilities. Owner is the entity identified as such in the Contract and referred to throughout the Contract Documents as if singular in number.

3.1.1 Preconstruction Conference. Prior to, or concurrent with, the issuance of Notice to Proceed with construction, a conference will be convened for attendance by Owner, Contractor, A/E and appropriate Subcontractors. The purpose of the conference is to establish a working understanding among the parties as to the Work, the operational conditions at the Project Site, and general administration of the Project. Topics include communications, schedules, procedures for handling Shop Drawings and other submittals, processing Applications for Payment, maintaining required records and all other matters of importance to the administration of the Project and effective communications between the Project team members.

3.1.2 Owner's Designated Representative. Prior to the start of construction, Owner will identify Owner's Designated Representative (ODR), who has the express authority to act and bind Owner to the extent and for the purposes described in the various Articles of the Contract, including responsibilities for general administration of the Contract.

3.1.2.1 Unless otherwise specifically defined elsewhere in the Contract Documents, ODR is the single point of contact between Owner and Contractor. Notice to ODR, unless otherwise noted, constitutes notice to Owner under the Contract.

3.1.2.2 Directives on behalf of Owner will be conveyed to Contractor and A/E by ODR in writing.

3.1.2.3 The Owner will provide, at no cost, a digital/electronic version and the specified number of complete sets of the Drawings, Specifications, and addenda as outlined in the Supplementary General Conditions or Special Conditions.

3.1.2.4 The ODR will establish the protocol for planning, scheduling and documenting progress meetings with provisions for absence of various project team members that have a key role in these duties.

3.1.3 Owner Supplied Materials and Information.

3.1.3.1 Owner will furnish to Contractor those surveys describing the physical characteristics, legal description, limitations of the Site, Site utility locations, and other information used in the preparation of the Contract Documents.

3.1.3.2 Owner will provide information, equipment, or services under Owner's control to Contractor with reasonable promptness.

3.1.4 Availability of Lands. Owner will furnish, as indicated in the Contract, all required rights to use the lands upon which the Work occurs. This includes rights-of-way and easements for access and such other lands that are designated for use by Contractor. Contractor shall comply with all Owner identified encumbrances or restrictions specifically related to use of lands so furnished. Owner will obtain and pay for easements for permanent structures or permanent changes in existing facilities,

3.1.5 Limitation on Owner's Duties.

3.1.5.1 Owner will not supervise, direct, control or have authority over or be responsible for Contractor's means, methods, technologies, sequences or procedures of construction or the safety precautions and programs incident thereto. Owner is not responsible for any failure of Contractor to comply with laws and regulations applicable to the Work. Owner is not responsible for the failure of Contractor to perform or furnish the Work in accordance with the Contract Documents. Except as provided in Section 2.5, Owner is not responsible for the acts or omissions of Contractor, or any of its Subcontractors, suppliers or of any other person or organization performing or furnishing any of the Work on

behalf of Contractor.

3.1.5.2 Owner will not take any action in contravention of a design decision made by A/E in preparation of the Contract Documents, when such actions are in conflict with statutes under which A/E is licensed for the protection of the public health and safety.

3.2 Role of Architect/Engineer. Unless specified otherwise in the Contract between Owner and Contractor, A/E shall provide general administration services for Owner during the construction phase of the project. Written correspondence, requests for information, and Shop Drawings/submittals shall be directed to A/E for action. A/E has the authority to act on behalf of Owner to the extent provided in the Contract Documents, unless otherwise modified by written instrument, which will be furnished to Contractor by ODR, upon request.

3.2.1 Site Visits.

3.2.1.1 A/E will make visits to the Site at intervals as provided in the A/E's Contract with Owner, to observe the progress and the quality of the various aspects of Contractor's executed Work and report findings to Owner.

3.2.1.2 A/E has the authority to interpret Contract Documents and inspect the Work for compliance and conformance with the Contract. Except as referenced in Paragraph 3.1.5.2, Owner retains the sole authority to accept or reject Work and issue direction for correction, removal, or replacement of Work.

3.2.2 Clarifications and Interpretations. It may be determined that clarifications or interpretations of the Contract Documents are necessary. Upon direction by ODR, such clarifications or interpretations will be provided by A/E consistent with the intent of the Contract Documents. A/E will issue these clarifications with reasonable promptness to Contractor as A/E's supplemental instruction ("ASI") or similar instrument. If Contractor believes that such clarification or interpretation justifies an adjustment in the Contract Sum or the Contract Time, Contractor shall so notify Owner in accordance with the provisions of Article 11.

3.2.3 Limitations on Architect/Engineer Authority. A/E is not responsible for:

3.2.3.1 Contractor's means, methods, techniques, sequences, procedures, safety, or programs incident to the Project, nor will A/E supervise, direct, control or have authority over the same;

3.2.3.2 The failure of Contractor to comply with laws and regulations applicable to the furnishing or performing the Work;

3.2.3.3 Contractor's failure to perform or furnish the Work in accordance with the Contract Documents; or

3.2.3.4 Acts or omissions of Contractor, or of any other person or organization performing or furnishing any of the Work.

3.3 Contractor's General Responsibilities. Contractor is solely responsible for implementing the Work in full compliance with all applicable laws and the Contract Documents and shall supervise and direct the Work using the best skill and attention to assure that each element of the Work conforms to the Contract requirements. Contractor is solely responsible for all construction means, methods, techniques, safety, sequences, coordination, procedures and protection of the installed work as part of the contract until substantial completion of the project. Contractor remains responsible for the care and protection of materials and Work in the areas where punch list items are completed until Final Completion.

3.3.1 Project Administration. Contractor shall provide Project administration for all Subcontractors, vendors, suppliers, and others involved in implementing the Work and shall coordinate administration efforts with those of A/E and ODR in accordance with these general conditions and other provisions of the Contract, and as outlined in the preconstruction conference. Contractor's Project Administration includes periodic daily reporting on weather, work progress, labor, materials, equipment, obstructions to prosecution of the work, accidents and injuries in accordance with the Contract and transmitted no less frequently than on a weekly basis.

3.3.2 Contractor's Management Personnel. Contractor shall employ a competent person or persons who will be present at the Project Site during the progress of the Work to supervise or oversee the work. The competent persons are subject to the approval of ODR. Contractor shall not change approved staff during the course of the project without the written approval of ODR unless the staff member leaves the employment of Contractor. Contractor shall provide additional quality control, safety and other staff as stated in the Supplementary General Conditions.

3.3.3 Labor. Contractor shall provide competent, suitably qualified personnel to survey, lay-out, and construct the Work as required by the Contract Documents and maintain good discipline and order at the Site at all times.

3.3.4 Services, Materials, and Equipment. Unless otherwise specified, Contractor shall provide and assume full responsibility for all services, materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities, and all other facilities, incidentals, and services necessary for the construction, performance, testing, start-up, inspection and completion of the Work.

3.3.5 Contractor General Responsibility. For Owner furnished equipment or material

that will be in the care, custody, and control of Contractor, Contractor is responsible for damage or loss. Owner shall deliver to Contractor a complete list and respective values of such materials or equipment and make an equitable adjustment to the contract amount for any increase in cost of Builder's Risk insurance.

3.3.6 Non-Compliant Work. Should A/E and/or ODR identify Work as non-compliant with the Contract Documents, A/E and/or ODR shall communicate the finding(s) to Contractor, and Contractor shall correct such Work at no additional cost to the Owner. The approval of Work by either A/E or ODR does not relieve Contractor from the obligation to comply with all requirements of the Contract Documents.

3.3.7 Subcontractors. Contractor shall not employ any Subcontractor, supplier or other person or organization, whether initially or as a substitute, against whom Owner shall have reasonable objection. Owner will communicate such objections in writing within ten (10) days of receipt of Contractor's intent to use such Subcontractor, supplier, or other person or organization. Contractor is not required to employ any Subcontractor, supplier or other person or organization to furnish any of the work to whom Contractor has reasonable objection. Contractor shall not substitute Subcontractors without the acceptance of Owner. Pursuant to Tex. Gov't Code § 2269.256(b), if the Contractor reviews, evaluates and recommends that the Owner accept a bid or proposal from a Subcontractor but the Owner requires another bid or proposal to be accepted, Owner shall compensate the Contractor by a change in price, time or guaranteed maximum cost for any additional cost or risk the Contractor will incur because of Owner's requirement to select another bid or proposal rather than the one recommended.

3.3.7.1 All Subcontracts and supply contracts shall be consistent with and bind the Subcontractors and suppliers to the terms and conditions of the Contract Documents including provisions of the Contract between Contractor and Owner.

3.3.7.2 Contractor shall be solely responsible for scheduling and coordinating the Work of Subcontractors, suppliers and other persons and organizations performing or furnishing any of the Work under a direct or indirect contract with Contractor. Require all Subcontractors, suppliers and such other persons and organizations performing or furnishing any of the Work to communicate with Owner only through Contractor. Contractor shall furnish to Owner a copy, at Owner's request, of each first-tier subcontract promptly after its execution. Contractor agrees that Owner has no obligation to review or approve the content of such contracts and that providing Owner such copies in no way relieves Contractor of any of the terms and conditions of the Contract, including, without limitation, any provisions of the Contract which require the Subcontractor to be bound to Contractor in the same manner in which Contractor is bound to Owner.

3.3.8 Continuing the Work. Contractor shall carry on the Work and adhere to the progress schedule during all disputes, disagreements, or alternative resolution processes with Owner. Contractor shall not delay or postpone any Work because of pending unresolved disputes, disagreements or alternative resolution processes, except as Owner and Contractor may agree in writing.

3.3.9 Cleaning. Contractor shall at all times, keep the Site and the Work clean and free from accumulation of waste materials or rubbish caused by the construction activities under the Contract. Contractor shall ensure that the entire Project is thoroughly cleaned prior to requesting Substantial Completion inspection and, again, upon completion of the Project prior to the final inspection.

3.3.10 Acts and Omissions of Contractor, its Subcontractors, and Employees. Contractor shall be responsible for acts and omissions of his employees and all its Subcontractors, their agents and employees. Owner may, in writing, require Contractor to remove from the Project any of Contractor's or its Subcontractor's employees whom ODR finds to be careless, incompetent, unsafe, uncooperative, disruptive, or otherwise objectionable.

3.3.11 Acts or Omissions. **CONTRACTOR SHALL IDEMNIFY AND HOLD HARMLESS THE STATE OF TEXAS AND CUSTOMERS, AND/OR THEIR OFFICERS, AGENTS, EMPLOYEES, REPRESENTATIVES, CONTRACTORS, ASSIGNEES, AND/OR DESIGNEES FROM ANY AND ALL LIABILITY, ACTIONS, CLAIMS, DEMANDS, OR SUITS, AND ALL RELATED COSTS, ATTORNEY FEES, AND EXPENSES ARISING OUT OF, OR RESULTING FROM ANY ACTS OR OMISSIONS OF CONTRACTOR OR ITS AGENTS, EMPLOYEES, SUBCONTRACTORS, ORDER FULLFILLERS, OR SUPPLIERS OF SUBCONTRACTORS IN THE EXECUTION OR PERFORMANCE OF THE CONTRACT AND ANY PURCHASE ORDERS ISSUED UNDER THE CONTRACT. THE DEFENSE SHALL BE COORDINATED BY CONTRACTOR WITH THE OFFICE OF THE ATTORNEY GENERAL WHEN TEXAS STATE AGENCIES ARE NAMED DEFENDANTS IN ANY LAWSUIT AND CONTRACTOR MAY NOT AGREE TO ANY SETTLEMENT WITHOUT FIRST OBTAINING THE CONCURRENCE FROM THE OFFICE OF THE ATTORNEY GENERAL. CONTRACTOR AND OWNER AGREE TO FURNISH TIMELY WRITTEN NOTICE TO EACH OTHER OF ANY SUCH CLAIM.**

3.3.12 Infringements.

3.3.12.1 **CONTRACTOR SHALL IDEMNIFY AND HOLD HARMLESS THE STATE OF TEXAS AND CUSTOMERS, AND/OR THEIR EMPLOYEES, AGENTS, REPRESENTATIVES, CONTRACTORS, ASSIGNEES, AND/OR DESIGNEES FROM ANY AND ALL THIRD PARTY CLAIMS INVOLVING**

INFRINGEMENT OF UNITED STATES PATENTS, COPYRIGHTS, TRADE AND SERVICE MARKS, OR ANY OTHER INTELLECTUAL OR INTANGIBLE PROPERTY RIGHTS IN CONNECTION WITH THE PERFORMANCES OR ACTIONS OF CONTRACTOR PURSUANT TO THIS CONTRACT. CONTRACTOR AND THE CUSTOMER AGREE TO FURNISH TIMELY WRITTEN NOTICE TO EACH OTHER OF ANY SUCH CLAIM. CONTRACTOR SHALL BE LIABLE TO PAY ALL COSTS OF DEFENSE INCLUDING ATTORNEYS' FEES. THE DEFENSE SHALL BE COORDINATED BY CONTRACTOR WITH THE OFFICE OF THE ATTORNEY GENERAL WHEN TEXAS STATE AGENCIES NAMED DEFENDANTS IN ANY LAWSUIT AND CONTRACTOR MAY NOT AGREE TO ANY SETTLEMENT WITHOUT FIRST OBTAINING THE CONCURRENCE FROM THE OFFICE OF THE ATTORNEY GENERAL.

3.3.12.2 Contractor shall have no liability under this section if the alleged infringement is caused in whole or in part by: (i) use of the product or service for a purpose or in a manner for which the product or service was not designed, (ii) any modification made to the product without Contractor's written approval, (iii) any modifications made to the product by Contractor pursuant to Customer's specific instructions, (iv) any intellectual property right owned by or licensed to Customer, or (v) any use of the product or service by Customer that is not in conformity with the terms of any applicable license agreement.

3.3.12.3 If Contractor becomes aware of an actual or potential claim, or Customer provides Contractor with notice of an actual or potential claim, Contractor may (or in the case of an injunction against Customer, shall), at Contractor's sole option and expense; (i) procure for the Customer the right to continue to use the affected portion of the product or service, or (ii) modify or replace the affected portion of the product or service with functionally equivalent or superior product or service so that Customer's use is non-infringing.

3.3.12.4 Taxes/Workers' Compensation/Unemployment Insurance–Including Indemnity.

3.3.12.4.1 **CONTRACTOR AGREES AND ACKNOWLEDGES THAT DURING THE EXISTENCE OF THIS CONTRACT, CONTRACTOR SHALL BE ENTIRELY RESPONSIBLE FOR THE LIABILITY AND PAYMENT OF CONTRACTOR'S AND CONTRACTOR'S EMPLOYEES' TAXES OF WHATEVER KIND, ARISING OUT OF THE PERFORMANCES IN THIS CONTRACT.**

CONTRACTOR AGREES TO COMPLY WITH ALL STATE AND FEDERAL LAWS APPLICABLE TO ANY SUCH PERSONS, INCLUDING LAWS REGARDING WAGES, TAXES, INSURANCE, AND WORKERS' COMPENSATION. THE CUSTOMER AND/OR THE STATE SHALL NOT BE LIABLE TO CONTRACTOR, ITS EMPLOYEES, AGENTS, OR OTHERS FOR THE PAYMENT OF TAXES OR THE PROVISION OF UNEMPLOYMENT WORKERS' COMPENSATION OR ANY BENEFIT AVAILABLE TO A STATE EMPLOYEE OR EMPLOYEE OF ANOTHER GOVERNMENTAL ENTITY CUSTOMER.

3.3.12.5 The provisions of this indemnification are solely for the benefit of the parties hereto and not intended to create or grant any rights, contractual or otherwise, to any other person or entity.

3.3.12.6 Contractor shall promptly advise Owner in writing of any claim or demand against Owner or against Contractor which involves Owner and known to Contractor and related to or arising out of Contractor's activities under this Contract.

3.3.13 Ancillary Areas. Operate and maintain operations and associated storage areas at the site of the Work in accordance with the following:

3.3.13.1 Confine all Contractor operations, including storage of materials and employee parking upon the Site of Work, to areas designated by Owner.

3.3.13.2 Contractor may erect, at its own expense, temporary buildings that will remain its property. Remove such buildings and associated utility service lines upon completion of the Work, unless Contractor requests and Owner provides written consent that it may abandon such buildings and utilities in place.

3.3.13.3 Use only established roadways or construct and use such temporary roadways as may be authorized by Owner. Do not allow load limits of vehicles to exceed the limits prescribed by appropriate regulations or law. Provide protection to road surfaces, curbs, sidewalks, trees, shrubbery, sprinkler systems, drainage structures and other like existing improvements to prevent damage and repair any damage thereto at the expense of Contractor.

3.3.13.4 Owner may restrict Contractor's entry to the Site to specifically assigned entrances and routes.

3.3.14 Separate Contracts. Owner reserves the right to award other contracts in connection with other portions of the Project under these same or substantially similar contract conditions, including those portions related to insurance and waiver of subrogation. Owner reserves the right to perform operations related to the Project with Owner's own forces.

3.3.15 Under a system of separate contracts, the conditions described herein continue to apply except as may be amended by change order.

3.3.16 Contractor shall cooperate with other contractors or forces employed on the Project by Owner, including providing access to Site and Project information as requested.

3.3.17 Owner shall be reimbursed by Contractor for costs incurred by Owner which are payable to a separate contractor because of delays, improperly timed activities, or defective construction by Contractor. Owner will equitably adjust the Contract by Change Order for costs incurred by Contractor because of delays, improperly timed activities, damage to the Work or defective construction by a separate contractor.

Article 4. Historically Underutilized Business (HUB) Subcontracting Plan

4.1 General Description. The purpose of the Historically Underutilized Business (HUB) program is to promote equal business opportunities for economically disadvantaged persons (as defined by Tex. Gov't Code, Ch. 2161) to contract with the State of Texas in accordance with the goals specified in the State of Texas Disparity Study. The HUB program annual procurement utilization goals are defined in 34 T.A.C. § 20.13(b).

4.2 State agencies are required by statute to make a good faith effort to assist HUBs in participating in contract awards issued by the State. 34 T.A.C. § 20.13(b) outlines the State's policy to encourage the utilization of HUBs in State contracting opportunities through race, ethnic and gender-neutral means.

4.2.1 A Contractor who contracts with the State in an amount of $100,000 or greater is required to make a good faith effort to award subcontracts to HUBs in accordance with 34 T.A.C. § 20.14(a)(2)(A) by submitting a HUB subcontracting plan within twenty-four (24) hours after the bid or response is due and complying with the HUB subcontracting plan after it is accepted by Owner and during the term of the Contract.

4.3 Compliance with Approved HUB Subcontracting Plan. Contractor, having been awarded this Contract in part by complying with the HUB program statute and rules, hereby covenants to continue to comply with the HUB program as follows:

4.3.1 Prior to adding or substituting a Subcontractor, promptly notify Owner in the event a change is required for any reason to the accepted HUB subcontracting plan.

4.3.2 Conduct the good-faith effort activities required and provide Owner with necessary documentation to justify approval of a change to the approved HUB subcontracting plan.

4.3.3 Cooperate in the execution of a Change Order or such other approval of the change in the HUB subcontracting plans as Contractor and Owner may agree to.

4.3.4 Maintain and make available to Owner upon request business records documenting compliance with the accepted HUB subcontracting plan.

4.3.5 Upon receipt of payment for performance of Work, submit to Owner a compliance report, in the format required by Owner that demonstrates Contractor's performance of the HUB subcontracting plan.

4.3.5.1 Progress Assessment Report (PAR): monthly compliance reports to Owner (contracting agency), verifying their compliance with the HUB subcontracting plan, including the use/expenditures they have made to Subcontractors. (The PAR is available in the Index Forms Library on the Facilities Design & Construction page of the Texas Facilities Commission website.

4.3.6 Promptly and accurately explain and provide supplemental information to Owner to assist in Owner's investigation of Contractor's good-faith effort to fulfill the HUB subcontracting plan and the requirements under 34 T.A.C. § 20.14(a)(1).

4.4 Failure to Demonstrate Good-Faith Effort. Upon a determination by Owner that Contractor has failed to demonstrate a good-faith effort to fulfill the HUB subcontracting plan or any Contract covenant detailed above, Owner may, in addition to all other remedies available to it, report the failure to perform to the Comptroller of Public Accounts, Texas Procurement and Support Services Division, Historically Underutilized Business Program and may bar Contractor from future contracting opportunities with Owner.

Article 5. Bonds and Insurance

5.1 Construction Bonds. Contractor is required to tender to Owner, prior to commencing the Work, performance and payment bonds, as required by Tex. Gov't Code, Ch. 2253. On Construction Manager-at-Risk and Design-Build Projects the Owner shall require a security bond, as described in Subsection 5.1.2 below.

5.1.1 Bond Requirements. Each bond shall be executed by a corporate surety or sureties authorized to do business in the State of Texas and acceptable to Owner, on Owner's form, and in compliance with the relevant provisions of the Texas Insurance Code. If any bond is for more than ten (10) percent of the surety's capital and surplus, Owner may require certification that the company has

reinsured the excess portion with one or more reinsurers authorized to do business in the State. A reinsurer may not reinsure for more than ten (10) percent of its capital and surplus. If a surety upon a bond loses its authority to do business in the State, Contractor shall, within thirty (30) days after such loss, furnish a replacement bond at no added cost to Owner.

5.1.1.1 A Performance bond is required if the Contract Sum is in excess of $100,000. The performance bond is solely for the protection of Owner. The performance bond is to be for the Contract Sum to guarantee the faithful performance of the Work in accordance with the Contract Documents. The form of the bond shall be approved by the Office of the Attorney General of Texas. The performance bond shall be effective through Contractor's warranty period.

5.1.1.2 A Payment bond is required if the Contract price is in excess of $25,000. The payment bond is to be for the Contract Sum and is payable to Owner solely for the protection and use of payment bond beneficiaries. The form of the bond shall be approved by the Office of the Attorney General of Texas.

5.1.2 Security Bond. The security bond provides protection to Owner if Contractor presents an acceptable guaranteed maximum price ("GMP") to Owner and 1) fails to execute the GMP; or 2) fails to deliver the required payment and performance bonds within the time period stated below.

5.1.3 When Bonds Are Due.

5.1.3.1 Security bonds are due within ten (10) days of signing a Construction Manager-at-Risk or Design-Build Contract.

5.1.3.2 Payment and performance bonds are due within ten (10) days of Contractor's receipt of a fully executed GMP on a Construction Manager-at-Risk project or the Contract Sum for a Design-Build project, or within ten (10) days of Contractor's receipt of a fully executed Contract on competitively bid or competitive sealed proposal projects.

5.1.4 Power of Attorney. Each bond shall be accompanied by a valid power of attorney (issued by the surety company and attached, signed and sealed with the corporate embossed seal, to the bond) authorizing the attorney-in-fact who signs the bond to commit the company to the terms of the bond, and stating any limit in the amount for which the attorney can issue a single bond.

5.1.5 Bond Indemnification. **THE PROCESS OF REQUIRING AND ACCEPTING BONDS AND MAKING CLAIMS THEREUNDER SHALL BE CONDUCTED IN COMPLIANCE WITH TEX. GOV'T CODE CH. 2253. IF FOR ANY REASON A STATUTORY PAYMENT OR PERFORMANCE BOND IS NOT HONORED BY THE SURETY, CONTRACTOR SHALL FULLY INDEMNIFY AND HOLD OWNER**

HARMLESS OF AND FROM ANY COSTS, LOSSES, OBLIGATIONS OR LIABILITIES IT INCURS AS A RESULT.

5.1.6 Furnishing Bond Information. Owner shall furnish certified copies of the payment bond and the related Contract to any qualified person seeking copies who complies with Tex. Gov't Code § 2253.026.

5.1.7 Claims on Payment Bonds. Claims on payment bonds must be sent directly to Contractor and his surety in accordance with Tex. Gov't Code § 2253.041. All payment bond claimants are cautioned that no lien exists on the funds unpaid to Contractor on such Contract, and that reliance on notices sent to Owner may result in loss of their rights against Contractor and/or his surety. Owner is not responsible in any manner to a claimant for collection of unpaid bills, and accepts no such responsibility because of any representation by any agent or employee.

5.1.8 Payment Claims when Payment Bond not Required. The rights of Subcontractors regarding payment are governed by Tex. Prop. Code §§ 53.231-53.239 when the value of the Contract between Owner and Contractor is less than $25,000.00. These provisions set out the requirements for filing a valid lien on funds unpaid to Contractor as of the time of filing the claim, actions necessary to release the lien and satisfaction of such claim.

5.1.9 Sureties. A surety shall be listed on the US Department of the Treasury's Listing of Approved Sureties maintained by the Bureau of Financial Management Service (FMS), www.fms.treas.gov/c570, stating companies holding Certificates of Authority as acceptable sureties on Federal bonds and acceptable reinsuring companies (FMS Circular 570).

5.2 Insurance Requirements. Contractor shall carry insurance in the types and amounts indicated in this Article for the duration of the Contract. The insurance shall be evidenced by delivery to Owner of certificates of insurance executed by the insurer or its authorized agent stating coverages, limits, expiration dates and compliance with all applicable required provisions. Upon request, Owner, and/or its agents, shall be entitled to receive without expense, copies of the policies and all endorsements. Contractor shall update all expired policies prior to submission for monthly payment. Failure to update policies shall be reason for withholding of payment until renewal is provided to Owner.

5.2.1 Contractor shall provide and maintain all insurance coverage with the minimum amounts described below until the end of the warranty period unless otherwise stated in Supplementary General Conditions or Special Conditions. Failure to maintain insurance coverage, as required, is grounds for suspension of Work for cause pursuant to Article 14.

5.2.2 Contractor shall deliver to Owner true and complete copies of certificates and corresponding policy endorsements prior to the issuance of any Notice to Proceed.

5.2.3 Failure of Owner to demand such certificates or other evidence of Contractor's full compliance with these insurance requirements or failure of Owner to identify a deficiency in compliance from the evidence provided shall not be construed as a waiver of Contractor's obligation to maintain such insurance.

5.2.4 The insurance and insurance limits required herein shall not be deemed as a limitation on Contractor's liability under the indemnities granted to Owner in the Contract Documents.

5.2.5 The insurance coverage and limits established in the Uniform General Conditions, Supplementary General Conditions or Special Conditions shall not be interpreted as any representation or warranty that the insurance coverage and limits necessarily will be adequate to protect Contractor.

5.2.6 Coverage shall be written on an occurrence basis by companies authorized and admitted to do business in the State of Texas and rated A or better by A.M. Best Company or similar rating company or otherwise acceptable to Owner.

5.2.6.1 Insurance Coverage Required.

5.2.6.1.1 Workers' Compensation. Insurance with limits as required by the Texas Workers' Compensation Act, with the policy endorsed to provide a waiver of subrogation in favor of Owner, employer's liability insurance of not less than:

$1,000,000 each accident;
$1,000,000 disease each employee; and
$1,000,000 disease policy limit.

5.2.6.1.2 Commercial General Liability Insurance. Including premises, operations, independent contractor's liability, products and completed operations and contractual liability, covering, but not limited to, the liability assumed under the indemnification provisions of this Contract, fully insuring Contractor's liability for bodily injury (including death) and property damage with a minimum limit of:

$1,000,000 per occurrence;
$2,000,000 general aggregate;
$5,000 Medical Expense each person;
$1,000,000 Personal Injury and Advertising Liability;
$2,000,000 products and completed operations aggregate; and

$50,000 Damage to Premises Rented to You;
and Coverage shall be on an "occurrence" basis.

The policy shall include coverage extended to apply to completed operations and explosion, collapse, and underground hazards. The policy shall include endorsement CG2503 Amendment of Aggregate Limits of Insurance (per Project) or its equivalent.

If the Work involves any activities within fifty (50) feet of any railroad, railroad protective insurance as may be required by the affected railroad, written for not less than the limits required by such railroad.

5.2.6.1.3 Asbestos Abatement Liability Insurance, including coverage for liability arising from the encapsulation, removal, handling, storage, transportation, and disposal of asbestos containing materials. This requirement applies if the Work or the Project includes asbestos containing materials.

The combined single limit for bodily injury and property damage will be a minimum of $1,000,000 per occurrence.

*Specific requirement for claims-made form: Required period of coverage will be determined by the following formula: continuous coverage for life of the Contract, plus one (1) year (to provide coverage for the warranty period), and an extended discovery period for a minimum of five (5) years which shall begin at the end of the warranty period.

Employer's liability limits for asbestos abatement will be:

$500,000 each accident;

$500,000 disease each employee; and

$500,000 disease policy limit.

If this Contract is for asbestos abatement only, the Special Form builder's risk or Special Form installation floater (e) is not required.

5.2.6.1.4 Comprehensive Automobile Liability Insurance, covering owned, hired, and non-owned vehicles, with a minimum combined single limit for bodily injury (including death) and property damage of $1,000,000 per accident. No

aggregate shall be permitted for this type of coverage.

Such insurance is to include coverage for loading and unloading hazards.

5.2.6.1.5 Special Form Builder's Risk Insurance, if applicable (or Special Form installation floater for instances in which the project involves solely the installation of material and/or equipment). Coverage shall be Special Form, including, but not limited to, fire, extended coverage, vandalism and malicious mischief, theft and, if applicable, flood, earth movement and named storm. Builder's risk and installation floater limits shall be equal to 100 percent of the Contract Sum plus, if any, existing property and Owner-furnished equipment specified by Owner. The policy shall be written jointly in the names of Owner and Contractor. Subcontractors shall be named as additional insureds. The policy shall have endorsements as follows:

5.2.6.1.5.1 This insurance shall be specific as to coverage and not contributing insurance with any permanent insurance maintained on the property.

5.2.6.1.5.2 This insurance shall not contain an occupancy clause suspending or reducing coverage should Owner partially occupy the Site and before the parties have determined Substantial Completion.

5.2.6.1.5.3 Loss, if any, shall be adjusted with and made payable to Owner as trustee for the insureds as their interests may appear. Owner shall be named as loss payee.

5.2.6.1.5.4 For renovation projects or projects that involve portions of Work contained within an existing structure, refer to Supplementary General and Special Conditions for possible additional builder's risk insurance requirements.

5.2.6.1.5.5 For Owner furnished equipment or materials that will be in care, custody or control of Contractor, Contractor will be responsible for damage and loss.

5.2.6.1.5.6 For those properties located within a Tier 1

or 2 windstorm area, named storm coverage must be provided with limits specified by Owner.

5.2.6.1.5.7 For those properties located in flood prone areas, flood insurance coverage must be provided with limits specified by Owner.

5.2.6.1.5.8 Builder's risk insurance policy shall remain in effect until Substantial Completion.

5.2.6.1.6 "Umbrella" Liability Insurance. Contractor shall obtain, pay for and maintain umbrella liability insurance during the Contract term, insuring Contractor for an amount of not less than amount specified in the Supplementary General Conditions or Special Conditions that provides coverage at least as broad as and applies in excess and follows form of the primary liability coverages required hereinabove. The policy shall provide "drop down" coverage where underlying primary insurance coverage limits are insufficient or exhausted.

5.2.7 Policies must include the following clauses, as applicable:

5.2.7.1 This insurance shall not be canceled, materially changed, or non-renewed except after thirty (30) days written notice has been given to Owner.

5.2.7.2 It is agreed that Contractor's insurance shall be deemed primary with respect to any insurance or self insurance carried by Owner for liability arising out of operations under the Contract with Owner.

5.2.7.3 Owner, its officials, directors, employees, representatives, and volunteers are added as additional insureds as respects operations and activities of, or on behalf of the named insured performed under Contract with Owner. The additional insured status must cover completed operations as well. This is not applicable to workers' compensation policies.

5.2.7.4 A waiver of subrogation in favor of Owner shall be provided in all policies.

5.2.8 Without limiting any of the other obligations or liabilities of Contractor, Contractor shall require each Subcontractor performing work under the Contract, at Subcontractor's own expense, to maintain during the term of the Contract, the same stipulated minimum insurance including the required provisions and additional policy conditions as shown above. As an alternative, Contractor may include its Subcontractors as additional insureds on its own coverage as prescribed under these requirements. Contractor's certificate of

insurance shall note in such event that Subcontractors are included as additional insureds and that Contractor agrees to provide workers' compensation for Subcontractors and their employees. Contractor shall obtain and monitor the certificates of insurance from each Subcontractor in order to assure compliance with the insurance requirements. Contractor must retain the certificates of insurance for the duration of the Contract plus five (5) years and shall have the responsibility of enforcing these insurance requirements among its Subcontractors. Owner shall be entitled, upon request and without expense, to receive copies of these certificates.

5.2.9 Workers' compensation insurance coverage must be provided for all workers at all tier levels and meet the statutory requirements of Tex. Lab. Code § 401.011(44) and specific to construction projects for public entities as required by Tex. Lab. Code § 406.096.

Article 6. Construction Documents, Coordination Documents, and Record Documents

6.1 Drawings and Specifications.

6.1.1 Copies Furnished. Contractor will be furnished, free of charge, the number of complete sets of the Drawings, Specifications, and Addenda as provided in the Supplementary General Conditions or Special Conditions. Additional complete sets of Drawings and Specifications, if requested, will be furnished at reproduction cost to the entity requesting such additional sets. Electronic copies of such documents will be provided to Contractor without charge.

6.1.2 Ownership of Drawings and Specifications. All Drawings, Specifications and copies thereof furnished by A/E are to remain A/E's property. These documents are not to be used on any other project, and with the exception of the Contract record set and electronic versions needed for warranty operations, are to be returned to the A/E, upon request, following completion of the Work.

6.1.3 Interrelation of Documents. The Contract Documents as referenced in the Contract between Owner and Contractor are complimentary, and what is required by one shall be as binding as if required by all.

6.1.4 Resolution of Conflicts in Documents. Where conflicts may exist within the Contract Documents, the documents shall govern in the following order: (a) Change Orders, addenda, and written amendments to the Contract; (b) the Contract; (c) Drawings; (d) Specifications (but Specifications shall control over Drawings as to quality of materials and workmanship); and (e) other Contract Documents. Among categories of documents having the same order of precedence, the term or provision that includes the latest date shall control and more specific requirements shall govern over general requirements. Contractor shall notify A/E and ODR for resolution of the issue prior to executing the Work in question.

6.1.5 Contractor's Duty to Review Contract Documents. In order to facilitate its responsibilities for completion of the Work in accordance with and as reasonably inferable from the Contract Documents, prior to commencing the Work, Contractor shall examine and compare the Contract Documents, information furnished by Owner, relevant field measurements made by Contractor and any visible or reasonably anticipated conditions at the Site affecting the Work. This duty extends throughout the construction phase prior to commencing each particular work activity and/or system installation.

6.1.6 Discrepancies and Omissions in Drawings and Specifications.

6.1.6.1 Promptly report to ODR and to A/E the discovery of any apparent error, omission or inconsistency in the Contract Documents prior to execution of the Work.

6.1.6.2 It is recognized that Contractor is not acting in the capacity of a licensed design professional, unless it is performing as a Design-Build firm.

6.1.6.3 It is further recognized that Contractor's examination of Contract Documents is to facilitate construction and does not create an affirmative responsibility to detect errors, omissions or inconsistencies or to ascertain compliance with applicable laws, building codes or regulations, unless it is performing as a Design-Build firm.

6.1.6.4 When performing as a Design-Build firm, Contractor has sole responsibility for discrepancies, errors, and omissions in the Drawings and Specifications.

6.1.6.5 When performing as a Construction Manager-at-Risk, Contractor has a responsibility for efficient resolution of discrepancies, errors, and omissions in the Contract Documents. In such case, Contractor's responsibility is limited to review, coordination, and recommendation of resolution strategies within budget constraints.

6.1.6.6 Contractor has no liability for errors, omissions, or inconsistencies unless Contractor knowingly failed to report a recognized problem to Owner or the Work is executed under a Design-Build Contract, as outlined above. Should Contractor fail to perform the examination and reporting obligations of these provisions, Contractor is responsible for avoidable costs and direct damages.

6.2 Requirements for Record Documents. Contractor shall:

6.2.1 Maintain at the Site one copy of all Drawings, Specifications, addenda, approved submittals, Contract modifications, and all Project correspondence.

Keep current and maintain Drawings and Specifications in good order with postings and markings to record actual conditions of Work and show and reference all changes made during construction. Provide Owner and A/E access to these documents.

6.2.2 Maintain the Record Documents including Drawings, Specifications and other materials which reflect the actual field conditions and representations of the Work performed, whether it be directed by addendum, Change Order or otherwise. Make available all records prescribed herein for reference and examination by Owner and its representatives and agents.

6.2.3 Update the Record Documents at least monthly prior to submission of periodic partial pay estimates. Failure to maintain current Record Documents constitutes cause for denial of a progress payment otherwise due.

6.2.4 Prior to requesting Substantial Completion inspection Contractor shall furnish a copy of its marked-up Record Documents and a preliminary copy of each instructional manual, maintenance and operating manual, parts catalog, wiring diagrams, spare parts, specified written warranties and like publications, or parts for all installed equipment, systems, and like items and as described in the Contract Documents. (Unexecuted samples of the aforementioned documentation may be reviewed by ODR when the absence of substantial completion transactions preclude execution; however, Contractor remains obligated to provide fully executed copies of such materials prior to final payment).

6.2.5 Once determined acceptable by ODR with input from A/E, provide one (1) reproducible copy and one (1) electronic media copy of all Record Documents, unless otherwise required by the Supplementary General Conditions or Special Conditions.

6.2.6 Contractor shall be responsible for updating the Record Documents for all Contractor initiated documents and changes to the Contract Documents due to coordination and actual field conditions, including RFIs.

6.2.7 A/E shall be responsible for updating the Record Documents for any addenda, Change Orders, A/E supplemental instructions and any other alterations to the Contract Documents generated by A/E or Owner.

Article 7. Construction Safety

7.1 General. It is the duty and responsibility of Contractor and all of its Subcontractors to be familiar with, enforce and comply with all requirements of Public Law No. 91- 596, 29 U.S.C. § 651 et. seq., the Occupational Safety and Health Act of 1970, (OSHA) and all amendments thereto. Contractor shall prepare a safety plan specific to the Project and submit it to ODR and A/E prior to commencing Work. In addition, Contractor and

all of its Subcontractors shall comply with all applicable laws and regulations of any public body having jurisdiction for safety of persons or property to protect them from damage, injury or loss and erect and maintain all necessary safeguards for such safety and protection.

7.2 Notices. Contractor shall provide notices as follows:

7.2.1 Notify owners of adjacent property including those that own or operate utility services and/or underground facilities, and utility owners, when prosecution of the Work may affect them or their facilities, and cooperate with them in the protection, removal, relocation and replacement, and access to their facilities and/or utilities.

7.2.2 Coordinate the exchange of material safety data sheets or other hazard communication information required to be made available to or exchanged between or among employers at the site in connection with laws and regulations. Maintain a complete file of material safety data sheets for all materials in use on site throughout the construction phase and make such file available to Owner and its agents as requested.

7.3 Emergencies. In any emergency affecting the safety of persons or property, Contractor shall act to minimize, mitigate, and prevent threatened damage, injury or loss.

7.3.1 Have authorized agents of Contractor respond immediately upon call at any time of day or night when circumstances warrant the presence of Contractor to protect the Work or adjacent property from damage or to take such action pertaining to the Work as may be necessary to provide for the safety of the public.

7.3.2 Give ODR and A/E prompt notice of all such events.

7.3.3 If Contractor believes that any changes in the Work or variations from Contract Documents have been caused by its emergency response, promptly notify Owner within seventy-two (72) hours of the emergency response event.

7.3.4 Should Contractor fail to respond, Owner is authorized to direct other forces to take action as necessary and Owner may deduct any cost of remedial action from funds otherwise due Contractor.

7.4 Injuries. In the event of an incident or accident involving outside medical care for an individual on or near the Work, Contractor shall notify ODR and other parties as may be directed promptly, but no later than twenty-four (24) hours after Contractor learns that an event required medical care.

7.4.1 Record the location of the event and the circumstances surrounding it, by using photography or other means, and gather witness statements and other documentation which describes the event.

7.4.2 Supply ODR and A/E with an incident report no later than thirty-six (36) hours after the occurrence of the event. In the event of a catastrophic incident (one (1) fatality or three (3) workers hospitalized), barricade and leave intact the scene of the incident until all investigations are complete. A full set of incident investigation documents, including facts, finding of cause, and remedial plans shall be provided within one (1) week after occurrence, unless otherwise directed by legal counsel. Contractor shall provide ODR with written notification within one week of such catastrophic event if legal counsel delays submission of full report.

7.5 Environmental Safety. Upon encountering any previously unknown potentially hazardous material, or other materials potentially contaminated by hazardous material, Contractor shall immediately stop work activities impacted by the discovery, secure the affected area, and notify ODR immediately.

7.5.1 Bind all Subcontractors to the same duty.

7.5.2 Upon receiving such notice, ODR will promptly engage qualified experts to make such investigations and conduct such tests as may be reasonably necessary to determine the existence or extent of any environmental hazard. Upon completion of this investigation, ODR will issue a written report to Contractor identifying the material(s) found and indicate any necessary steps to be taken to treat, handle, transport or dispose of the material.

7.5.3 Owner may hire third-party Contractors to perform any or all such steps.

7.5.4 Should compliance with ODR's instructions result in an increase in Contractor's cost of performance, or delay the Work, Owner will make an equitable adjustment to the Contract Sum and/or the time of completion, and modify the Contract in writing accordingly.

7.6 Trenching Plan. When the project requires excavation which either exceeds a depth of four (4) feet, or results in any worker's upper body being positioned below grade level, Contractor is required to submit a trenching plan to ODR prior to commencing trenching operations unless an engineered plan is part of the Contract Documents. The plan is required to be prepared and sealed by a professional engineer registered in the State of Texas and hired or employed by Contractor or Subcontractor to perform the work. Said engineer cannot be anyone who is otherwise either directly or indirectly engaged on this project.

Article 8. Quality Control

8.1 Materials & Workmanship. Contractor shall execute Work in a good and workmanlike matter in accordance with the Contract Documents. Contractor shall develop and provide a quality control plan specific to this Project and acceptable to Owner. Where Contract Documents do not specify quality standards, complete and construct all Work in compliance with generally accepted construction industry standards. Unless otherwise specified, incorporate all new materials and equipment into the Work under

the Contract.

8.2 Testing.

8.2.1 Owner is responsible for coordinating and paying for routine and special tests required to confirm compliance with quality and performance requirements, except as stated below or otherwise required by the Contract Documents. Contractor shall provide the following testing:

8.2.1.1 Any test of basic material or fabricated equipment included as part of a submittal for a required item in order to establish compliance with the Contract Documents.

8.2.1.2 Any test of basic material or fabricated equipment offered as a substitute for a specified item on which a test may be required in order to establish compliance with the Contract Documents.

8.2.1.3 Preliminary, start-up, pre-functional and operational testing of building equipment and systems as necessary to confirm operational compliance with requirements of the Contract Documents.

8.2.1.4 All subsequent tests on original or replaced materials conducted as a result of prior testing failure.

8.2.2 All testing shall be performed in accordance with standard test procedures by an accredited laboratory, or special consultant as appropriate, acceptable to Owner. Results of all tests shall be provided promptly to ODR, A/E, and Contractor.

8.2.3 Non-Compliance (Test Results). Should any of the tests indicate that a material and/or system does not comply with the Contract requirements, the burden of proof remains with Contractor, subject to:

8.2.3.1 Contractor selection and submission of the laboratory for Owner acceptance.

8.2.3.2 Acceptance by Owner of the quality and nature of tests.

8.2.3.3 All tests taken in the presence of A/E and/or ODR, or their representatives.

8.2.3.4 If tests confirm that the material/systems comply with Contract Documents, Owner will pay the cost of the test.

8.2.3.5 If tests reveal noncompliance, Contractor will pay those laboratory fees and costs of that particular test and all future tests, of that failing Work, necessary to eventually confirm compliance with Contract Documents.

8.2.3.6 Proof of noncompliance with the Contract Documents will make Contractor liable for any corrective action which ODR determines appropriate, including complete removal and replacement of non-compliant work or material.

8.2.4 Notice of Testing. ODR and Contractor agree to use good faith to establish an effective testing schedule and notification system to ensure necessary access to the Work for independent third party testing companies. Contractor shall give ODR and A/E timely notice of its readiness and the date arranged so ODR and A/E may observe such inspection, testing, or approval.

8.2.5 Test Samples. Contractor is responsible for providing Samples of sufficient size for test purposes and for coordinating such tests with their Work Progress Schedule to avoid delay.

8.2.6 Covering Up Work. If Contractor covers up any Work without providing Owner an opportunity to inspect, Contractor shall, if requested by ODR, uncover and recover the work at Contractor's expense.

8.3 Submittals.

8.3.1 Contractor's Submittals. Contractor shall submit with reasonable promptness consistent with the Project schedule and in orderly sequence all Shop Drawings, Samples, or other information required by the Contract Documents, or subsequently required by Change Order. Prior to submitting, Contractor shall review each submittal for general compliance with Contract Documents and approve submittals for review by A/E and Owner by an approval stamp affixed to each copy. Submittal data presented without Contractor's stamp will be returned without review or comment, and any delay resulting from failure is Contractor's responsibility.

8.3.1.1 Contractor shall within twenty-one (21) days of the effective date of the Notice To Proceed with construction, submit to ODR and A/E, a submittal schedule/register, organized by specification section, listing all items to be furnished for review and approval by A/E and Owner. The list shall include Shop Drawings, manufacturer's literature, certificates of compliance, materials Samples, materials colors, guarantees, and all other items identified throughout the Specifications.

8.3.1.2 Contractor shall indicate the type of item, Contract requirements reference, and Contractor's scheduled dates for submitting the item along with the requested dates for approval answers from A/E and Owner. The submittal register shall indicate the projected dates for procurement of all included items and shall be updated at least monthly with actual approval and procurement dates. Contractor's Submittal Register must be reasonable in terms of the

review time for complex submittals. Contractor's submittal schedule must be consistent with the Work Progress Schedule and identify critical submittals. Show and allow a minimum of fifteen (15) days duration after receipt by A/E and ODR for review and approval. If resubmittal required, allow a minimum of an additional fifteen(15) days for review. Submit the updated Submittal Register with each request for progress payment. Owner may establish routine review procedures and schedules for submittals at the preconstruction conference and/or elsewhere in the Contract Documents. If Contractor fails to update and provide the Submittal Register as required, Owner may, after seven (7) days notice to Contractor withhold a reasonable sum of money that would otherwise be due Contractor.

8.3.1.3 Contractor shall coordinate the Submittal Register with the Work Progress Schedule. Do not schedule Work that requires an approved submittal to begin prior to scheduling review and approval of the related submittal. Revise and/or update both schedules monthly to ensure consistency and current project data. Provide to ODR the updated Submittal Register and schedule with each application for progress payment. Refer to requirements in Section 9.3 for the Work Progress Schedule for inclusion of procurement activities therein. The Submittal Register shall identify dates submitted and returned and shall be used to confirm status and disposition of particular items submitted, including approval or other action taken and other information not conveniently tracked through the Work Progress Schedule.

8.3.1.4 By submitting Shop Drawings, Samples or other required information, Contractor represents that it has determined and verified all applicable field measurements, field construction criteria, materials, catalog numbers and similar data to the extent possible from existing conditions and design information provided by A/E prior to fabrication; and has checked and coordinated each Shop Drawing and Sample with the requirements of the Work and the Contract Documents.

8.3.2 Review of Submittals. A/E and ODR review is only for conformance with the design concept, the information and any specified level of performance provided in the Contract Documents. Responses to submittals will be in writing. The approval of a separate item does not indicate approval of an assembly in which the item functions. The approval of a submittal does not relieve Contractor of responsibility for any deviation from the requirements of the Contract unless Contractor informs A/E and ODR of such deviation in a clear, conspicuous, and written manner on the submittal transmittal and at the time of submission, and obtains Owner's written specific approval of the particular deviation.

8.3.3 Correction and Resubmission. Contractor shall make any corrections required

to a submittal and resubmit the required number of corrected copies in the required format promptly so as to avoid delay, until submittal approval. Direct attention in writing to A/E and ODR, when applicable, to any new revisions other than the corrections requested on previous submissions.

8.3.4 Limits on Shop Drawing Review. Contractor shall not commence any Work requiring a submittal until review of the submittal under Subsection 8.3.2. Construct all such work in accordance with reviewed submittals. Comments incorporated as part of the review in Subsection 8.3.2 of Shop Drawings and Samples is not authorization to Contractor to perform extra work or changed work unless authorized through a Change Order. A/E's and ODR's review, if any, does not relieve Contractor from responsibility for defects in the Work resulting from errors or omissions of any kind on the submittal, regardless of any approval action. A/E or ODR shall not make formal changes to the Contract Documents via the submittal process. Changes to the Construction Documents shall be accomplished via Subsection 3.2.2 and Article 11 Changes.

8.3.5 No Substitutions Without Approval. ODR and A/E may receive and consider Contractor's request for substitution when the request is in the best interest of the project. Owner is not obligated to consider a substitution request if Contractor cannot provide the originally specified product or method due to Contractor's failure to pursue the Work promptly or coordinate activities properly. A non-exclusive list of factors to be considered by the ODR and A/E in response to a substitution include:

8.3.5.1 Whether the Contract Documents require extensive revisions; and

8.3.5.2 Whether the proposed changes are in keeping with the general intent of the Contract Documents and the design intent of A/E and do not result in an increase in cost to Owner; and

8.3.5.3 Whether the request is timely, fully documented, properly submitted and one or more of the following apply:

8.3.5.3.1 Contractor cannot provide the specified product, assembly or method of construction within the Contract Time;

8.3.5.3.2 The request directly relates to an "or-equal" clause or similar language in the Contract Documents;

8.3.5.3.3 The request directly relates to a "product design standard" or "performance standard" clause in the Contract Documents;

8.3.5.3.4 The requested substitution offers Owner a substantial advantage in cost, time, energy conservation or other considerations, after deducting additional responsibilities Owner must assume;

8.3.5.3.5 The specified product or method of construction cannot receive necessary approval by an authority having jurisdiction, and ODR can approve the requested substitution;

8.3.5.3.6 Contractor cannot provide the specified product, assembly or method of construction in a manner that is compatible with other materials and where Contractor certifies that the substitution will overcome the incompatibility;

8.3.5.3.7 Contractor cannot coordinate the specified product, assembly or method of construction with other materials and where Contractor certifies they can coordinate the proposed substitution; or

8.3.5.3.8 The specified product, assembly or method of construction cannot provide a warranty required by the Contract Documents and where Contractor certifies that the proposed substitution provides the required warranty.

8.3.5.3.9 The manufacture of the specified product has been removed from production due to cancellation or obsolescence.

8.3.6 Unauthorized Substitutions at Contractor's Risk. Contractor is financially responsible for any additional costs or delays resulting from unauthorized substitution of materials, equipment or fixtures other than those specified. Contractor shall reimburse Owner for any increased design or contract administration costs resulting from such unauthorized substitutions.

8.4 Field Mock-up.

8.4.1 Mock-ups shall be constructed prior to commencement of a specified scope of work to confirm acceptable workmanship.

8.4.1.1 As a minimum, field mock-ups shall be constructed for roofing systems, exterior veneer / finish systems, glazing systems, and any other Work requiring a mock-up as identified throughout the Contract Documents. Mock-ups for systems not part of the Project scope shall not be required.

8.4.1.2 Mock-ups may be incorporated into the Work if allowed by the Contract Documents and if acceptable to ODR. If mock-ups are freestanding, they shall remain in place until otherwise directed by Owner.

8.4.1.3 Contractor shall include field mock-ups in their Work Progress Schedule and shall notify ODR and A/E of readiness for review sufficiently in advance to coordinate review without delay.

8.5 Inspection During Construction.

8.5.1 Contractor shall provide sufficient, safe, and proper facilities, including equipment as necessary for safe access, at all reasonable times for observation and/or inspection of the Work by Owner and its agents. "Reasonable times" of inspection allow for sufficient monitoring of the quality of materials and installation without substantially impeding the progress of the Work.

8.5.2 Contractor shall not cover up any Work with finishing materials or other building components prior to providing Owner and its agents an opportunity to perform an inspection of the Work.

8.5.2.1 Should corrections of the Work be required for approval, Contractor shall not cover-up corrected Work until Owner indicates approval.

8.5.2.2 Contractor shall provide notification of at least five (5) working days or otherwise as mutually agreed to ODR of the anticipated need for a cover-up inspection. Should ODR fail to make the necessary inspection within the agreed period, Contractor may proceed with cover-up Work but is not relieved of responsibility for Work to comply with requirements of the Contract Documents.

Article 9. Construction Schedules

9.1 Contract Time. **TIME IS AN ESSENTIAL ELEMENT OF THE CONTRACT.** The Contract Time is the time between the dates indicated in the Notice to Proceed for commencement of the Work and for achieving Substantial Completion. The Contract Time can be modified only by Change Order. Failure to achieve Substantial Completion within the Contract Time as otherwise agreed to in writing will cause damage to Owner and may subject Contractor to liquidated damages as provided in the Contract Documents. If Contractor fails to achieve Final Completion within thirty (30) days after Substantial Completion or a mutually agreed upon longer period of time between Contractor and Owner, Contractor shall be responsible for Owner's additional inspection, project management, and maintenance cost to the extent caused by Contractor's failure to achieve Final Completion.

9.2 Notice to Proceed. Owner will issue a Notice to Proceed which shall state the dates for beginning Work and for achieving Substantial Completion of the Work.

9.3 Work Progress Schedule. Refer to Supplementary General Conditions or Special Conditions for additional schedule requirements. Unless indicated otherwise in those documents, Contractor shall submit their initial Work Progress Schedule for the Work in relation to the entire Project not later than twenty-one (21) days after the effective

date of the Notice to Proceed to ODR and A/E. Unless otherwise indicated in the Contract Documents, the Work Progress Schedule shall be computerized Critical Path Method (CPM) with fully editable logic. This initial schedule shall indicate the dates for starting and completing the various aspects required to complete the Work, including mobilization, submittals, procurement, installation, testing, inspection, delivery of Close-out Documents and acceptance of all the Work of the Contract. When acceptable to Owner, the initially accepted schedule shall be the Baseline Schedule for comparison to actual conditions throughout the Contract duration.

9.3.1 Schedule Requirements. Contractor shall submit electronic and paper copy of the initial Work Progress Schedule reflecting accurate and reliable representations of the planned progress of the Work, the Work to date if any, and of Contractor's actual plans for its completion. Contractor shall organize and provide adequate detail so the schedule is capable of measuring and forecasting the effect of delaying events on completed and uncompleted activities.

9.3.1.1 Contractor shall resubmit initial schedule as required to address review comments from A/E and ODR until such schedule is accepted as the Baseline Schedule.

9.3.1.2 Submittal of a schedule, schedule revision or schedule update constitutes Contractor's representation to Owner of the accurate depiction of all progress to date and that Contractor will follow the schedule as submitted in performing the Work.

9.3.2 Schedule Updates. Contractor shall update the Work Progress Schedule and the Submittal Register monthly, as a minimum, to reflect progress to date and current plans for completing the Work, while maintaining original schedule as Baseline Schedule and submit paper and electronic copies of the update to A/E and ODR as directed, but as a minimum with each request for payment. Owner has no duty to make progress payments unless accompanied by the updated Work Progress Schedule. Show the anticipated date of completion reflecting all extensions of time granted through Change Order as of the date of the update. Contractor may revise the Work Progress Schedule when in Contractor's judgment it becomes necessary for the management of the Work. Contractor shall identify all proposed changes to schedule logic to Owner and to A/E via an executive summary accompanying the updated schedule for review prior to final implementation of revisions into a revised Baseline Schedule. Schedule changes that materially impact Owner's operations shall be communicated promptly to ODR and shall not be incorporated into the revised Baseline Schedule without ODR's consent.

9.3.3 The Work Progress Schedule is for Contractor's use in managing the Work and submittal of the schedule, and successive updates or revisions, is for the information of Owner and to demonstrate that Contractor has complied with requirements for planning the Work. Owner's acceptance of a schedule, schedule update or revision constitutes Owner's agreement to coordinate its own activities with Contractor's activities as shown on the schedule.

9.3.3.1 Acceptance of the Work Progress Schedule, or update and/or revision thereto does not indicate any approval of Contractor's proposed sequences and duration.

9.3.3.2 Acceptance of a Work Progress Schedule update or revision indicating early or late completion does not constitute Owner's consent, alter the terms of the Contract, or waive either Contractor's responsibility for timely completion or Owner's right to damages for Contractor's failure to do so.

9.3.3.3 Contractor's scheduled dates for completion of any activity or the entire Work do not constitute a change in terms of the Contract.

9.3.3.4 Change Orders are the only method of modifying the Substantial Completion Date(s) and Contract Time.

9.4 Ownership of Float. Unless indicated otherwise in the Contract Documents, Contractor shall develop its schedule, pricing, and execution plan to provide a minimum of ten (10) percent total float at acceptance of the Baseline Schedule. Float time contained in the Work Progress Schedule is not for the exclusive benefit of Contractor or Owner, but belongs to the Project and may be consumed by either party as needed on a first-used basis upon approval by Owner.

9.5 Completion of Work. Contractor is accountable for completing the Work within the Contract Time stated in the Contract, or as otherwise amended by Change Order.

9.5.1 If, in the judgment of Owner, the work is behind schedule and the rate of placement of work is inadequate to regain scheduled progress to insure timely completion of the entire work or a separable portion thereof, Contractor, when so informed by Owner, shall immediately take action to increase the rate of work placement by:

9.5.1.1 An increase in working forces.

9.5.1.2 An increase in equipment or tools.

9.5.1.3 An increase in hours of work or number of shifts.

9.5.1.4 Expedite delivery of materials.

9.5.1.5 Other action proposed if acceptable to Owner.

9.5.2 Within ten (10) days after such notice from ODR, Contractor shall notify ODR in writing of the specific measures taken and/or planned to increase the rate of progress. Contactor shall include an estimate as to the date of scheduled progress recovery and an updated Work Progress Schedule illustrating

Contractor's plan for achieving timely completion of the Project. Should ODR deem the plan of action inadequate, Contractor shall take additional steps or make adjustments as necessary to its plan of action until it meets with ODR's approval. Costs for necessary measures to increase the rate of work placement to achieve scheduled Substantial Completion and that are made necessary by delays that are not excusable are the responsibility of Contractor.

9.6 Modification of the Contract Time.

9.6.1 Delays and extension of time as hereinafter described are valid only if executed in accordance with provisions set forth in Article 11.

9.6.2 Any delays in or failure of performance by either Party, except in respect of the obligation of payments under this Agreement, entitles Contractor to an extension of time if and to the extent such delays or failure of performance are caused solely by occurrence(s) beyond the reasonable control of the Party affected, and which by the exercise of due diligence such Party is unable to prevent.

9.6.3 When a delay defined herein as excusable prevents Contractor from completing the Work within the Contract Time, Contractor is entitled to an extension of time. Owner will make an equitable adjustment and extend the number of days lost because of excusable delay or Weather Days, as measured by Contractor's progress schedule. All extensions of time will be granted in days. In no event, however, will an extension of time be granted for delays that merely extend the duration of non-critical activities, or which only consume float without delaying the project Substantial Completion date(s).

9.6.3.1 A "Weather Day" is a day on which Contractor's current schedule indicates Work is to be done, and on which inclement weather and/or related site conditions prevent Contractor from performing seven (7) continuous hours of Work on the critical path between the hours of 7:00 a.m. and 6:00 p.m. Weather days are excusable delays. When weather conditions at the site prevent work from proceeding, Contractor shall immediately notify ODR for confirmation of the conditions. At the end of each calendar month, submit to ODR and A/E a list of Weather Days occurring in that month along with documentation of the impact on critical activities. Based on confirmation by ODR, any time extension granted will be issued by Change Order. If Contractor and Owner cannot agree on the time extension, Owner may issue a ULCO for fair and reasonable time extension.

9.6.3.2 Excusable Delay. Contractor is entitled to an equitable adjustment of the Contract Time, issued via change order, for delays caused by the following:

9.6.3.2.1 Errors, omissions and imperfections in design, which A/E

corrects by means of changes in the Drawings and Specifications.

9.6.3.2.2 Unanticipated physical conditions at the Site, which A/E corrects by means of changes to the Drawings and Specifications or for which ODR directs changes in the Work identified in the Contract Documents.

9.6.3.2.3 Failure of Owner to have secured property, right-of-way or easements necessary for Work to begin or progress.

9.6.3.2.4 Changes in the Work that effect activities identified in Contractor's schedule as "critical" to completion of the entire Work, if such changes are ordered by ODR or recommended by A/E and ordered by ODR.

9.6.3.2.5 Suspension of Work for unexpected natural events, Force Majeure (sometimes called "acts of God" or the public enemy), sabotage, war, mobilization, revolution, civil unrest, riots, strikes, lockouts, fires, accidents, breakdowns, or floods, earthquakes, hurricanes, or any other natural disaster, and governmental actions or orders concerning pandemics or epidemics, but not otherwise, which are not within the reasonable control of Contractor.

9.6.3.2.6 Notice. In any Force Majeure event, the Party claiming force majeure shall notify the other of the Force Majeure event in writing within seventy-two (72) hours of the earlier of (a) the commencement of the Force Majeure event or (b) the entry of any order by an Authority Having Jurisdiction of an emergency or Force Majeure event. In the event Contractor fails to timely provide said notice, such failure shall constitute, without further notice or action, a waiver of the right to claim Force Majeure for such event. If possible, such notice shall set forth the extent and duration thereof. Owner shall determine the termination of the Force Majeure event in the exercise of reasonable discretion and based upon any applicable order entered by an Authority Having Jurisdiction.

9.6.3.2.7 Due Diligence. Contractor shall exercise due diligence to prevent, eliminate, or overcome any Force Majeure event where it is possible to do so and resume performance of Professional Services at the earliest possible date. However, if nonperformance continues for more than thirty (30) Days, Owner may terminate this Agreement immediately upon written notification to Contractor.

9.6.3.2.8 Suspension of Work for convenience of ODR, which prevents Contractor from completing the Work within the Contract Time.

9.6.3.2.9 Administrative delays caused by activities or approval requirements related to an Authority Having Jurisdiction.

9.6.4 Contractor's relief in the event of such delays is the time impact to the critical path as determined by analysis of Contractor's schedule. In the event that Contractor incurs additional direct costs because of the excusable delays other than described in Subparagraph 9.6.3.2.4 and within the reasonable control of Owner, the Contract price and Contract Time are to be equitably adjusted by Owner pursuant to the provisions of Article 11.

9.7 No Damages for Delay. No Damages for Delay. An extension of the Contract Time shall be the sole remedy of Contractor for delays in performance of the Work, whether or not such delays are foreseeable, except for delays caused solely by acts of Owner that constitute intentional interference with Contractor's performance of the Work and then only to the extent such acts continue after Contractor notifies Owner in writing of such interference. For delays caused by any act(s) other than the sole intentional interference of Owner, Contractor shall not be entitled to any compensation or recovery of any damages including, without limitation, consequential damages, lost opportunity costs, impact damages, loss of productivity, or other similar damages. Owner's exercise of any of its rights or remedies under the Contract including, without limitation, ordering changes in the Work or directing suspension, rescheduling, or correction of the Work, shall not be construed as intentional interference with Contractor's performance of the Work regardless of the extent or frequency of Owner's exercise of such rights or remedies.

9.8 Concurrent Delay. When the completion of the Work is simultaneously delayed by an excusable delay and a delay arising from a cause not designated as excusable, Contractor may be entitled to a time extension only for the portion of the concurrent delay with (attributable to) an overlapping excusable cause.

9.9 Other Time Extension Requests. Time extensions requested in association with changes to the Work directed or requested by Owner shall be included with Contractor's proposed costs for such change. Time extensions requested for inclement weather are covered by Paragraph 9.6.3.1 above. If Contractor believes that the completion of the Work is delayed by a circumstance other than for changes directed to the Work or weather, they shall give ODR written notice, stating the nature of the delay and the activities potentially affected, within five (5) days after the onset of the event or circumstance giving rise to the excusable delay. Contractor shall provide sufficient written evidence to document the delay. In the case of a continuing cause of delay, only one claim is necessary. State claims for extensions of time in numbers of whole or half days.

9.9.1 Within ten (10) days after the cessation of the delay, Contractor shall formalize its request for extension of time in writing to include a full analysis of the

schedule impact of the delay and substantiation of the excusable nature of the delay. All changes to the Contract Time or made as a result of such claims is by Change Order, as set forth in Article 11.

9.9.2 No extension of time releases Contractor or the Surety furnishing a performance or payment bond from any obligations under the Contract or such a bond. Those obligations remain in full force until the discharge of the Contract.

9.9.3 Contents of Time Extension Requests. Contractor shall provide with each Time Extension Request a quantitative demonstration of the impact of the delay on project completion time, based on the Work Progress Schedule. Contractor shall include with Time Extension Requests a reasonably detailed narrative setting forth:

9.9.3.1 The nature of the delay and its cause; the basis of Contractor's claim of entitlement to a time extension.

9.9.3.2 Documentation of the actual impacts of the claimed delay on the critical path indicated in Contractor's Work Progress Schedule, and any concurrent delays.

9.9.3.3 Description and documentation of steps taken by Contractor to mitigate the effect of the claimed delay, including, when appropriate, the modification of the Work Progress Schedule.

9.9.4 Owner's Response. Owner will respond to the Time Extension Request by providing to Contractor written notice of the number of days granted, if any, and giving its reason if this number differs from the number of days requested by Contractor.

9.9.4.1 Owner will not grant time extensions for delays that do not affect the Contract Substantial Completion date.

9.9.4.2 Owner will respond to each properly submitted Time Extension Request within fifteen (15) days following receipt. If Owner cannot reasonably make a determination about Contractor's entitlement to a time extension within that time, Owner will notify Contractor in writing. Unless otherwise agreed by Contractor, Owner has no more than fifteen (15) additional days to prepare a final response. If Owner fails to respond within forty-five (45) days from the date the Time Extension Request is received, Contractor is entitled to a time extension in the amount requested.

9.10 Failure to Complete Work Within the Contract Time. **TIME IS AN ESSENTIAL ELEMENT OF THE CONTRACT.** Contractor's failure to substantially complete the Work within the Contract Time or to achieve Substantial Completion as required will cause damage to Owner. These damages shall be liquidated by agreement of Contractor and Owner, in the amount per day as set forth in the Contract Documents.

9.11 Liquidated Damages. Owner may collect liquidated damages due from Contractor directly or indirectly by reducing the Contract Sum in the amount of liquidated damages stated in the Supplementary General Conditions or Special Conditions.

9.12 Waiver of Claims for Consequential Damages. The Contractor and Owner waive Claims against each other for consequential damages arising out of or relating to this Contract. This mutual waiver includes

9.12.1 Damages incurred by Owner for rental expenses, for losses of use, income, profit, financing, business and reputation, and for loss of management or employee productivity or of the services of such persons; and

9.12.2 Damages incurred by Contractor for principal office expenses including the compensation of personnel stationed there, for losses of financing, business and reputation, and for loss of profit, except anticipated profit arising directly form the Work.

9.12.3 This mutual waiver is applicable, without limitation, to all consequential damages due to either party's termination in accordance with Article 14. Nothing contained in this Section 9.12 shall be deemed to preclude assessment of liquidated damages, when applicable, in accordance with the requirements of the Contract Documents.

Article 10. Payments

10.1 Schedule of Values. Contractor shall submit to ODR and A/E for acceptance a Schedule of Values accurately itemizing material and labor for the various classifications of the Work based on the organization of the specification sections and of sufficient detail acceptable to ODR. The accepted Schedule of Values will be the basis for the progress payments under the Contract.

10.1.1 No progress payments will be made prior to receipt and acceptance of the Schedule of Values, provided in such detail as required by ODR, and submitted not less than twenty-one (21) days prior to the first request for payment. The Schedule of Values shall follow the order of trade divisions of the Specifications and include itemized costs for general conditions, costs for preparing close out documents, fees, contingencies, and Owner cash allowances, if applicable, so that the sum of the items will equal the Contract price. As appropriate, assign each item labor and/or material values, the subtotal thereof equaling the value of the work in place when complete.

10.1.1.1 Owner requires that the Work items be inclusive of the cost of the Work items only. Any contract markups for overhead and profit, general conditions, etc., shall be contained within separate line items for those specific purposes which shall be divided into at least two (2) lines, one (1) for labor and one (1) for materials.

10.1.2 Contractor shall retain a copy of all worksheets used in preparation of its bid or proposal, supported by a notarized statement that the worksheets are true

and complete copies of the documents used to prepare the bid or proposal. Make the worksheets available to ODR at the time of Contract execution. Thereafter Contractor shall grant Owner during normal business hours access to said copy of worksheets at any time during the period commencing upon execution of the Contract and ending one year after final payment.

10.2. Progress Payments. Contractor will receive periodic progress payments for Work performed, materials in place, suitably stored on Site, or as otherwise agreed to by Owner and Contractor. Payment is not due until receipt by ODR or his designee of a correct and complete Pay Application in electronic and/or hard copy format as set forth in the Supplementary General Conditions, Special Conditions, or elsewhere in the contract documents and certified by A/E. Progress payments are made provisionally and do not constitute acceptance of work not in accordance with the Contract Documents. Owner will not process progress payment applications for Change Order Work until all parties execute the Change Order.

10.2.1 Preliminary Pay Worksheet. Once each month that a progress payment is to be requested, the Contractor shall submit to A/E and ODR a complete, clean copy of a preliminary pay worksheet or preliminary pay application, to include the following:

10.2.1.1 Contractor's estimate of the amount of Work performed, labor furnished and materials incorporated into the Work, using the established Schedule of Values; and

10.2.1.2 An updated Work Progress Schedule including the executive summary and all required schedule reports; and

10.2.1.3 A summary of "Weather Days" reported to the ODR within the payment period in accordance with Paragraph 9.6.3.1 for which Contractor plans to claim schedule float or excusable delay to the critical path schedule; and

10.2.1.4 HUB subcontracting plan Progress Assessment Report as required in Paragraph 4.3.5.1; and

10.2.1.5 Such additional documentation as Owner may require as set forth in the Supplementary General Conditions, Special Conditions or elsewhere in the Contract Documents; and

10.2.1.6 Construction payment affidavit.

10.2.2 Contractor's Application for Payment. As soon as practicable, but in no event later than seven (7) days after receipt of the preliminary pay worksheet, A/E and ODR will meet with Contractor to review the preliminary pay worksheet and to observe the condition of the Work. Based on this review, ODR and A/E may require modifications to the preliminary pay worksheet prior to the submittal of an Application for Payment, and will promptly notify Contractor

of revisions necessary for approval. As soon as practicable, Contractor shall submit its Application for Payment on the appropriate and completed form, reflecting the required modifications to the Schedule of Values required by A/E and/or ODR. Attach all additional documentation required by ODR and/or A/E, as well as an affidavit affirming that all payrolls, bills for labor, materials, equipment, subcontracted work and other indebtedness connected with Contractor's Application for Payment are paid or will be paid within the time specified in Tex. Gov't Code, Ch. 2251. No Application for Payment is complete unless it fully reflects all required modifications, and includes all required documentation including Contractor's affidavit.

10.2.3 Certification by Architect/Engineer. Within five (5) days or earlier following A/E's receipt of Contractor's formal Application for Payment, A/E will review the Application for Payment for completeness, and forward it to ODR. A/E will certify that the application is complete and payable, or that it is incomplete, stating in particular what is missing. If the Application for Payment is incomplete, Contractor shall make the required corrections and resubmit the Application for Payment for processing.

10.3 Owner's Duty to Pay. Owner has no duty to pay the Contractor except on receipt by ODR of: 1) a complete Application for Payment certified by A/E; 2) Contractor's updated Work Progress Schedule; and 3) confirmation that Contractor's record documentation at the Site is kept current.

10.3.1 Payment for stored materials and/or equipment confirmed by Owner and A/E to be on-site or otherwise properly stored is limited to eighty-five (85) percent of the invoice price or eighty-five (85) percent of the scheduled value for the materials or equipment, whichever is less.

10.3.2 Retainage. Owner will withhold from each progress payment, as retainage, five (5) percent of the total earned amount, the amount authorized by law, or as otherwise set forth in the Supplementary General Conditions or Special Conditions. Retainage is managed in conformance with Tex. Gov't Code, Ch. 2252, Subch. B.

10.3.2.1 Contractor shall provide written consent of its surety for any request for reduction or release of retainage.

10.3.2.2 At least sixty-five (65) percent of the Contract, or such other discrete Work phase as set forth in Subsection 12.1.6 or Work package delineated in the Contract Documents, must be completed before Owner can consider a retainage reduction or release.

10.3.2.3 Contractor shall not withhold retainage from their Subcontractors and suppliers in amounts that are any percentage greater than that withheld in its Contract with Owner under this subsection, unless otherwise acceptable to Owner.

10.3.2.4 Absent a dispute between Owner and Contractor, retainage shall be paid not later than 90 days after Substantial Completion of the project.

10.3.2.5 Owner may reduce the amount of retainage paid, as provided by Subsection 10.3.3.

10.3.3 Price Reduction to Cover Loss. Owner may reduce any Application for Payment, prior to payment to the extent necessary to protect Owner from loss on account of actions of Contractor including, but not limited to, the following:

10.3.3.1 Defective or incomplete Work not remedied;

10.3.3.2 Damage to Work of a separate Contractor;

10.3.3.3 Failure to maintain scheduled progress or reasonable evidence that the Work will not be completed within the Contract Time;

10.3.3.4 Persistent failure to carry out the Work in accordance with the Contract Documents;

10.3.3.5 Reasonable evidence that the Work cannot be completed for the unpaid portion of the Contract Sum;

10.3.3.6 Assessment of fines for violations of prevailing wage rate law; or

10.3.3.7 Failure to include the appropriate amount of retainage for that periodic progress payment.

10.3.4 Title to all material and Work covered by progress payments transfers to Owner upon payment.

10.3.4.1 Transfer of title to Owner does not relieve Contractor and its Subcontractors of the sole responsibility for the care and protection of materials and Work upon which payments have been made until substantial completion, responsibility for the care and protection of materials and Work in areas where punch list items are completed until final completion or the restoration of any damaged Work, or waive the right of Owner to require the fulfillment of all the terms of the Contract.

10.4 Progress Payments. Progress payments to Contractor do not release Contractor or its surety from any obligations under the Contract.

10.4.1 Upon Owner's request, Contractor shall furnish manifest proof of the status of Subcontractor's accounts in a form acceptable to Owner.

10.4.2 Pay estimate certificates must be signed by a corporate officer or a representative duly authorized by Contractor.

10.4.3 Provide copies of bills of lading, invoices, delivery receipts or other evidence of the location and value of such materials in requesting payment for materials.

10.4.4 For purposes of Tex. Gov't Code § 2251.021(a)(2), the date the performance of service is complete is the date when ODR approves the Application for Payment.

10.5 Off-Site Storage. With prior approval by Owner and in the event Contractor elects to store materials at an off-site location, abide by the following conditions, unless otherwise agreed to in writing by Owner.

10.5.1 Store materials in a commercial warehouse meeting the criteria stated below.

10.5.2 Provide insurance coverage adequate not only to cover materials while in storage, but also in transit from the off-site storage areas to the Project Site. Copies of duly authenticated certificates of insurance, made out to insure the State agency which is signatory to the Contract, must be filed with Owner's representative.

10.5.3 Inspection by Owner's representative is allowed at any time. Owner's inspectors must be satisfied with the security, control, maintenance, and preservation measures.

10.5.4 Materials for this Project are physically separated and marked for the Project in a sectioned-off area. Only materials which have been approved through the submittal process are to be considered for payment.

10.5.5 Owner reserves the right to reject materials at any time prior to final acceptance of the complete Contract if they do not meet Contract requirements regardless of any previous progress payment made.

10.5.6 With each monthly payment estimate, submit a report to ODR and A/E listing the quantities of materials already paid for and still stored in the off-site location. Include photo-documentation of materials stored off-site for which Contractor requests payment.

10.5.7 Make warehouse records, receipts and invoices available to Owner's representatives, upon request, to verify the quantities and their disposition.

10.5.8 In the event of Contract termination or default by Contractor, the items in storage off-site, upon which payment has been made, will be promptly turned over to Owner or Owner's agents at a location convenient to Owner as directed by ODR. The full provisions of performance and payment bonds on this Project cover the materials off-site in every respect as though they were stored on the Project Site.

10.6 Time for Payment by Contractor Pursuant to Tex. Gov't Code § 2251.022.

10.6.1 Contractor who receives a payment from a governmental entity shall pay Subcontractor the appropriate share of the payment not later than the tenth (10th) day after the date Contractor receives the payment.

10.6.2 The appropriate share is overdue on the eleventh (11th) day after the date Contractor receives the payment.

Article 11. Changes

11.1 Change Orders. A Change Order issued after execution of the Contract is a written order to Contractor, signed by ODR, Contractor, and A/E, authorizing a change in the Work or an adjustment in the Contract Sum or the Contract Time. The Contract Sum and the Contract Time can only be changed by Change Order. A Change Order signed by Contractor indicates his agreement therewith, including the adjustment in the Contract Sum and/or the Contract Time. ODR may issue a written authorization for Contractor to proceed with Work of a Change Order in advance of final execution by all parties in accordance with Section 11.9.

11.1.1 Owner, without invalidating the Contract, may order changes in the Work within the general scope of the Contract consisting of additions, deletions or other revisions, and the Contract Sum and the Contract Time will be adjusted accordingly. All such changes in the Work shall be authorized by Change Order or ULCO, and shall be performed under the applicable conditions of the Contract Documents. If such changes cause an increase or decrease in Contractor's cost of, or time required for, performance of the Contract, an equitable adjustment shall be made and confirmed in writing in a Change Order or a ULCO.

11.1.2 It is recognized by the parties hereto and agreed by them that the Specifications and Drawings may not be complete or free from errors, omissions and imperfections or that they may require changes or additions in order for the Work to be completed to the satisfaction of Owner and that, accordingly, it is the express intention of the parties, notwithstanding any other provisions in this Contract, that any errors, omissions or imperfections in such Specifications and Drawings, or any changes in or additions to same or to the Work ordered by Owner and any resulting delays in the Work or increases in Contractor's costs and expenses arising out of such errors, shall not constitute or give rise to any claim, demand or cause of action of any nature whatsoever in favor of Contractor, whether for breach of Contract, or otherwise; provided, however, that Owner shall be liable to Contractor for the sum stated to be due Contractor in any Change Order approved and signed by both parties, it being agreed hereby that such sum, together with any extension of time contained in said Change Order, shall constitute full compensation to Contractor for all costs, expenses and damages to Contractor, as permitted under Tex. Gov't Code, Ch. 2260.

11.1.3 Procedures for administration of Change Orders shall be established by Owner

and stated in Supplementary General Conditions, Special Conditions, or elsewhere in the Contract Documents.

11.1.4 No verbal order, verbal statement, or verbal direction of Owner or his duly appointed representative shall be treated as a change under this article or entitle Contractor to an adjustment.

11.1.5 Contractor agrees that Owner or any of its duly authorized representatives shall have access and the right to examine any directly pertinent books, documents, papers, and records of Contractor. Further, Contractor agrees to include in all its subcontracts a provision to the effect that Subcontractor agrees that Owner or any of its duly authorized representatives shall have access to and the right to examine any directly pertinent books, documents, papers and records of such Subcontractor relating to any claim arising from the Contract, whether or not the Subcontractor is a party to the claim. The period of access and examination described herein which relates to appeals under the Disputes article of the Contract, litigation, or the settlement of claims arising out of the performance of the Contract shall continue until final disposition of such claims, appeals or litigation.

11.2 Unit Prices. If unit prices are stated in the Contract Documents or subsequently agreed upon, and if the quantities originally contemplated are so changed in a Proposed Change Order that application of the agreed unit prices to the quantities of work proposed will cause substantial inequity to Owner or Contractor, the applicable unit prices shall be equitably adjusted as provided in the Supplementary General Conditions or Special Conditions or as agreed to by the parties and incorporated into a Change Order.

11.3 Claims for Additional Costs.

11.3.1 If Contractor wishes to make a claim for an increase in the Contract Sum not related to a requested change, they shall give Owner and A/E written notice thereof within twenty-one (21) days after the occurrence of the event giving rise to such claim, but, in any case before proceeding to execute the Work considered to be additional cost or time, except in an emergency endangering life or property in which case Contractor shall act in accordance with Subsection 7.2.1. No such claim shall be valid unless so made. If Owner and Contractor cannot agree on the amount of the adjustment in the Contract Sum, it shall be determined as set forth under Article 15. Any change in the Contract Sum resulting from such claim shall be authorized by a Change Order or a ULCO.

11.3.2 If Contractor claims that additional cost is involved because of, but not limited to, 1) any written interpretation of the Contract Documents, 2) any order by Owner to stop the Work pursuant to Article 14 where Contractor was not at fault, or 3) any written order for a minor change in the Work issued pursuant to Section 11.4, Contractor shall make such claim as provided in Subsection 11.3.1.

11.3.3 Should Contractor or his Subcontractors fail to call attention of A/E to discrepancies or omissions in the Contract Documents, but claim additional costs for corrective Work after Contract award, Owner may assume intent to circumvent competitive bidding for necessary corrective Work. In such case, Owner may choose to let a separate Contract for the corrective Work, or issue a ULCO to require performance by Contractor. Claims for time extensions or for extra cost resulting from delayed notice of patent Contract Document discrepancies or omissions will not be considered by Owner.

11.4 Minor Changes. A/E, with concurrence of ODR, will have authority to order minor changes in the Work not involving an adjustment in the Contract Sum or an extension of the Contract Time. Such changes shall be effected by written order which Contractor shall carry out promptly and record on as-built record documents.

11.5 Concealed Site Conditions. Contractor is responsible for visiting the Site and being familiar with local conditions such as the location, accessibility, and general character of the Site and/or building. If, in the performance of the Contract, subsurface, latent, or concealed conditions at the Site are found to be materially different from the information included in the Contract Documents, or if unknown conditions of an unusual nature are disclosed differing materially from the conditions usually inherent in Work of the character shown and specified, ODR and A/E shall be notified in writing of such conditions before they are further disturbed or subsequent related work proceeds. Upon such notice, or upon its own observation of such conditions, A/E, with the approval of ODR, will promptly make such changes in the Drawings and Specifications as they deem necessary to conform to the different conditions, and any increase or decrease in the cost of the Work, or in the time within which the Work is to be completed, resulting from such changes will be adjusted by Change Order, subject to the prior approval of ODR.

11.6 Extension of Time. All changes to the Contract Time shall be made as a consequence of requests as required under Section 9.6, and as documented by Change Order as provided under Section 11.1.

11.7 Administration of Change Order Requests. All changes in the Contract shall be administered in accordance with procedures approved by Owner, and when required, make use of such electronic information management system(s) as Owner may employ.

11.7.1 Routine changes in the construction Contract shall be formally initiated by A/E by means of a PCO form detailing requirements of the proposed change for pricing by Contractor. This action may be preceded by communications between Contractor, A/E and ODR concerning the need and nature of the change, but such communications shall not constitute a basis for beginning the proposed Work by Contractor. Except for emergency conditions described below, approval of Contractor's cost proposal by A/E and ODR will be required for authorization to proceed with the Work being changed. Owner will not be responsible for the cost of Work changed without prior approval and Contractor may be required to remove Work so installed.

11.7.2 All proposed costs for change order Work must be supported by itemized accounting of material, equipment and associated itemized installation costs in sufficient detail, following the outline and organization of the establish Schedule of Values, to permit analysis by A/E and ODR using current estimating guides and/or practices. Photocopies of Subcontractor and vendor proposals shall be furnished unless specifically waived by ODR. Contractor shall provide written response to a change request within twenty-one (21) days of receipt.

11.7.3 Any unexpected circumstance which necessitates an immediate change in order to avoid a delay in progress of the Work may be expedited by verbal communication and authorization between Contractor and Owner, with written confirmation following within twenty-four (24) hours. A limited scope not-to-exceed estimate of cost and time will be requested prior to authorizing Work to proceed. Should the estimate be impractical for any reason, ODR may authorize the use of detailed cost records of such work to establish and confirm the actual costs and time for documentation in a formal Change Order.

11.7.4 Emergency changes to save life or property may be initiated by Contractor alone (see Section 7.3) with the claimed cost and/or time of such work to be fully documented as to necessity and detail of the reported costs and/or time.

11.7.5 The method of incorporating approved Change Orders into the parameters of the accepted Schedule of Values must be coordinated and administered in a manner acceptable to ODR.

11.8 Pricing Change Order Work. The amounts that Contractor and/or its Subcontractor adds to a Change Order for profit and overhead will also be considered by Owner before approval is given. The amounts established hereinafter are the maximums that are acceptable to Owner.

11.8.1 For Work performed by its forces, Contractor will be allowed their actual costs for materials, the total amount of wages (including benefits) paid for labor, plus the total cost of State and Federal payroll taxes and of worker's compensation and comprehensive general liability insurance, plus additional bond and builders risk insurance cost if the change results in an increase in the premium paid by Contractor. To the total of the above costs, Contractor will be allowed to add a percentage as noted below to cover overhead and profit combined. Allowable percentages for overhead and profit on any specific change shall not exceed fifteen (15) percent for the first $10,000 of value for self-performed work or portion thereof, ten (10) percent for the second $10,000 of value for self-performed work or portion thereof and seven and a half (7.5) percent for any value of the self-performed work that exceeds $20,000.

11.8.2 For subcontracted Work each affected Subcontractor shall figure its costs, overhead and profit as described above for Contractor's Work, all Subcontractor costs shall be combined, and to that total Subcontractor cost

Contractor will be allowed to add a maximum mark-up of ten (10) percent for the first $10,000 of subcontracted Work value or portion thereof, seven and half (7.5) percent for the second $10,000 of subcontracted Work value or portion thereof, and five (5) percent for any value of the subcontracted Work exceeding $20,000.

11.8.3 On changes involving both additions and deletions, percentages for overhead and profit will be allowed only on the net addition.

11.8.4 Owner does not accept and will not pay for additional Contract cost identified as indirect or consequential damages.

11.8.5 For Contracts based on a Guaranteed Maximum Price (GMP), the Construction Manager-at-Risk or Design Builder shall NOT be entitled to a percentage mark-up on any Change Order Work unless the Change Order increases the Guaranteed Maximum Price. The only percentage mark-up allowed is the construction management fee and shall not exceed the rate established in the contract.

11.9 Unilateral Change Order (ULCO). Owner may issue a written ULCO directing a change in the Work prior to reaching agreement with Contractor on the adjustment, if any, in the Contract price and/or the Contract Time.

11.9.1 Owner and Contractor shall negotiate for appropriate adjustments, as applicable, to the Contract Sum or the Contract Time arising out of a ULCO. As the changed Work is performed, Contractor shall submit its costs for such Work with its Application for Payment beginning with the next Application for Payment within thirty (30) days of the issuance of the ULCO. The Parties reserve their rights as to the disputed amount, subject to Article 15.

11.10 Final Resolution of Changes. Upon execution of a Change Order and /or a ULCO by Owner, Contractor and A/E, all costs and time issues regarding that change are final and not subject to additive adjustments.

Article 12. Project Completion and Acceptance

12.1 Closing Inspections.

12.1.1 Substantial Completion Inspection. When Contractor considers the entire Work or part thereof Substantially Complete, it shall notify ODR in writing that the Work will be ready for Substantial Completion inspection on a specific date. Contractor shall include with this notice Contractor's Punchlist to indicate that it has previously inspected all the Work associated with the request for inspection, noting items it has corrected and included all remaining work items with date scheduled for completion or correction prior to final inspection. The failure to include any items on this list does not alter the responsibility of Contractor to complete all Work in accordance with the Contract Documents. If any of the items on this list prevents the Project from being used as intended,

Contractor shall not request a Substantial Completion Inspection. Owner and its representatives will review the list of items and schedule the requested inspection, or inform Contractor in writing that such an inspection is premature because the Work is not sufficiently advanced or conditions are not as represented on Contractor's list.

12.1.1.1 Prior to the Substantial Completion inspection, Contractor shall furnish a copy of its marked-up Record Documents and a preliminary copy of each instructional manual, maintenance and operating manual, parts catalog, wiring diagrams, spare parts, specified written warranties, and like publications or parts for all installed equipment, systems, and like items as described in the Contract Documents. Delivery of these items is a prerequisite for requesting the Substantial Completion inspection.

12.1.1.2 On the date requested by Contractor, or as mutually agreed upon pending the status of the Open Items List, A/E, ODR, Contractor, and other Owner representatives as determined by Owner will jointly attend the Substantial Completion inspection, which shall be conducted by ODR or their delegate. If ODR determines that the Work is Substantially Complete, ODR will issue a Certificate of Substantial Completion to be signed by A/E, Owner, and Contractor establishing the date of Substantial Completion and identifying responsibilities for security, maintenance, insurance and utilities. A/E will provide with this certificate a consolidated list of Punchlist items (the pre-final Punchlist including all items noted by the various inspecting parties) for completion prior to final inspection. This list may include items in addition to those on Contractor's Punchlist, which the inspection team deems necessary to correct or complete prior to final inspection. The failure to include any items on this list does not alter the responsibility of Contractor to complete all Work in accordance with the Contract Documents. If Owner occupies the Project upon determination of Substantial Completion, Contractor shall complete all corrective Work at the convenience of Owner, without disruption to Owner's use of the Project for its intended purposes.

12.1.2 Final Inspection. Contractor shall complete the list of items identified on the pre-final Punchlist prior to requesting a final inspection. Unless otherwise specified, or otherwise agreed in writing by the parties as documented on the Certificate of Substantial Completion, Contractor shall complete and/or correct all Work within thirty (30) days of the Substantial Completion date, or where Contractor has used its best efforts to procure replacement parts in a timely manner for reasons outside of its control, or an agreed term that is within industry standards for such work. Upon completion of the pre-final Punchlist work, Contractor shall give written notice to ODR and A/E that the Work will be ready for final inspection on a specific date. Contractor shall accompany this notice with a copy of the updated pre-final Punchlist indicating resolution of all items. On the date specified or as soon thereafter as is practicable, ODR, A/E

and Contractor will inspect the Work. A/E will submit to Contractor a final Punchlist of open items that the inspection team requires corrected or completed before final acceptance of the Work.

12.1.2.1 Correct or complete all items on the final Punchlist before requesting Final Payment. Unless otherwise agreed to in writing by the parties, complete this work within seven (7) days of receiving the final Punchlist. Upon completion of the final Punchlist, notify A/E and ODR in writing stating the disposition of each final Punchlist item. A/E, Owner, and Contractor shall promptly inspect the completed items. When the final Punchlist is complete, and the Contract is fully satisfied according to the Contract Documents ODR will issue a certificate establishing the date of Final Completion. Completion of all Work is a condition precedent to Contractor's right to receive Final Payment.

12.1.3 Annotation. Any Certificate issued under this Article may be annotated to indicate that it is not applicable to specified portions of the Work, or that it is subject to any limitation as determined by Owner.

12.1.4 Purpose of Inspection. Inspection is for determining the completion of the Work, and does not relieve Contractor of its overall responsibility for completing the Work in a good and competent fashion, in compliance with the Contract. Work accepted with incomplete Punchlist items or failure of Owner or other parties to identify Work that does not comply with the Contract Documents or is defective in operation or workmanship does not constitute a waiver of Owner's rights under the Contract or relieve Contractor of its responsibility for performance or warranties.

12.1.5 Additional Inspections.

12.1.5.1 If Owner's inspection team determines that the Work is not substantially complete at the Substantial Completion inspection, ODR or A/E will give Contractor written notice listing cause(s) of the rejection. Contractor will set a time for completion of incomplete or defective work acceptable to ODR. Contractor shall complete or correct all work so designated prior to requesting a second Substantial Completion inspection.

12.1.5.2 If Owner's inspection team determines that the Work is not complete at the final inspection, ODR or A/E will give Contractor written notice listing the cause(s) of the rejection. Contractor will set a time for completion of incomplete or defective work acceptable to ODR. Contractor shall complete or correct all Work so designated prior to again requesting a final inspection.

12.1.5.3 The Contract contemplates four (4) comprehensive inspections: the

Substantial Completion inspection, the Final Completion inspection, the inspection of completed final Punchlist items and the "warranty walk" inspection that is scheduled at least thirty (30) days prior to the end of Contractor's warranty period defined in Section 13.2. The cost to Owner of additional inspections resulting from the Work not being ready for one or more of these inspections is the responsibility of Contractor. Owner may issue a ULCO deducting these costs from Final Payment. Upon Contractor's written request, Owner will furnish documentation of any costs so deducted. Work added to the Contract by Change Order after Substantial Completion inspection is not corrective Work for purposes of determining timely completion, or assessing the cost of additional inspections.

12.1.6 Phased Completion. The Contract may provide, or Project conditions may warrant, as determined by ODR, that designated elements or parts of the Work be completed in phases. Where phased completion is required or specifically agreed to by the parties, the provisions of the Contract related to closing inspections, occupancy, and acceptance apply independently to each designated element or part of the Work. For all other purposes, unless otherwise agreed by the parties in writing, Substantial Completion of the Work as a whole is the date on which the last element or part of the Work completed receives a Substantial Completion certificate.

Final Completion of the Work as a whole is the date on which the last element or part of the Work completed receives a Final Completion certificate.

12.2 Owner's Right of Occupancy. Owner may occupy or use all or any portion of the Work following Substantial Completion, or at any earlier stage of completion. Should Owner wish to use or occupy the Work, or part thereof, prior to Substantial Completion, ODR will notify Contractor in writing and identify responsibilities for security, maintenance, insurance and utilities. Work performed on the premises by third parties on Owner's behalf does not constitute occupation or use of the Work by Owner for purposes of this Article. All Work performed by Contractor after occupancy, whether in part or in whole, shall be at the convenience of Owner so as to not disrupt Owner's use of, or access to occupied areas of the Project.

12.3 Acceptance and Payment.

12.3.1 Request for Final Payment. Following the certified completion of all work, including all final Punchlist items, cleanup, and the delivery of record documents, Contractor shall submit a certified Application for Final Payment and include all sums held as retainage and forward to A/E and ODR for review and approval.

12.3.2 Final Payment Documentation. Contractor shall submit, prior to or with the Application for Final Payment, final copies of all close out documents, maintenance and operating instructions, guarantees and warranties, certificates, Record Documents and all other items required by the Contract. Contractor

shall submit evidence of return of access keys and cards, evidence of delivery to Owner of attic stock, spare parts, and other specified materials. Contractor shall submit consent of surety to Final Payment form and an affidavit that all payrolls, bills for materials and equipment, subcontracted work and other indebtedness connected with the Work, except as specifically noted, are paid, will be paid, after payment from Owner or otherwise satisfied within the period of time required by Tex. Gov't Code, Ch. 2251. Contractor shall furnish documentation establishing payment or satisfaction of all such obligations, such as receipts, releases and waivers of claims and liens arising out of the Contract. Contractor may not subsequently submit a claim on behalf of Subcontractor or vendor unless Contractor's affidavit notes that claim as an exception.

12.3.3 Architect/Engineer Approval. A/E will review a submitted Application for Final Payment promptly but in no event later than ten (10) days after its receipt. Prior to the expiration of this deadline, A/E will either: 1) return the Application for Final Payment to Contractor with corrections for action and resubmission; or 2) accept it, note their approval, and send to Owner.

12.3.4 Offsets and Deductions. Owner may deduct from the Final Payment all sums due from Contractor. If the Certificate of Final Completion notes any Work remaining, incomplete, or defects not remedied, Owner may deduct the cost of remedying such deficiencies from the Final Payment. On such deductions, Owner will identify each deduction, the amount, and the explanation of the deduction on or by the twenty-first (21st) day after Owner's receipt of an approved Application for Final Payment. Such offsets and deductions shall be incorporated via a final Change Order, including a ULCO as may be applicable.

12.3.5 Final Payment Due. Final Payment is due and payable by Owner, subject to all allowable offsets and deductions, on the thirtieth (30th) day following Owner's approval of the Application for Payment. If Contractor disputes any amount deducted by Owner, Contractor shall give notice of the dispute on or before the thirtieth (30th) day following receipt of Final Payment. Failure to do so will bar any subsequent claim for payment of amounts deducted.

12.3.6 Effect of Final Payment. Final Payment constitutes a waiver of all claims by Owner, relating to the condition of the Work except those arising from:

12.3.6.1 Faulty or defective Work appearing after Substantial Completion (latent defects);

12.3.6.2 Failure of the Work to comply with the requirements of the Contract Documents;

12.3.6.3 Terms of any warranties required by the Contract, or implied by law; or

12.3.6.4 Claims arising from personal injury or property damage to third parties.

12.3.7 Waiver of Claims. Final payment constitutes a waiver of all claims and liens by Contractor except those specifically identified in writing and submitted to ODR prior to the application for Final Payment.

12.3.8 Effect on Warranty. Regardless of approval and issuance of Final Payment, the Contract is not deemed fully performed by Contractor and closed until the expiration of all warranty periods. Issuance of Final Payment does not alter Contractor's contractual obligations during the warranty period.

Article 13. Warranty and Guarantee

13.1 Contractor's General Warranty and Guarantee. Contractor warrants to Owner that all Work is executed in accordance with the Contract, complete in all parts and in accordance with approved practices and customs, and of the required finish and workmanship. Contractor further warrants that unless otherwise specified, all materials and equipment incorporated in the Work under the Contract are new. Owner may, at its option, agree in writing to waive any failure of the Work to conform to the Contract, and to accept a reduction in the Contract price for the cost of repair or diminution in value of the Work by reason of such defect. Absent such a written agreement, Contractor's obligation to perform and complete the Work in accordance with the Contract Documents is absolute and is not waived by any inspection or observation by Owner, A/E or others, by making any progress payment or final payment, by the use or occupancy of the Work or any portion thereof by Owner, at any time, or by any repair or correction of such defect made by Owner.

13.2 Warranty Period. Except as may be otherwise specified or agreed, Contractor shall repair all defects in materials, equipment, or workmanship appearing within one year from the date of Substantial Completion of the Work. If Substantial Completion occurs by phase, then the warranty period for that particular Work begins on the date of such occurrence, or as otherwise stipulated on the Certificate of Substantial Completion for the particular Work.

13.3 Limits on Warranty. Contractor's warranty and guarantee hereunder excludes defects or damage caused by:

13.3.1 Modification or improper maintenance or operation by persons other than Contractor, Subcontractors, or any other individual or entity for whom Contractor is not responsible, unless Owner is compelled to undertake maintenance or operation due to the neglect of Contractor.

13.3.2 Normal wear and tear under normal usage after acceptance of the Work by Owner.

13.3.3 Force Majeure events and/or named storms.

13.4 Events Not Affecting Warranty. Contractor's obligation to perform and complete the Work in a good and workmanlike manner in accordance with the Contract Documents

is absolute. None of the following will constitute an acceptance of defective Work that is not in accordance with the Contract Documents or a release of Contractor's obligation to perform the Work in accordance with the Contract Documents:

13.4.1 Observations by Owner and/or A/E;

13.4.2 Recommendation to pay any progress or final payment by A/E;

13.4.3 The issuance of a certificate of Substantial Completion or any payment by Owner to Contractor under the Contract Documents;

13.4.4 Use or occupancy of the Work or any part thereof by Owner**;**

13.4.5 Any acceptance by Owner or any failure to do so;

13.4.6 Any review of a Shop Drawing or sample submittal; or

13.4.7 Any inspection, test or approval by others.

13.5 Separate Warranties. If a particular piece of equipment or component of the Work for which the Contract requires a separate warranty is placed in continuous service before Substantial Completion, the warranty period for that equipment or component will not begin until Substantial Completion, regardless of any warranty agreements in place between suppliers and/or Subcontractors and Contractor. ODR will certify the date of service commencement in the Substantial Completion certificate.

13.5.1 In addition to Contractor's warranty and duty to repair, Contractor expressly assumes all warranty obligations required under the Contract for specific building components, systems and equipment.

13.5.2 Contractor may satisfy any such obligation by obtaining and assigning to Owner a complying warranty from a manufacturer, supplier, or Subcontractor. Where an assigned warranty is tendered and accepted by Owner which does not fully comply with the requirements of the Contract, Contractor remains liable to Owner on all elements of the required warranty not provided by the assigned warranty.

13.6 Correction of Defects. Upon receipt of written notice from Owner, or any agent of Owner designated as responsible for management of the warranty period, of the discovery of a defect, Contractor shall promptly remedy the defect(s), and provide written notice to Owner and designated agent indicating action taken. In case of emergency where delay would cause serious risk of loss or damage to Owner, or if Contractor fails to remedy within thirty (30) days, or within another period agreed to in writing, Owner may correct the defect and be reimbursed the cost of remedying the defect from Contractor or its surety.

13.7 Certification of No Asbestos Containing Materials or Work. Contractor shall ensure compliance with the Asbestos Hazard Emergency Response Act (AHERA– 40 C.F.R

§ 763-99(7)) from all Subcontractors and materials suppliers, and shall provide a notarized certification to Owner that all equipment and materials used in fulfillment of their Contract responsibilities are non-Asbestos Containing Building Materials (ACBM). This certification must be provided no later than Contractor's application for Final Payment.

Article 14. Suspension and Termination

14.1 Suspension of Work for Cause. Owner may, at any time without prior notice, suspend all or any part of the Work, if after reasonable observation and/or investigation, Owner determines it is necessary to do so to prevent or correct any condition of the Work, which constitutes an immediate safety hazard, or which may reasonably be expected to impair the integrity, usefulness or longevity of the Work when completed.

14.1.1 Owner will give Contractor a written notice of suspension for cause, setting forth the reason for the suspension and identifying the Work suspended. Upon receipt of such notice, Contractor shall immediately stop the Work so identified. As soon as practicable following the issuance of such a notice, Owner will initiate and complete a further investigation of the circumstances giving rise to the suspension, and issue a written determination of the findings.

14.1.2 If it is confirmed that the cause was within the control of Contractor, Contractor will not be entitled to an extension of time or any compensation for delay resulting from the suspension. If the cause is determined not to have been within the control of Contractor, and the suspension has prevented Contractor from completing the Work within the Contract Time, the suspension is an excusable delay and a time extension will be granted through a Change Order.

14.1.3 Suspension of Work under this provision will be no longer than is reasonably necessary to remedy the conditions giving rise to the suspension.

14.2 Suspension of Work for Owner's Convenience. Upon seven (7) days written notice to Contractor, Owner may at any time without breach of the Contract suspend all or any portion of the Work for a period of up to thirty (30) days for its own convenience. Owner will give Contractor a written notice of suspension for convenience, which sets forth the number of suspension days for which the Work, or any portion of it, and the date on which the suspension of Work will cease. When such a suspension prevents Contractor from completing the Work within the Contract Time, it is an excusable delay. A notice of suspension for convenience may be modified by Owner at any time on seven (7) days written notice to Contractor. If Owner suspends the Work for its convenience for more than sixty (60) consecutive days, Contractor may elect to terminate the Contract pursuant to the provisions of the Contract.

14.3 Termination by Owner for Cause.

14.3.1 Upon written notice to Contractor and its surety, Owner may, without prejudice to any right or remedy, terminate the Contract and take possession of the Site

and of all materials, equipment, tools, construction equipment, and machinery thereon owned by Contractor under any of the following circumstances:

14.3.1.1 Persistent or repeated failure or refusal, except during complete or partial suspensions of work authorized under the Contract, to supply enough properly skilled workmen or proper materials;

14.3.1.2 Persistent disregard of laws, ordinances, rules, regulations or orders of any public authority having jurisdiction, including ODR;

14.3.1.3 Persistent failure to prosecute the Work in accordance with the Contract, and to ensure its completion within the time, or any approved extension thereof, specified in the Contract;

14.3.1.4 Failure to remedy defective work condemned by ODR;

14.3.1.5 Failure to pay Subcontractors, laborers, and material suppliers pursuant to Tex. Gov't Code, Ch. 2251;

14.3.1.6 Persistent endangerment to the safety of labor or of the Work;

14.3.1.7 Failure to supply or maintain statutory bonds or to maintain required insurance, pursuant to the Contract;

14.3.1.8 Any material breach of the Contract; or

14.3.1.9 Contractor's insolvency, bankruptcy, or demonstrated financial inability to perform the Work.

14.3.2 Failure by Owner to exercise the right to terminate in any instance is not a waiver of the right to do so in any other instance.

14.3.3 Should Owner decide to terminate the Contract under the provisions of Section 14.3, it will provide to Contractor and its surety thirty (30) days prior written notice.

14.3.4 Should Contractor or its surety, after having received notice of termination, demonstrate to the satisfaction of Owner that Contractor or its surety are proceeding to correct such default with diligence and promptness, upon which the notice of termination was based, the notice of termination may be rescinded in writing by Owner. If so rescinded, the Work may continue without an extension of time.

14.3.5 If Contractor or its surety fails, after written notice from Owner to commence and continue correction of such default with diligence and promptness to the satisfaction of Owner within thirty (30) days following receipt of notice, Owner may arrange for completion of the Work and deduct the cost of completion from the unpaid Contract Sum.

14.3.5.1 This amount includes the cost of additional Owner costs such as A/E services, other consultants, and contract administration.

14.3.5.2 Owner will make no further payment to Contractor or its surety unless the costs to complete the Work are less than the Contract balance, then the difference shall be paid to Contractor or its surety. If such costs exceed the unpaid balance, Contractor or its surety will pay the difference to Owner.

14.3.5.3 This obligation for payment survives the termination of the Contract.

14.3.5.4 Owner reserves the right in termination for cause to take assignment of all the Contracts between Contractor and its Subcontractors, vendors, and suppliers. ODR will promptly notify Contractor of the contracts Owner elects to assume. Upon receipt of such notice, Contractor shall promptly take all steps necessary to effect such assignment.

14.4 Conversion to Termination for Convenience. In the event that any termination of Contractor for cause under Section 14.3 is later determined to have been improper, the termination shall automatically convert to a termination for convenience under Section 14.5 and Contractor's recovery for termination shall be strictly limited to the payments allowable under Section 14.5.

14.5 Termination for Convenience of Owner. Owner reserves the right, without breach, to terminate the Contract prior to, or during the performance of the Work, for any reason. Upon such an occurrence, the following shall apply:

14.5.1 Owner will immediately notify Contractor and A/E in writing, specifying the reason for and the effective date of the Contract termination. Such notice may also contain instructions necessary for the protection, storage or decommissioning of incomplete work or systems, and for safety.

14.5.2 Upon receipt of the notice of termination, Contractor shall immediately proceed with the following obligations, regardless of any delay in determining or adjusting any amounts due at that point in the Contract:

14.5.2.1 Stop all work.

14.5.2.2 Place no further subcontracts or orders for materials or services.

14.5.2.3 Terminate all subcontracts for convenience.

14.5.2.4 Cancel all materials and equipment orders as applicable.

14.5.2.5 Take action that is necessary to protect and preserve all property related to the Contract which is in the possession of Contractor.

14.5.3 When the Contract is terminated for Owner's convenience, Contractor may recover from Owner payment for all Work executed and costs incurred as a result of such termination, including a termination fee, earned for all work properly executed. Contractor may not claim lost profits on other work or lost business opportunities.

14.6 Termination By Contractor. If the Work is stopped for a period of ninety (90) days under an order of any court or other public authority having jurisdiction, or as a result of an act of government, such as a declaration of a national emergency making materials unavailable, through no act or fault of Contractor or Subcontractor or their agents or employees or any other persons performing any of the Work under a contract with Contractor, then Contractor may, upon thirty (30) additional days written notice to ODR, terminate the Contract and recover from Owner payment for all Work executed, but not lost profits on other work or lost business opportunities. If the cause of the Work stoppage is removed prior to the end of the thirty (30) day notice period, Contractor may not terminate the Contract.

14.7 Settlement on Termination. When the Contract is terminated for any reason, at any time prior to one hundred eighty (180) days after the effective date of termination, Contractor shall submit a final termination settlement proposal to Owner based upon recoverable costs as provided under the Contract. If Contractor fails to submit the proposal within the time allowed, Owner may determine the amount due to Contractor because of the termination and pay the determined amount to Contractor.

Article 15. Dispute Resolution

15.1 Unresolved Contractor Disputes. The dispute resolution process provided for in Tex. Gov't Code, Ch. 2260 or Tex. Civ. Prac. & Rem. Code, Ch. 114, shall be used by Contractor to attempt to resolve any claim for breach of Contract made by Contractor that is not resolved under procedures described throughout the Uniform General Conditions, Supplementary Conditions, or Special Conditions of the Contract.

15.2 Alternative Dispute Resolution Process. Owner may establish a dispute resolution process to be utilized in advance of that outlined in Tex. Gov't Code, Ch. 2260 or Tex. Civ. Prac. & Rem. Code, Ch. 114.

15.3 Nothing herein shall hinder, prevent, or be construed as a waiver of Owner's right to seek redress on any disputed matter in a court of competent jurisdiction.

15.4 Nothing herein shall waive or be construed as a waiver of the State's sovereign immunity.

Article 16. Miscellaneous

16.1 Supplementary General and Special Conditions. When the Work contemplated by Owner is of such a character that the foregoing Uniform General Conditions of the Contract cannot adequately cover necessary and additional contractual relationships, the Contract may include Supplementary General and Special Conditions as described below:

16.1.1 Supplementary General Conditions may describe the standard procedures and requirements of contract administration followed by a contracting agency of the State. Supplementary General Conditions may expand upon matters covered by the Uniform General Conditions, where necessary, provided the expansion does not weaken the character or intent of the Uniform General Conditions. Supplementary General Conditions are of such a character that it is to be anticipated that a contracting agency of the State will normally use the same, or similar, conditions to supplement each of its several projects.

16.1.2 Special Conditions shall relate to a particular Project and be unique to that Project but shall not weaken the character or intent of the Uniform General Conditions.

16.2 Federally Funded Projects. On Federally funded projects, Owner may waive, suspend or modify any Article in these Uniform General Conditions which conflicts with any Federal statue, rule, regulation or procedure, where such waiver, suspension or modification is essential to receipt by Owner of such Federal funds for the Project. In the case of any Project wholly financed by Federal funds, any standards required by the enabling Federal statute, or any Federal rules, regulations or procedures adopted pursuant thereto, shall be controlling.

16.3 Internet-based Project Management Systems. At its option, Owner may administer its design and construction management through an Internet-based management system. In such cases, Contractor shall conduct communication through this media and perform all Project related functions utilizing this database system. This includes correspondence, submittals, Requests for Information, vouchers or payment requests and processing, amendment, Change Orders and other administrative activities.

16.3.1 Accessibility and Administration.

16.3.1.1 When used, Owner will make the software accessible via the Internet to all Project team members.

16.3.1.2 Owner shall administer the software.

16.3.2 Training. When used, Owner shall provide training to the Project team members.

16.4 Administrative Inspections and Audits. Contractor agrees that all relevant records related to this Contract or any work product under this Contract, including practices of its Subcontractors, shall be subject, at any reasonable time, to inspection, examination, review, audit, and copying at any office or location of Contractor where such records

may be found, with or without notice by the Texas State Auditor's Office ("SAO"), the contracting agency or its contracted examiners, or the Office of the Texas Attorney General, and with regard to any federal funding, the relevant federal agency, the Comptroller General, the General Accounting Office, the Office of the Inspector General, or any of their authorized representatives. All Subcontracts shall reflect the requirements of this section. In addition, pursuant to Tex. Gov't Code § 2262.003 the SAO may conduct an audit or investigation of any entity receiving funds under this Contract, including direct payments to Contractor and indirect payments under a Subcontract to this Contract; acceptance of such monies acts as acceptance of SAO authority, under legislative audit committee direction, to audit and investigate related to those funds and the entity subject to the audit or investigation must provide SAO with access to any information SAO considers relevant to the scope of the audit or investigation.

End of Uniform General Conditions

2025 SUPPLEMENTAL GENERAL CONDITIONS
TO THE
STATE OF TEXAS 2025 EDITION OF THE UNIFORM GENERAL CONDITIONS FOR CONTRACTS

The following Supplemental General Conditions amend and/or supplement the 2025 edition of the Uniform General Conditions for Construction Contracts and, at TFC's sole discretion, provides for bonding per GMP.

Article 5. Bonds and Insurance

5.1. Construction Bonds.

Subparagraph 5.1.1.1 is supplemented to modify 5.1.1.1, as follows:

> A Performance bond is required if the Contract Sum is in excess of $100,000. The performance bond is solely for the protection of Owner. Except for Construction Manager-at-Risk Contracts where, in Owner's sole discretion and determination, a Performance Bond is acceptable in the amount of the guaranteed maximum price (GMP), the performance bond is to be for the Contract Sum to guarantee the faithful performance of the Work in accordance with the Contract Documents. The form of the bond shall be approved by the Office of the Attorney General of Texas. The performance bond shall be effective through Contractor's warranty period.

Subparagraph 5.1.1.2 is supplemented to modify 5.1.1.2, as follows:

> A Payment bond is required if the Contract price is in excess of $25,000. Except for Construction Manager-at-Risk Contracts where, in Owner's sole discretion and determination, a Payment Bond is acceptable in the amount of the guaranteed maximum price (GMP), the payment bond is to be for the Contract Sum and is payable to Owner solely for the protection and use of payment bond beneficiaries. The form of the bond shall be approved by the Office of the Attorney General of Texas.

CONSTRUCTION MANAGER-AT-RISK CONTRACT

EXHIBIT C

SPECIAL CONDITIONS OF THE AGREEMENT

LIQUIDATED DAMAGES SCHEDULE

Liquidated Damages for Interim Construction Milestone(s) (if any): Pursuant to Section 9.5 of the Agreement, the liquidated damages for failure to achieve Substantial Completion of the interim construction milestone (s), if any, shall be as set forth below:

> **Milestone 1:** The sum of Five Hundred and no/100 Dollars ($500) per calendar day for each day of delay in achieving Substantial Completion of Milestone 1, beginning on day eight (8) (so as to allow a seven (7) day grace period), as required by Contract Documents.

Liquidated Damages for the Entire Work: Pursuant to Section 9.5 of the Agreement, the liquidated damages for failure to achieve Substantial Completion of the entire Work shall, in addition to and not in lieu of any liquidated damages as provided above with regard to the interim construction milestone (s), be as set forth below:

Days Beyond Substantial Completion	Liquidated Damages
1 - 7 calendar days	$0, to allow for a seven (7) calendar day grace period
8 - 30 calendar days	**$500** per calendar day
31 - 45 calendar days	**$500** per calendar day
46+ calendar days	**$500** per calendar day

The liquidated damages arising from the failure to achieve Substantial Completion of the interim construction milestone (s) and the liquidated damages arising from the failure to achieve Substantial Completion of the entire Work are to be charged separately, but in no event shall the daily rate exceed the highest singular applicable daily rate (i.e., no stacking).

TEXAS FACILITIES COMMISSION

CRIMINAL BACKGROUND CHECKS AND APPLICATION GUIDELINES

It is the policy of the Texas Facilities Commission ("TFC") that all Contractor employees and subcontractors that will complete any work on-site at a state-owned property shall be subject to a criminal background check. Any expense associated with such criminal background check shall be borne by the Contractor. Contractor's employees and subcontractors who work on TFC contracts are required to submit a criminal history background check. A criminal history background check shall be completed before any Contractor's employee or subcontractor performs services at the site. Criminal background checks must be performed by the Texas Department of Public Safety ("DPS") and must be on the form provide by TFC.

I. CRIMINAL HISTORY CRITERIA

Employers should use the following criminal history criteria when hiring employees to perform work for TFC. Any employee failing to meet the minimum standard will be denied. If special circumstances exist, please contact the TFC representative for clarification or further consideration.

A conviction or deferred adjudication for one of the following offenses will result in the **permanent disqualification** of a person from eligibility to provide contractual services with Texas Facilities Commission:

(i) any act causing death as defined in Texas Penal Code; and

(ii) any felony or misdemeanor involving arson, burglary, breach of computer security, credit card abuse, counterfeiting, forgery, kidnapping, robbery, stalking, terroristic threat, theft, and any sexual offense designated as a felony in Texas Penal Code.

Additionally, anyone who has a current duty to register as a sex offender, is under indictment or is a fugitive from justice is disqualified.

For individuals who have a conviction or deferred adjudication for felonies not enumerated above, 10 years must have passed from the time of disposition or discharge of probation in order for that person to be eligible to provide contractual services with the TFC.

For individuals who have a misdemeanor conviction or deferred adjudication for misdemeanors not enumerated above, 5 years must have passed from the time of disposition or discharge of probation in order for that person to be eligible to provide contractual services with the TFC.

II. CRIMINAL BACKGROUND PROCESS

DPS has entered into an exclusive contract with IdentoGO Centers, formerly L-1 Enrollment Services, operated by MorphoTrust USA. IdentoGO by MorphoTrust is the exclusive live scan fingerprinting provider for DPS. All TFC contractors that are subject to TFC criminal background check requirements must create an account with IdentoGO in accordance with the IdentoGO Account Application and requirements attached hereto as "Attachment A". Thereafter, all contractor employees and subcontractors must follow the registration procedures attached hereto as "Attachment A" including using the ***Texas Facilities Commission Service Code 11G6ZN.*** All necessary instructions and information to schedule a fingerprint appointment is included in Attachment A. In addition, the only service code accepted by DPS for a TFC criminal background check is the service code provided in Attachment A, hereto, therefore, if an individual does not use the service code in Attachment A, he or she may be required to repeat the process at the expense of contractor. Contractors can began the process by simply clicking on this link:
https://uenroll.identogo.com/servicecode/11G6ZN

Additionally, forms and instructions can be found on the IdentoGO website at http://www.identogo.com by clicking on the State of Texas. Links on that page include one for online scheduling and a list for the state-wide fingerprinting locations. The waiver form for the criminal background check is attached hereto as "Attachment B". In the event Contractor needs to set up a new account, please refer to the attached link for instructions: http://www.l1enrollment.com/state/forms/tx/566718664f05a.pdf.

III. CRIMINAL HISTORY ERROR RESOLUTION

The Error Resolution Unit ("ER") is responsible for updating and evaluating possible errors in criminal history records. Potential errors are reported to ER by law enforcement, judicial agencies, as well as private citizens.

If an applicant would like to make a request that a criminal history record be updated or corrected, the applicant will need to supply certified documents to the ER. Required forms and additional information submit a correction request to the ER can be found at:

http://txdps.state.tx.us/administration/crime_records/pages/errorresolution.htm.

IV. TFC CONTACTS

For any questions involving the TFC criminal background check process, please contact the following:

Tommy Oates, Deputy Executive Director
Office: 512-463-3057
Cell: 512-463-3376
Email: tommy.oates@tfc.state.tx.us

Mandy Burrell, Manager
Office: 512-463-1799
Cell: 512-247-1290
Email:
mandy.burrell@tfc.state.tx.us

ATTACHMENT A

Facilities Commission (ORI Facilities Commission/Service Code 11G6ZN)

The general process for electronic fingerprinting is:

1. Schedule an appointment to be electronically fingerprinted by MorphoTrust USA at one of their IdentoGo enrollment centers.
    - Internet based scheduling is the quickest and most convenient way to obtain a fingerprint appointment.
        a. **You may begin the process now by simply clicking on this link: https://uenroll.identogo.com/servicecode/11G6ZN**
        b. Provide all required pre-enrollment data and select a convenient date and time for your appointment
    - If you prefer to schedule over the telephone, you must:
        a. Have your Service Code ready (**11G6ZN**), then call **888.467.2080**;
        b. MorhphoTrust will prompt you for the Service Code (**11G6ZN**);
        c. Provide all required pre-enrollment data and select a convenient date and time for your appointment
2. Arrive at your scheduled appointment with your photo identification and fee
    - If you plan on bringing a form of identification other than a valid (unexpired) TX Driver License, please refer to the Department of Public Safety's acceptable document types here: http://www.l1enrollment.com/state/forms/tx/55fc619a7f7aa.doc
    - MorphoTrust accepts Visa/MasterCard/Discover/American Express, business checks, money orders and coupon codes (employer accounts) at the time of service.
    - Please note that personal checks and cash are **not accepted**.
3. Your fingerprints will be submitted electronically to DPS and the FBI. You will not receive a printed fingerprint card.
4. At the conclusion of your appointment, the MorphoTrust enrollment agent will provide you with an IdentoGo receipt stating that you were fingerprinted.
    - Do not throw away the receipt;
    - You may check status on your submission by clicking on this link: **https://uenroll.identogo.com/servicecode/11G6ZN** and then;
    - Click "**Check Status**"

Fingerprints provided for this application shall be used to check criminal history records of the Texas Department of Public Safety and the Federal Bureau of Investigation, in accordance with applicable statutes.

ATTACHMENT B

IdentoGO
By MorphoTrust USA

Texas Fingerprint Service Code Form

Facilities Commission

Service Name: Facilities Commission

To schedule your ten-minute fingerprint appointment, simply visit **https://uenroll.identogo.com** and enter the following Service Code

11G6ZN

Service Code is unique to your hiring/licensing agency. Do not use this code for another purpose.

Background Check Waiver

I certify that all information I provided in relation to this criminal history record check is true and accurate. I authorize the Texas Department of Public Safety (DPS) to access Texas and Federal criminal history record information that pertains to me and disseminate that information to the designated Authorized Agency or Qualified Entity with which I am or am seeking to be employed or to serve as a volunteer, through the DPS Fingerprint-based Applicant Clearinghouse of Texas and as authorized by Texas Government Code Chapter 411 and any other applicable state or federal statute or policy.

I authorize the Texas Department of Public Safety to submit my fingerprints and other application information to the FBI for the purpose of comparing the submitted information to available records in order to identify other information that may be pertinent to the application. I authorize the FBI to disclose potentially pertinent information to the DPS during the processing of this application and for as long hereafter as may be relevant to the activity for which this application is being submitted. I understand that the FBI may also retain my fingerprints and other applicant information in the FBI's permanent collection of fingerprints and related information, where all such data will be subject to comparisons against other submissions received by the FBI and to further disseminations by the FBI as may be authorized under the Privacy Act of 1974 (5 USC 552a). I understand my fingerprints will be searched by and against civil, criminal and latent fingerprints in the Next Generation Identification (NGI) system. I understand I am entitled to obtain a copy of any criminal history record check and challenge the accuracy and completeness of the information before a final determination is made by the Qualified Entity. I also understand the Qualified Entity may deny me access to children, the elderly, or individuals with disabilities until the criminal history record check is completed. If a need arises to challenge the FBI record response, you may contact the agency that submitted the information to the FBI, or you may send a written challenge request to the FBI's Criminal Justice Information Services (CJIS) Division at FBI CJIS Division, Attention: Correspondence Group, 1000 Custer Hollow Road, Clarksburg, WV 26306.

Don't have access to the Internet? You can still schedule an appointment by calling 888.467.2080

TFC-FDC-Pay Voucher, revised 08/2007

STATE OF TEXAS PURCHASE VOUCHER - CONSTRUCTION

Agency Voucher No.

Comptroller's Vendor No.	Agency No.	Agency Name	TFC Project Number

Pay to: (name, address, city state, ZIP code	Period Covered		Contract Date
	From:	To:	

Invoice Date	Invoice No.	Voucher Amount

DESCRIPTION	AMOUNTS
ORIGINAL CONTRACT	
EXTRAS ORDERED	
TOTAL	
DEDUCTIONS ORDERED	
TOTAL NET CONTRACT	
TOTAL AMOUNT EARNED TO DATE	
TOTAL RETAINED PERCENTAGE DATE	
TOTAL EARNED LESS RETAINED PERCENTAGE	
TOTAL PREVIOUSLY APPROVED	
AMOUNT DUE THIS STATEMENT	

ARCHITECT/ENGINEER CERTIFICATION

In accordance with the Contract Documents, based on on-site observations and other pertinent data, the Architect/Engineer certifies that, to the best of the Architect/Engineer's knowledge, information and belief, the work has progressed to the point indicated and that this is a true and correct statement of work performed and materials supplied by the Contractor, and that this statement of account and the amount due is correct and that all work and material has been performed in full accordance with the terms and conditions of the Contract Documents and authorized changes thereto.

By: _____ _____
Architect/Engineer Date

TFC Contact Name _____ Phone No. _____

AGENCY CERTIFICATION

I certify that the above services were rendered or goods received; that they correspond in every particular with the contract under which they were procured; that the invoice is true and unpaid; and that the claim was presented to the State within the applicable limitations period.

Name _____ Title _____

Name _____ Title _____

PAYMENT

Name _____ Title _____

Name _____ Title _____

CONTRACTOR'S CERTIFICATION

I _____ do hereby certify that I am

(Title of person certifying)

and that I am duly authorized to make this certification for and on behalf of

(Name of payee company/claimant)

I further certify that the attached invoice is correct and that it corresponds in every particular with the supplies and/or services contracted for. I further certify that the account is true, correct and unpaid.

Signature Date

PRICES ABOVE ARE APPROVED

By: _____

FOR FISCAL USE ONLY

Remittance Vendor ID	DT	Source Code	(circle one) Send to USAS	Batch #	Date Paid
			YES	Entered by	
	Amount	PCC	NO	Date	Warrant / Direct Deposit #

Encumbrance No	C	Req #	Order Date	Invoice #	Received Date	AY	Agency Fund	Object Class	Org Code

Amount	Payment Due Date	Request Payment Date	Interest Override	Description (includes vendor account#)

Descriptive / Legal Text

Prepared by: **Date:** **Approved by:** **Date:**

Continuation Sheet

Application Number:

Period from: to:

A	B	C	D	E	F	G		H	I
Item No.	Description of Work	Scheduled Value	Work Completed		Materials Presently Stored (Not in D or E)	Total Completed and Stored to Date	% (C-G)	Balance to Finish (C-G)	Retainage
			From Previous Application (D+E)	This Period					

PROJECT NO.:_____

CONSTRUCTION PAYMENT AFFIDAVIT

State of Texas
County of _____

The undersigned, being duly sworn and having personal knowledge of the matters set forth herein, deposes and say under oath:

1. That he or she _____ , is _____
(Name) (Title)

of _____
(Firm/Corp./Partnership, etc.)

2. That _____ is the contractor of a

construction project pursuant to a contract, identified as _____

_____

_____
(Project No. and Title of Contract)

("Contract" herein) in which the State of Texas is defined as the Owner.

3. The Contractor has performed work and labor or furnished materials for use in the construction project defined by the Contract.

4. All payments by the Contractor to its Subcontractors and Material men for work, labor, materials, machinery and equipment furnished to it by said Subcontractors and Material men are timely made or shall be made within the meaning of and in accordance with the requirements of the Uniform General Conditions applicable to the contract and Contractor knows of no other person or entity having a right to assert any lien on account of materials or labor furnished to it for construction pursuant to the Contract.

Signature _____

Title _____

Sworn and subscribed to before me the undersigned authority on this _____ day of

_____ , _____

_____
Notary Public State of Texas
My Commission Expires _____

HUB Subcontracting Plan (HSP)
Prime Contractor Progress Assessment Report

This form must be completed and submitted to the contracting agency each month to document compliance with your HSP.

Contract/Requisition Number: _____ **Date of Award:** _____ (mm/dd/yyyy) **Object Code:** _____ (Agency Use Only)

Contracting Agency/University Name: _____

Contractor (Company) Name: _____ **State of Texas VID #:** _____

Point of Contact: _____ **Phone #:** _____

Reporting (Month) Period: _____ **Total Amount Paid this Reporting Period to** $ -

Report HUB and Non-HUB subcontractor information

Subcontractor's Name	Subcontractor's VID or HUB Certificate Number	*Texas Certified HUB? (Yes or No)	Total Contract $ Amount from HSP with Subcontractor	Total $ Amount Paid This Reporting Period to Subcontractor	Total Contract $ Amount Paid to Date to Subcontractor	Object Code (Agency Use Only)
			$ -	$ -	$ -	
			$ -	$ -	$ -	
			$ -	$ -	$ -	
			$ -	$ -	$ -	
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			$ -	$ -	$ -	
		TOTALS:	$ -	$ -	$ -	

Signature: _____ **Title:** _____ **Date:** _____

Comptroller of Public Accounts FORM 74-176 (Rev.12-09/7)

CLEAR ALL FIELDS

Vendor Direct Deposit Authorization/ Advance Payment Notification Authorization

TRANSACTION TYPE

SECTION 1

☐ New setup	*(Sections 2, 3 & 4)*	☐ Change financial institution	*(Sections 2, 3 & 4)*
☐ Cancellation	*(Sections 2, 3, 5 & 7)*	☐ Change account number	*(Sections 2, 3 & 4)*
☐ Interagency transfer	*(Sections 2, 3, 4 & 7)*	☐ Change account type	*(Sections 2, 3 & 4)*

PAYEE IDENTIFICATION

SECTION 2

1. Social Security or Employer Identification Number (EIN)		2. Mail code *(If not known, will be completed by Paying State Agency)*	
3. Name		4. Phone number ( )	
5. Mailing address	6. City	7. State	8. ZIP code

AUTHORIZATION FOR SETUP, CHANGES OR CANCELLATION

SECTION 3

9. I authorize the Texas Comptroller of Public Accounts to deposit my payments from the state of Texas to my financial institution electronically. I understand that the Comptroller of Public Accounts will reverse any payments made to my account in error.

I further understand that the Comptroller's office will comply at all times with the National Automated Clearing House Association's rules. For further information on these rules, please contact your financial institution.

Will these payments be forwarded to a financial institution outside the United States? ☐ YES ☐ NO

10. Authorized signature	11. Printed name	12. Date

FINANCIAL INSTITUTION *(Completion by financial institution is recommended.)*

SECTION 4

13. Name	14. City	15. State
16. Routing transit number – –	17. Customer account number *(Dashes required* ☐ **YES***)*	18. Type of account ☐ **Checking** ☐ **Savings**
19. Representative name *(Please print)*	20. Title	
21. Representative signature *(Optional)*	22. Phone number ( )	23. Date

CANCELLATION BY AGENCY

SEC. 5

24. Reason	25. Date

AUTHORIZATION FOR ADVANCE PAYMENT NOTIFICATION SETUP

SECTION 6

26. By completing this section, I authorize the Texas Comptroller of Public Accounts to send a notification via e-mail address or FAX one business day prior to the payment settling in my account. I understand that notifications may include payment information that is considered confidential and therefore exempt from public disclosure.

Please indicate the one method you want to receive payment notification by providing either an e-mail address or FAX number.

E-mail: _____ FAX number: ( ) _____

Include payment remittance information? ☐ YES ☐ NO

AUTHORIZED SIGNATURE

SECTION 7

sign here 27. Authorized signature *(Applicant or authorized agent - Required)*	28. Phone number (*Required*) ( )	29. Date *(Required)*
30. Agency name	31. Agency number	
32. Comments		

INSTRUCTIONS FOR VENDOR DIRECT DEPOSIT AUTHORIZATION/ ADVANCE PAYMENT NOTIFICATION AUTHORIZATION FORM

Alterations must be initialed.

SECTION 1: Select the appropriate transaction type(s).

SECTION 2: Provide the Social Security number or Employer Identification Number (EIN).

SECTION 3: The person authorizing the direct deposit setup must sign, print their name and date the form. **If you receive state payments via direct deposit which are forwarded from a U.S. financial institution to a financial institution outside the U.S., please contact the Comptroller's office at (512) 936-8138 and FAX your form to (512) 936-5970.**

SECTION 4: Completion by financial institution is recommended.

SECTION 5: Must be completed by the paying state agency.

SECTION 6: Receiving your state payments by direct deposit enables you to take advantage of our Advance Payment Notification option. Notifications can be sent by e-mail or FAX, and provide one (1) business day advance notice of your payment posting to your financial institution. You may also choose to have your payment remittance information included. To sign up, simply complete Section 6.

SECTION 7: To be completed by the paying agency if the state agency is submitting the form to the Comptroller's office for processing.

Submit the completed form to the state agency with which you are conducting business. This agency will be designated as your custodial agency. If the direct deposit instructions need to be updated or cancelled, contact your custodial agency.

You have certain rights under Chapters 552 and 559, Government Code, to review, request and correct information we have on file about you. Contact us at (800) 531-5441, ext. 6-8138.

Transmittal Letter

To: _____ Date: _____

FDC Project Number: _____

Attention: _____ If enclosures are not as noted, please notify our office.

If checked below, please:

☐ Acknowledge receipt of enclosures.

☐ Return enclosures to use.

We Transmit: ☐ herewith ☐ under separate cover via

☐ in accordance with our request _____

For Your : ☐ approval ☐ distribution to parties ☐ information

☐ review & comment ☐ record ☐ use ☐ _____

The Following: ☐ drawings ☐ specifications ☐ change order

☐ shop drawings ☐ product literature ☐ samples

☐ correspondence _____

Copies	Date	Number	Description

Remarks: _____

Copies to: _____ (with enclosures) ☐ By: _____

SUBMITTAL

Texas Facilities Commission
Facilities Design and Construction Division
PO Box 13047
Austin, Texas 78711-3047

Project Number, Name and Location	Date
No. of copies and description of submittal	
Contractor and address with zip code	
Architect/Engineer and address with zip code	

Note: Approval does not relieve Contractor from responsibility for errors on submittals and for deviations from drawings and specifications unless he notifies A/E in writing and receives written approval. Drawing and specification changes are NOT authorized by approval of submittals.

Submittal No.	**Spec. Sect.**	**No.**	

ROUTING AND ACTION

CONTRACTOR

- ☐ Submittals checked for compliance
- ☐ Submittals sent to Architect/Engineer
- ☐ Submittals posted to IMPACT
- ☐ Submitted for record

By Contractor Date

ARCHITECT/ENGINEER

- ☐ No Exceptions
- ☐ Exceptions Noted
- ☐ Revise and Resubmit
- ☐ No Action Taken
- ☐ Submittal & Comments Posted to IMPACT

By Architect/Engineer Date

COMMENTS _____

By Date

ARCHITECT'S

Proposed Change Order Form

A

TO: Contractor

Please prepare a CONTRACTOR'S PROPOSED CHANGE ORDER FORM B on the following proposed change: (Additional sealed documents necessary to completely describe the change identified below are attached.)

TFC PROJECT NO.

PROPOSED CHANGE ORDER NO.

DATE

This Proposed Change Order was initiated

by

Your early response is solicited

by

Signature

Architect / Engineer

ROUTING INFORMATION

1. Architect / Engineer prepare Proposed Change Order (PCO) in Impact and assign PCO number. Prepare and upload form "A", along with any attachments and transmit to Contractor via Impact.

2. Contractor prepare Form "B." Respond to PCO in Impact, upload Form "B" and transmit to Architect / Engineer.

3. Architect / Engineer review Form "B" and prepare Form "C". Upload Form "C" and transmit to TFC via Impact.

4. TFC staff review all documents, fill in amounts on CHANGE ORDER form, assign CHANGE ORDER NUMBER, and endorse. Transmit to Using Agency via email/Impact.

5. Using Agency review all documents and endorse CHANGE ORDER form. Transmit to TFC via Impact.

6. TFC final Approval. Transmit copies of all documents to all parties via Impact.

CONTRACTOR'S

Proposed Change Order Form

B

TO: Architect / Engineer

The following is a detailed cost breakdown, including both materials and labor for all additions to and/or deductions from the contract sum if the change described on form A is accepted. (Additional data necessary to support itemized figures is attached and identified below.)

TFC PROJECT NO.

PROPOSED CHANGE ORDER NO.

DATE

Total Addition / Deduction (circle one) to CONTRACT SUM if accepted: $

Request is made for addition of _____ CALENDAR DAYS to the contract period.

The above proposal is submitted for your consideration. The undersigned contractor understands and agrees that this proposal is validated only by the approved CHANGE ORDER attached hereto

Authorized Signature

Name of Contracting Firm

ARCHITECT'S

Proposed Change Order Form

C

TO: Texas Facilities Commission

AND: _____
PM/ODR

_____
TFC PROJECT

The Proposed Change Order Documents are presented for your consideration and approval. The Contractor's Form "B" has been reviewed and it is recommended for approval by the undersigned. Acceptance of this change is recommended for the following REASON and JUSTIFICATION.

_____
PROPOSED CHANGE ORDER NO.

_____
DATE

REASON:

JUSTIFICATION:

Respectfully submitted

by _____
Signature

_____
Architect / Engineer

TIME
CHANGE ORDER
FOR TIME EXTENSIONS

TEXAS FACILITIES COMMISSION
FACILITIES DESIGN AND CONSTRUCTION
P. O. BOX 13047, AUSTIN, TEXAS 78711
TELEPHONE: (512) 463-3417

TFC PROJECT NO. _____

ARCHITECT/ENGINEER	CONTRACTOR	
Firm Name	Firm Name	Project Title
Address	Address	Project Site
City & State	City & State	Agency
Contract Date / Work Order Date	Original Contract Period	Original Completion Date

NOTE TO CONTRACTOR: List all time periods for which the request is being made. Give the month and days in each period and the reason this period was lost. If necessary, in order to document loss, use additional sheets or attach substantiating evidence.

Change Request No.	Change Order No.
Architect/Engineer	By FDC Division

T-

Gentlemen:

The following time was lost due for reasons beyond the control of this Contract: (Indicate losses resulting from?)

Signed _____
Contractor

FINAL PAYMENT CHECKLIST

TFC Project No.:_____ **Project Name:** _____
Location: _____

1. **Contractor Obligations to TFC:**
   - ☐ Original Certificate of Substantial Completion transmitted to TFC
   - ☐ Letter of Guarantee, Warranty transmitted to TFC
   - ☐ List of names and addresses of obligatory vendors (subcontractors/suppliers) transmitted to TFC
   - ☐ Release of Lien by Subcontractors/Suppliers transmitted to TFC
   - ☐ One final copy of Close-out and As-Built Documents transmitted to TFC (hard copy and electronic files)
   - ☐ Consent of Surety for release of final payment transmitted to TFC
   - ☐ TDLR inspection performed for TAS compliance and non-compliant items corrected.
   - ☐ Final HUB PAR form transmitted to TFC

   Where applicable due to special conditions, retainage is held for reasons stated in project record. See project record.

   Contractor certifies that the items indicated above have been completed
   _____ By Contractor _____ Date

   Architect/Engineer
   - ☐ Completed Substantial Completion Inspection and Final Punchlist
   - ☐ All contract Change Orders processed to effect final payment
   - ☐ Final copy of Close-out Documents and As-Built Documents received and project specifications met
   - ☐ A/E certification and recommendation to Owner of Contractor's final payment transmitted to TFC

   Architect/Engineer certifies that all items indicated above (including Contractor items) have been completed
   _____ By A/E _____ Date

   PM certifies that all items indicated above have been completed satisfactorily and that all items have been properly filed at TFC
   _____ By PM _____ Date

2. **Architect/Engineer Obligations to TFC:**
   - ☐ Project rendering transmitted to TFC (where applicable)
   - ☐ One copy Record Construction Drawings transmitted to TFC (hard copy, PDF, and upload to Impact)
   - ☐ One copy Record Project Manual / Specification transmitted to TFC (hard copy, PDF, and upload to Impact)
   - ☐ CAD Record Drawing files transmitted to TFC (disks and upload to Impact)
   - ☐ Copies of all reimbursable receipts transmitted to TFC
   - ☐ Copies of final HUB PAR forms transmitted to TFC
   - ☐ A/E certification of no asbestos used in work transmitted to TFC

   Where applicable due to special conditions, retainage is held for reasons stated in project records. See project record.

   CAD Manager certifies that all electronic Record Documents have been received and are in conformance with A/E Guidelines.
   _____ By CAD Manager _____ Date

   Architect/Engineer certifies that all items indicated above have been completed.
   _____ By A/E _____ Date

   PM certifies that items indicated above have been received and properly filed at TFC. Additionally, the PM has reviewed the A/E agreement for all fee considerations.
   _____ By PM _____ Date

3. **TFC Project Closure Review:**

   _____ _____
   Internal Purchasing Date

   _____ _____
   Fiscal Date

   _____ _____
   Impact Administrator Date

NON-USE OF ASBESTOS CONTAINING MATERIALS AFFIDAVIT - DESIGN

STATE OF TEXAS §
§
COUNTY OF _____ §

Project Name: _____

Project Number: _____

By the signature below, the signatory for the Design Professional certifies that neither he nor the firm, corporation, partnership or institution represented by the signatory or anyone acting for the firm providing Design Professional Services for this project have specified the use of materials, procedures or processes that knowingly or intentionally contain asbestos materials.

Signature: _____
Printed Name: _____
Title: _____
Company: _____
Date: _____

State of Texas
County of _____

Sworn to and subscribed before me on the _____ day of _____, 20___ by _____ (name/signature of signer) the undersigned authority on behalf of said Design Professional.

(Personalized Seal)

_____
Notary Public's Signature

My commission expires: _____

Revised Jan 2007

ROOFING GUARANTEE
FOR THE
TEXAS FACILITIES COMMISSION

In accordance with the contract between the Texas Facilities Commission and _____ _____ for Project No. _____ for the construction of _____ _____at _____ the Prime Contractor and the Roofing Contractor, jointly and individually, hereby guarantee the project roofing system and its components against defects of materials and workmanship for a period of five (5) years from the date of project acceptance, or occupancy by the State if earlier. Damage or defects due to natural disasters, design deficiencies or misuse by building occupants or others shall not be covered by the guarantee.

This guarantee requires that all building materials damaged by roof leaks and all defective roof system components shall be promptly and properly repaired or replaced by the Contractors, entirely at their expense, upon written notification by the Owner that defects have been observed during the guarantee period.

Roofing system components covered by the guarantee shall include necessary sheet or extruded metal work, roofing membranes, surfacings, flashings, rigid insulation, vents and other specified accessories, and supporting decks and walls directly affecting the performance of the roofing system. Illustrative defects to be corrected under the terms of the guarantee include, but are not limited to, the following: leaks, unusual deterioration, excessive shrinkage, bare spots, blisters, fishmouths, ridges, wrinkles, buckles, splits, slippage, extensive ponding (if not due to design), improper drainage slopes and inadequate attachment to substrates.

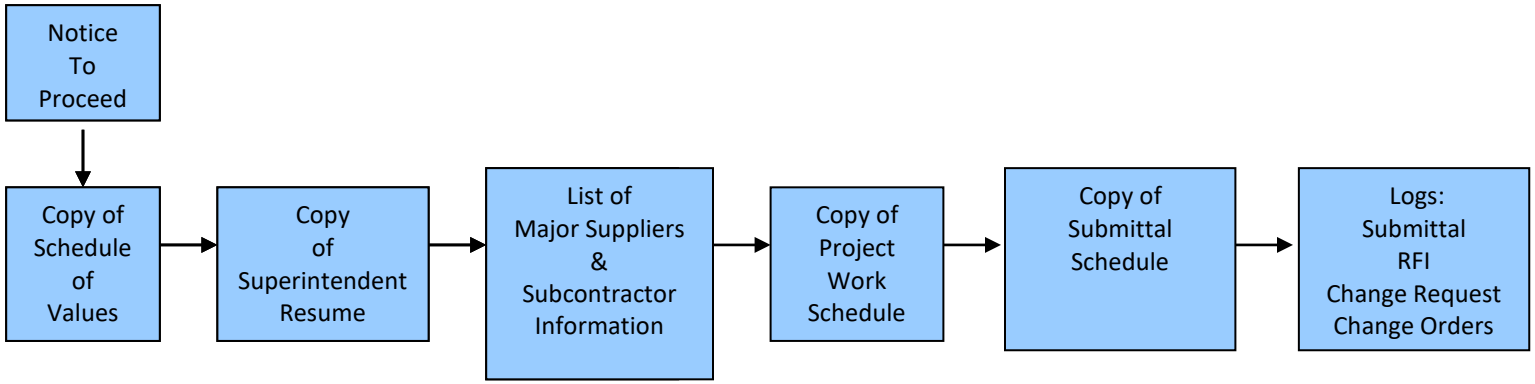
The guarantee for projects involving the rehabilitation or replacement of existing roofing systems shall cover both the new work required by the contract and, unless excluded by specification, the remaining portions of the existing systems. Failures due to defective substrates uncovered by the Contractors but not reported to the Owner for timely correction shall be covered by the guarantee.

IN WITNESS WHEREOF, this instrument has been duly executed this _____day of _____, 20_____.

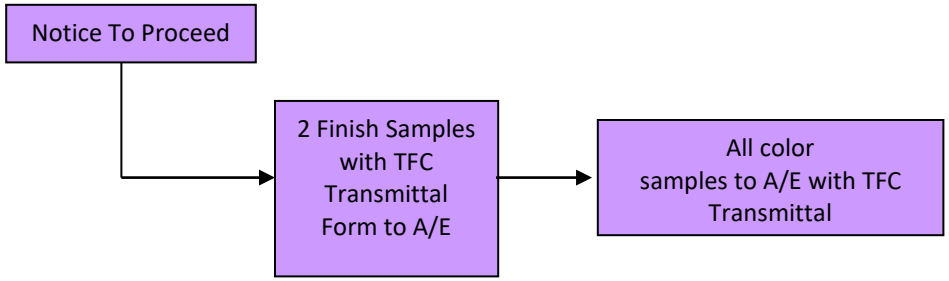
_____	_____
Authorized Signature	Authorized Signature
_____	_____
Title	Title
For:	
_____	_____
Name of Prime Contractor	Name of Roofing Contractor
_____	_____
Address	Address
_____	_____
City, State, Zip Code	City, State, Zip Code
_____	_____
Telephone	Telephone

Flow Chart - **All documents must be uploaded into IMPACT**

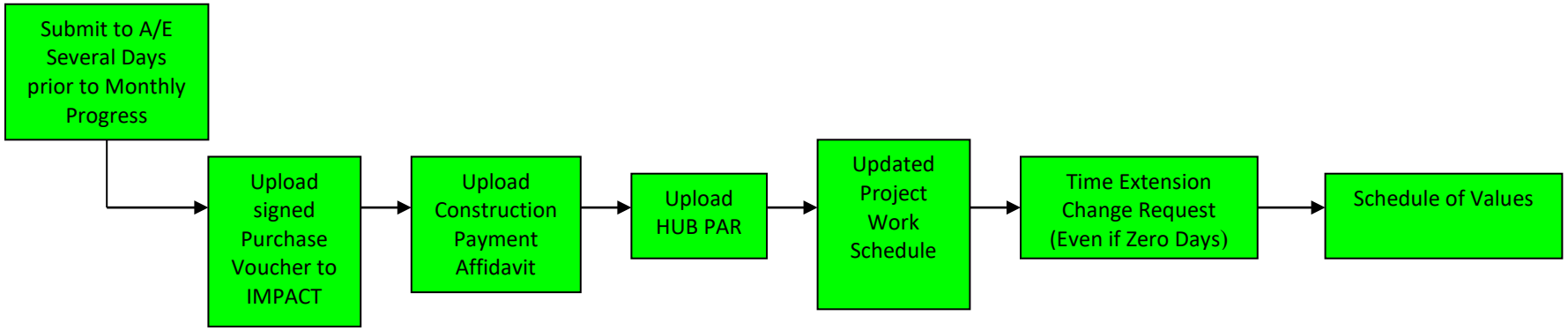
A. Within 20 days of "Notice to Proceed":



B. Within 30 days of "Notice to Proceed":



C. Monthly Payment Voucher: - Upload all signed documents into IMPACT



Warranty Transmittal Letter

To: Texas Facilities Commission
Facilities Design and Construction Division
P.O. Box 13047
Austin, Texas 78711-3047

From: _____

_____

_____

Project Number: _____

Project Name: _____

As requested by TFC, the close-out information for the above referenced project is as follows:

Substantial Completion Date: _____

(Attach a copy of the Substantial Completion)

A **listing of the warranties** provided by the Contractor, as required by the Contract Documents.

Warranty	Date Ends	Length of Warranty

(If more space is needed, please attach additional sheet.)

A listing of Subcontractors and Material Suppliers, with contact person's name and phone number.

(Please attach additional sheet.)

Project Closeout and Training Matrix

Project: - -

Division / Description	Spec. Section	Record Submission	O&M Manuals	Equipment to be Furnished	Training	Testing	Manuf. Warranty	Extra Materials
00 - Procurement and								
Contracting Requirements								
Uniform General Conditions 2010	UGC 2010		9.1.1 Prior to Substantial Completion				11.1 11.2	
01 - General Requirements								
Submittal Procedures	01330							
Closeout Procedures	01770							
Project Record Documents	01781							
Operation & Maintenance Data	01782							
Demonstration and Training	01820							
07 - Thermal & Moisture Protection								
Roof Accessories	07720							
Joint Sealants	07920							
08 - Doors & Windows								
Interior Aluminum Frames	08125							
Aluminum Windows	08520							
09 - Finishes								
Acoustic Panel Ceilings	09511							
10 - Specialties								
Louvers and Vents	10200							
13 - Special Construction								
Lighting Controls	13945							
Fire Alarm	13851							
15 - Mechanical								
Basic Mechanical	15050							
Hydronic Piping	15181							
Plumbing Fixtures	15410							
Centrifugal Fans	15837							
16 - Electrical								
Basic Electrical	16050							
Grounding and Bonding	16060							
Raceways and Boxes	16130							
Switchgear	16430							

SECTION 00 31 32 - GEOTECHNICAL DATA

PART 1 - GENERAL

1.1 SUMMARY

A. Related Requirements:
1. Division 01 Specification Sections apply to Work of this Section.

1.2 INFORMATION

A. Geotechnical Data:
1. An investigation of subsurface soil conditions at the construction site was authorized by Owner, and these investigations were made by:

Terracon Consultants, Inc.
800 Paloma Drive, Suite 150
Round Rock, Texas 78665
512.628.8600

2. Entire report is bound at the end of this Section.

1.3 GEOTECHNICAL DATA

A. This Document with its referenced attachments is part of the Procurement and Contracting Requirements for Project. They provide Owner's information for Bidders' convenience and are intended to supplement rather than serve in lieu of Bidders' own investigations. This Document and its attachments are not part of the Contract Documents.

B. Because subsurface conditions indicated by the soil borings are a sampling in relation to the entire construction area, and for other reasons, the Owner, Architect, Engineer, the Architect's or Engineer's consultants, and the firm reporting the subsurface conditions do not warranty the conditions below the depths of the borings or that the strata logged from the borings are necessarily typical of the entire site. Any party using the information described in the soil borings and geotechnical report shall accept full responsibility for its use.
1. The opinions expressed in this report are those of a geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by a geotechnical engineer. Owner is not responsible for interpretations or conclusions drawn from the data.
2. Any party using information described in the geotechnical report shall make additional test borings and conduct other exploratory operations that they may require to determine the character of subsurface materials that may be encountered.
3. Bidders are expected to examine the geotechnical data reports and then determine for themselves the validity of the information contained there-in as it relates to this Project.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 00 73 43 – WAGE RATE REQUIREMENTS

PART 1 - GENERAL

1.1 WAGE RATE ESTABLISHMENT

A. Pursuant to Chapter 2258, Texas Government Code, all contractors and any subcontractor involved in the construction of a public work project shall pay not less than the prevailing rates as per diem wages in the locality at the time of construction to all laborers, workmen and mechanics employed by them in the execution of this contract.
B. The contractor shall forfeit as a penalty to the Owner, $60.00 for each laborer, workman, or mechanic employed for each calendar day, or portion thereof, such laborer, workman, or mechanic is paid less than the said stipulated rates for any work done under this contract by him, or by any subcontractor under him.
C. Nothing herein contained, however, shall be construed to prohibit the payment of more than the prevailing rate of wages to any laborer, workman, or mechanic employed on the Work.
D. Attention is called to the fact that there must be paid on this project not less than the general prevailing rates which have been established by the Owner, and verified by the Contractor as indicated in the Schedule at the end of this document.
E. The General Prevailing Rate for overtime shall be 1-1/2 times the scheduled rate on an hourly basis.

1.2 POSTING WAGE RATES

A. Minimum Wage Rates shall be posted on job site in a conspicuous place open for inspection by all workmen.

1.3 EMPLOYEE CLAIMS

A. Any employee who alleges that he has not been paid the minimum wage rate may file a written claim with the Owner.

1.4 PAYMENT OF EMPLOYEES AND PAYROLL RECORDS

A. The Contractor and each subcontractor shall pay each of his employees engaged to perform Work under this contract in full (less mandatory legal deductions) not less than once a week.
B. Payment is to be in cash or check readily payable without discount. If payment is by cash, obtain the signature of the employee verifying the payroll period, total hours worked, rate per hour, total wages earned and the date received.
C. Attach 1 copy of cash payment verification to payroll records.
D. The Contractor and each subcontractor engaged at the site of the Work shall prepare and maintain weekly payroll reports certified to be correct.
E. Payroll records shall contain the name, social security number, classification, rate per hour, hours worked each day, including regular hours, and overtime hours.

1.5 PAYROLL RECORDS

A. Payroll records shall be made available upon request for inspection by the Architect or by a designated representative of the Owner to ascertain compliance with the minimum wage scale provision of this contract.

1.6 WAGE RATE SCHEDULE

A. See attached General Decision TX20250007 dated January 3, 2025, issued by the Federal Government and any revisions/updates issued for Williamson County.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

"General Decision Number: TX20250007 01/03/2025

Superseded General Decision Number: TX20240007

State: Texas

Construction Types: Heavy and Highway

Counties: Atascosa, Bandera, Bastrop, Bell, Bexar, Brazos, Burleson, Caldwell, Comal, Coryell, Guadalupe, Hays, Kendall, Lampasas, McLennan, Medina, Robertson, Travis, Williamson and Wilson Counties in Texas.

HEAVY (excluding tunnels and dams, not to be used for work on Sewage or Water Treatment Plants or Lift / Pump Stations in Bell, Coryell, McClennon and Williamson Counties) and HIGHWAY Construction Projects

Note: Contracts subject to the Davis-Bacon Act are generally required to pay at least the applicable minimum wage rate required under Executive Order 14026 or Executive Order 13658. Please note that these Executive Orders apply to covered contracts entered into by the federal government that are subject to the Davis-Bacon Act itself, but do not apply to contracts subject only to the Davis-Bacon Related Acts, including those set forth at 29 CFR 5.1(a)(1).

If the contract is entered into on or after January 30, 2022, or the contract is renewed or extended (e.g., an option is exercised) on or after January 30, 2022:	. Executive Order 14026 generally applies to the contract. . The contractor must pay all covered workers at least $17.75 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in 2025.
If the contract was awarded on or between January 1, 2015 and January 29, 2022, and the contract is not renewed or extended on or after January 30, 2022:	. Executive Order 13658 generally applies to the contract. . The contractor must pay all covered workers at least $13.30 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on that contract in 2025.

The applicable Executive Order minimum wage rate will be adjusted annually. If this contract is covered by one of the Executive Orders and a classification considered necessary for performance of work on the contract does not appear on this wage determination, the contractor must still submit a conformance request.

Additional information on contractor requirements and worker protections under the Executive Orders is available at http://www.dol.gov/whd/govcontracts.

Modification Number	Publication Date
0	01/03/2025

SUTX2011-006 08/03/2011

	Rates	Fringes
CEMENT MASON/CONCRETE FINISHER (Paving and Structures)	$ 12.56 **	
ELECTRICIAN	$ 26.35	
FORM BUILDER/FORM SETTER		
Paving & Curb	$ 12.94 **	
Structures	$ 12.87 **	

LABORER
     Asphalt Raker.....$ 12.12 **
     Flagger.....$ 9.45 **
     Laborer, Common.....$ 10.50 **
     Laborer, Utility.....$ 12.27 **
     Pipelayer.....$ 12.79 **
     Work Zone Barricade
     Servicer.....$ 11.85 **

PAINTER (Structures).....$ 18.34

POWER EQUIPMENT OPERATOR:
     Agricultural Tractor.....$ 12.69 **
     Asphalt Distributor.....$ 15.55 **
     Asphalt Paving Machine.....$ 14.36 **
     Boom Truck.....$ 18.36
     Broom or Sweeper.....$ 11.04 **
     Concrete Pavement
     Finishing Machine.....$ 15.48 **
     Crane, Hydraulic 80 tons
     or less.....$ 18.36
     Crane, Lattice Boom 80
     tons or less.....$ 15.87 **
     Crane, Lattice Boom over
     80 tons.....$ 19.38
     Crawler Tractor.....$ 15.67 **
     Directional Drilling
     Locator.....$ 11.67 **
     Directional Drilling
     Operator.....$ 17.24 **
     Excavator 50,000 lbs or
     Less.....$ 12.88 **
     Excavator over 50,000 lbs...$ 17.71 **
     Foundation Drill, Truck
     Mounted.....$ 16.93 **
     Front End Loader, 3 CY or
     Less.....$ 13.04 **
     Front End Loader, Over 3 CY.$ 13.21 **
     Loader/Backhoe.....$ 14.12 **
     Mechanic.....$ 17.10 **
     Milling Machine.....$ 14.18 **
     Motor Grader, Fine Grade....$ 18.51
     Motor Grader, Rough.....$ 14.63 **
     Pavement Marking Machine....$ 19.17
     Reclaimer/Pulverizer.....$ 12.88 **
     Roller, Asphalt.....$ 12.78 **
     Roller, Other.....$ 10.50 **
     Scraper.....$ 12.27 **
     Spreader Box.....$ 14.04 **
     Trenching Machine, Heavy....$ 18.48

Servicer.....$ 14.51 **

Steel Worker
     Reinforcing.....$ 14.00 **
     Structural.....$ 19.29

TRAFFIC SIGNALIZATION:
Traffic Signal Installation
     Traffic Signal/Light Pole
     Worker.....$ 16.00 **

TRUCK DRIVER
     Lowboy-Float.....$ 15.66 **
     Off Road Hauler.....$ 11.88 **
     Single Axle.....$ 11.79 **
     Single or Tandem Axle Dump
     Truck.....$ 11.68 **
     Tandem Axle Tractor w/Semi
     Trailer.....$ 12.81 **

WELDER.....$ 15.97 **

WELDERS - Receive rate prescribed for craft performing
operation to which welding is incidental.

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** Workers in this classification may be entitled to a higher
minimum wage under Executive Order 14026 ($17.75) or 13658
($13.30). Please see the Note at the top of the wage
determination for more information. Please also note that the
minimum wage requirements of Executive Order 14026 are not

currently being enforced as to any contract or subcontract to which the states of Texas, Louisiana, or Mississippi, including their agencies, are a party.

Note: Executive Order (EO) 13706, Establishing Paid Sick Leave for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO is available at https://www.dol.gov/agencies/whd/government-contracts.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (iii)).

The body of each wage determination lists the classifications and wage rates that have been found to be prevailing for the type(s) of construction and geographic area covered by the wage determination. The classifications are listed in alphabetical order under rate identifiers indicating whether the particular rate is a union rate (current union negotiated rate), a survey rate, a weighted union average rate, a state adopted rate, or a supplemental classification rate.

Union Rate Identifiers

A four-letter identifier beginning with characters other than ""SU"", ""UAVG"", ?SA?, or ?SC? denotes that a union rate was prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2024. PLUM is an identifier of the union whose collectively bargained rate prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. The date, 07/01/2024 in the example, is the effective date of the most current negotiated rate.

Union prevailing wage rates are updated to reflect all changes over time that are reported to WHD in the rates in the collective bargaining agreement (CBA) governing the classification.

Union Average Rate Identifiers

The UAVG identifier indicates that no single rate prevailed for those classifications, but that 100% of the data reported for the classifications reflected union rates. EXAMPLE: UAVG-OH-0010 01/01/2024. UAVG indicates that the rate is a weighted union average rate. OH indicates the State of Ohio. The next number, 0010 in the example, is an internal number used in producing the wage determination. The date, 01/01/2024 in the example, indicates the date the wage determination was updated to reflect the most current union average rate.

A UAVG rate will be updated once a year, usually in January, to reflect a weighted average of the current rates in the collective bargaining agreements on which the rate is based.

Survey Rate Identifiers

The ""SU"" identifier indicates that either a single non-union rate prevailed (as defined in 29 CFR 1.2) for this classification in the survey or that the rate was derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As a weighted average rate includes all rates reported in the survey, it may

include both union and non-union rates. Example: SUFL2022-007 6/27/2024. SU indicates the rate is a single non-union prevailing rate or a weighted average of survey data for that classification. FL indicates the State of Florida. 2022 is the year of the survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. The date, 6/27/2024 in the example, indicates the survey completion date for the classifications and rates under that identifier.

?SU? wage rates typically remain in effect until a new survey is conducted. However, the Wage and Hour Division (WHD) has the discretion to update such rates under 29 CFR 1.6(c)(1).

State Adopted Rate Identifiers

The ""SA"" identifier indicates that the classifications and prevailing wage rates set by a state (or local) government were adopted under 29 C.F.R 1.3(g)-(h). Example: SAME2023-007 01/03/2024. SA reflects that the rates are state adopted. ME refers to the State of Maine. 2023 is the year during which the state completed the survey on which the listed classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. The date, 01/03/2024 in the example, reflects the date on which the classifications and rates under the ?SA? identifier took effect under state law in the state from which the rates were adopted.

WAGE DETERMINATION APPEALS PROCESS

1) Has there been an initial decision in the matter? This can be:

a) a survey underlying a wage determination
b) an existing published wage determination
c) an initial WHD letter setting forth a position on a wage determination matter
d) an initial conformance (additional classification and rate) determination

On survey related matters, initial contact, including requests for summaries of surveys, should be directed to the WHD Branch of Wage Surveys. Requests can be submitted via email to davisbaconinfo@dol.gov or by mail to:

Branch of Wage Surveys
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

Regarding any other wage determination matter such as conformance decisions, requests for initial decisions should be directed to the WHD Branch of Construction Wage Determinations. Requests can be submitted via email to BCWD-Office@dol.gov or by mail to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2) If an initial decision has been issued, then any interested party (those affected by the action) that disagrees with the decision can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Requests for review and reconsideration can be submitted via email to dba.reconsideration@dol.gov or by mail to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3) If the decision of the Administrator is not favorable, an

interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210.

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END OF GENERAL DECISION"

SECTION 01 10 00 - SUMMARY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Project information.
   2. Work covered by Contract Documents.
   3. Work by Owner.
   4. Work under separate contracts.
   5. Access to site.
   6. Work restrictions.

B. Related Requirements:
   1. Texas Facilities Commission – 2015 Uniform General Conditions.
   2. Other Division 01 Specification Sections apply to Work of this Section.
   3. Section 01 50 00 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.2 PROJECT INFORMATION

A. Project Identification:
   1. Package 1: DPS HQ Perimeter Security Fence.
   2. Package 2: DPS HQ Commission Room Renovation.
   3. Package 3: DPS HQ Screening Building.
   4. Project Location: Austin, Texas.

B. Owner: Texas Department of Public Safety, Austin, Texas.

C. Architect: Parkhill, Austin, Texas.

D. Project Website: A Project Website administered by Owner will be used for purposes of managing communication and documents during the construction stage.

1.3 WORK COVERED BY CONTRACT DOCUMENTS

A. Work of Project is defined by Contract Documents and consists of the following:
   1. Construct a new perimeter security fence around the Department of Public Safety Headquarters campus located at 5805 North Lamar Boulevard in Austin, Texas. Fence shall be installed along North Lamar Boulevard, Denson Drive, Guadalupe Street, and West Koenig Lane. Fence installation shall include foundations, guard stations, vehicular gates, and pedestrian gates.
   2. Construct a renovation of the Cafeteria located in Building A to become a new meeting area for the Public Safety Commission. This renovation will include new finishes, HVAC, power, lighting, and restrooms.
   3. Construct a new 2,300 square foot public screening building located between Building A and Building B at the Headquarters campus.

B. Type of Contract: Competitive Sealed Proposals.
   1. Project will be constructed under a single prime contract.
   2. The State of Texas Uniform General Conditions for Construction Contracts, 2015 Edition, (Hereinafter called the Uniform General Conditions), and additional supplemental and special conditions, attached herein, govern Work of this Project.

1.4 WORK BY OWNER

A. General: Cooperate fully with Owner so Work may be carried out smoothly, without interfering with or delaying Work under this Contract or Work by Owner. Coordinate Work of this Contract with Work performed by Owner.
B. Concurrent Work: Owner will perform the following construction operations at Project site. Those operations will be conducted simultaneously with Work under this Contract.
   1. Materials Inspection and Testing.
   2. HVAC Testing, Adjusting, and Balancing.
   3. Commissioning.

1.5 WORK UNDER SEPARATE CONTRACTS

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

1.6 ACCESS TO SITE

A. General: Contractor shall have full use of Project site for construction operations during construction period. Contractor's use of Project site is limited only by Owner's right to perform Work or to retain other contractors on portions of Project.
B. Construction Operations: Contractor shall follow and abide by local laws and ordinances, and provisions of Contract Documents.
C. Use of Site: Contractor shall provide and allow access to site by:
   1. Others contracted by the Owner to perform Work.
   2. Owner and Owner representatives.
   3. Architect, and their representatives and consultants.
D. Additional Requirements:
   1. Provide for the required emergency access to the site for life safety.
   2. Keep all exits open during construction period. Provide temporary signage as required and if exit routes are altered temporarily.
   3. Materials stored on site shall be located so as not to block access to Work or to emergency access to the buildings.
   4. Provide for security of stored materials on site during construction.

1.7 WORK RESTRICTIONS

A. Work Restrictions, General: Comply with restrictions on construction operations.
   1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.
B. Nonsmoking Building: Smoking is not permitted within the building or within 25 feet of entrances, operable windows, or outdoor-air intakes.
C. Controlled Substances: Use of tobacco products and other controlled substances on Project site is not permitted.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 20 00 - PRICE AND PAYMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Administrative and procedural requirements necessary to prepare and process Applications for Payment.
B. Related Requirements:
   1. Texas Facilities Commission – 2015 Uniform General Conditions.
   2. Texas Facilities Commission – Preconstruction Guidelines.
   3. Other Division 01 Specification Sections apply to Work of this Section.

1.2 SCHEDULE OF VALUES

A. Contactor shall adhere to the procedures and requirements for Schedule of Values defined in the Uniform General Conditions, Article 10, 10.1.
B. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule.
   1. Coordinate line items in the schedule of values with other required administrative forms and schedules, including the following:
      a. Application for Payment forms with continuation sheets.
      b. Submittal schedule.
      c. Items required to be indicated as separate activities in Contractor's construction schedule.
   2. Submit the Schedule of Values to Owner Designated Representative (ODR) and Architect for approval.
   3. Schedule of Values must be received and accepted not less than 21 days prior to the first request for payment.
   4. Subschedules for Phased Work: Where Work is separated into phases requiring separately phased payments, provide subschedules showing values coordinated with each phase of payment.
   5. Subschedules for Separate Elements of Work: Where Contractor's construction schedule defines separate elements of Work, provide subschedules showing values coordinated with each element.

C. Format and Content: Use Project Manual table of contents for Specification Sections as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section. Identify site mobilization, bonds on insurance, self-performed Work and other General Conditions deemed necessary.
   1. Identification: Include the following Project identification on the schedule of values:
      a. Project name and location.
      b. Name of Architect.
      c. Architect's project number.
      d. Contractor's name and address.
      e. Date of submittal.
   2. Forms filled out by hand will not be accepted.
   3. Arrange schedule of values consistent with format of AIA Document G703.
   4. Arrange the schedule of values in tabular form with separate columns to indicate the following for each item listed:
      a. Related Specification Section or Division.
      b. Description of Work.
      c. Name of subcontractor.
      d. Change Orders (numbers) that affect value.
      e. Dollar value of the following, as a percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.
         1) Labor.
         2) Materials.
         3) Equipment.
   5. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with Project Manual table of contents.
   6. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
   7. Each item in the schedule of values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.
      a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the schedule of values or distributed as general overhead expense, at Contractor's option.
   8. Schedule Updating: Update and resubmit the schedule of values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1.3 APPLICATIONS FOR PAYMENT

A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments as certified by the ODR and Architect and paid for by Owner.
   1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements. Refer to the Uniform General Conditions, Article 10.

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

C. Payment Application Times: The date for each progress payment is indicated in the Agreement between Owner and Contractor. The period of construction Work covered by each Application for Payment is the period indicated in the Agreement.

D. Payment Application Times: The period covered by each Application for Payment is 1 month, ending on the last day of the month.
   1. Submit Preliminary Pay Worksheet once each month that a progress payment is to be requested. Follow the Uniform General Conditions, Article 10 for information to be provided in this worksheet.
   2. Application for Payment:
      a. ODR and Architect shall meet with contractor no later than 7 days after receipt of preliminary pay worksheet to review and observe conditions of Work.
      b. Based on review and observations ODR and Architect may require modifications to the preliminary pay worksheet prior to the Application for Payment.
      c. Contractor shall follow requirements of the Uniform General Conditions for submitting Application for Payment.

E. Application for Payment Forms: Use State of Texas Purchase Voucher – Construction as form for Applications for Payment. (Available on project website and AIA G 702 Forms.)

F. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.
   1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment, for stored materials.
   2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
   3. Provide summary documentation for stored materials indicating the following:
      a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
      b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
      c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.

4. Payment for stored material/equipment confirmed by ODR and Architect to be properly stored is limited to 85 percent of the scheduled value for the materials or equipment, whichever is less.

G. Include the following with the application:
1. Transmittal Letter as specified for Submittals in Section 01 33 00 "Submittal Procedures."
2. An updated Work Progress Schedule, including the executive summary and all required schedule reports.
3. Partial release of liens from major Subcontractors and vendors.
4. HUB subcontracting plan Progress Assessment Report.
5. Any additional documentation as Owner may require.

H. Modification Procedures:
1. Changes which involve a change in Work or an adjustment in the Contract Sum or the Contract Time shall comply with the requirements of the Uniform General Conditions, Article 11.
2. For minor changes not involving an adjustment to the Contract Sum or Contract Time, Architect will issue instructions directly to Contractor.
3. Proposed Change Order:
   a. Architect may issue a Proposed Change Order (PCO) when a change in the Contract Documents or change in Contract Time is necessary.
   b. Contractor shall review PCO and complete the form providing a detail in costs broken down by labor, materials, and equipment for the proposed change and return to the Architect.
   c. Any change in the Construction Time must be submitted along with Contractor’s response.
   d. Architect will review PCO and, if applicable, will approve and forward to Owner for final approval.
   e. Owner will review PCO and if accepting the change will approve and notify Contractor and Architect.
   f. Contractor may not proceed with Work before the Change Order form is distributed by Owner and issues a written Notice to Proceed or on Interim Change Authorization.
4. Substantiation of Costs: Provide full information required for evaluation.
   a. Provide the following data:
      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.
   b. Support each claim for additional costs with additional information:
      1) Origin and date of claim.
      2) Dates and times Work was performed, and by whom.
      3) Time records and wages paid.
      4) Invoices and receipts for products, equipment, and subcontracts, similarly documented.

5. Promptly revise progress schedules to reflect any changes in Contract Time, revise sub-schedules to adjust times for other Work affected by the change, and resubmit.
6. Promptly enter changes in Project Record Documents.

I. Final Payment Application:
   1. After the certified completion of all Work, under the Uniform General Conditions, including all final punchlist items, cleanup, and the delivery of record documents, Contractor shall prepare Application for Final Payment as specified for progress payments, identifying total adjusted Contract Sum, previous payments and sum remaining due.
   2. Application for Final Payment will not be considered until the following have been accomplished as required by the Uniform General Conditions:
      a. Contractor notification to ODR in writing that Project is substantially complete.
         1) Contractor's Punchlist, noting items remaining to be completed or corrected with date scheduled for completion or correction prior to final inspection.
      b. Record Drawings furnished to the ODR.
      c. Preliminary copy of each instructional manual, maintenance and operating manuals, parts catalog, wiring diagrams, spare parts, and specified written warranties.
      d. Substantial Completion Inspection is performed by the ODR and Substantial Completion Certificate is issued by the ODR to Contractor.
      e. Final Inspection is required in writing and inspection performed by the ODR.
   3. Acceptance of Final Payment Request:
      a. Architect will review a submitted Application for Final Payment within but no later than 10 days after its receipt.
      b. Architect will either
         1) Return for correction and resubmission,
         2) Or accept, note approval, and forward to Owner.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 23 00 - ALTERNATES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Administrative and procedural requirements for alternates.
B. Related Requirements:
   1. Texas Facilities Commission – 2015 Uniform General Conditions.
   2. Texas Facilities Commission – Preconstruction Guidelines.
   3. Other Division 01 Specification Sections apply to Work of this Section.

1.2 DEFINITIONS

A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain Work defined in the bidding requirements that may be added to or deducted from the base bid amount if the Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.
   1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
   2. The cost for each alternate is the net addition to the Contract Sum to incorporate alternates into the Work. No other adjustments are made to the Contract Sum.

1.3 PROCEDURES

A. Coordination: Revise or adjust affected adjacent Work as necessary to completely integrate Work of the alternate into Project.
   1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.
B. Execute accepted alternates under the same conditions as other Work of the Contract.
C. Schedule: A schedule of alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the Work described under each alternate.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES:

A. Alternate No. 1: Control Valve Manual Bypass.
1. Provide a full-size manual bypass with ball valve for each new control valve. Refer to detail on mechanical sheets.

END OF SECTION

SECTION 01 25 00 - SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Administrative and procedural requirements for substitutions.
B. Related Requirements:
   1. Texas Facilities Commission – 2015 Uniform General Conditions.
   2. Texas Facilities Commission – Preconstruction Guidelines.
   3. Other Division 01 Specification Sections apply to Work of this Section.
   4. Section 01 60 00 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.

1.2 DEFINITIONS

A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.
   1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
   2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.

1.3 SUBMITTALS

A. Request for substitutions will be considered if they are received at the Preconstruction Conference and meet the requirements of the Uniform General Conditions Article 8, Quality Control, Paragraph 8.3.5. No substitutions without Approval.
   1. Request received after the Preconstruction Conference may be considered or rejected at the discretion of the Architect or ODR.
B. Substitution Requests: Submit electronic copy of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
   1. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
      a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.
      b. Coordination information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors, that will be necessary to accommodate proposed substitution.

c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
d. Product Data, including Drawings and descriptions of products and fabrication and installation procedures.
e. Samples, where applicable or requested.
f. Certificates and qualification data, where applicable or requested.
g. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
h. Cost information, including a proposal of change, if any, in the Contract Sum.
i. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.
j. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

2. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or receipt of additional information or documentation.
   a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
   b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

1.4 QUALITY ASSURANCE

A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

1.5 PROCEDURES

A. Coordination: Revise or adjust affected Work as necessary to integrate Work of the approved substitutions.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 15 days prior to time required for preparation and review of related submittals.
   1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
      a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
      b. Substitution request is fully documented and properly submitted.
      c. Requested substitution will not adversely affect Contractor's construction schedule.
      d. Requested substitution has received necessary approvals of authorities having jurisdiction.
      e. Requested substitution is compatible with other portions of the Work.
      f. Requested substitution has been coordinated with other portions of the Work.
      g. Requested substitution provides specified warranty.
      h. If requested substitution involves more than 1 contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

B. Substitutions for Convenience:
   1. Conditions: Architect may consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
      a. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
      b. Requested substitution does not require extensive revisions to the Contract Documents.
      c. Requested substitution is consistent with the Contract Documents and will produce indicated results.
      d. Substitution request is fully documented and properly submitted.
      e. Requested substitution will not adversely affect Contractor's construction schedule.
      f. Requested substitution has received necessary approvals of authorities having jurisdiction.

g. Requested substitution is compatible with other portions of the Work.
h. Requested substitution has been coordinated with other portions of the Work.
i. Requested substitution provides specified warranty.
j. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 30 00 - ADMINISTRATIVE REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Project Information Management.
   2. Coordination.
   3. Preconstruction meeting.
   4. Request for information.
   5. Progress meetings.
   6. Preinstallation meetings.
   7. Cutting and patching.

B. Related Requirements:
   1. Texas Facilities Commission - 2015 Uniform General Conditions.
   2. Texas Facilities Commission - Preconstruction Guidelines.
   3. Other Division 01 Specification Sections apply to Work of this Section.

1.2 PROJECT INFORMATION MANAGEMENT

A. Administration and exchange of Project information will be accomplished through the use of Owner's Project Management system called ProjectMates.

B. Project information to be exchanged through ProjectMates website includes, but is not limited to, the following:
   1. Product Submittals.
   2. Requests for Information (RFI).
   3. Applications for Payment.
   4. Schedules.
   5. Construction Change Requests (CCRs).
   6. Close-out Documents.
   7. Construction Document Files.
      a. Weather Days.
      b. Electronic File Requests.
      c. Correspondence.
      d. Test Reports.
      e. Meeting Minutes.
      f. Field Reports.

C. All Parties shall refer to the Preconstruction Guidelines, C. Document Management/ ProjectMates for more information.

1.3 COORDINATION

A. Coordinate scheduling, submittals, and Work of the various Sections of the Project Manual to assure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.

B. Verify that utility requirements and characteristics of operating equipment are compatible with building utilities. Coordinate Work of various Sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.
C. Coordinate space requirements and installation of mechanical and electrical Work which are indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel with line of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
D. In finished areas, except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.
E. Large Apparatus: Any large piece of apparatus which is to be installed in any space in the building, and which is too large to permit access through windows, doorways or shafts, shall be brought to the job by the Contractor involved and placed in the space before the enclosing structure is completed.
F. Items which require electrical connections shall be coordinated with Division 26 for:
    1. Voltage.
    2. Phase.
    3. Ampacity.
    4. No. and size of wires.
    5. Wiring diagrams.
    6. Starter size, details and location.
    7. Control devices and details.
G. Coordinate completion and cleanup of Work of separate Sections in preparation for Substantial Completion and for portions of Work designated for Owner's occupancy.
H. After Owner occupancy of premises, coordinate access to site for correction of defective Work and Work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

1.4 PRECONSTRUCTION MEETING

A. ODR will schedule a meeting after Notice to Proceed.
B. Attendance Required: ODR, Architect, Contractor, and major Subcontractors.
C. Agenda: See attached Preconstruction Conference Agenda.
D. Record minutes and distribute copies within 3 days after meeting to participants with 2 copies to ODR, Architect and those affected by decisions made.

1.5 REQUEST FOR INFORMATION

A. Contractor shall use Owner’s ProjectMates website when submitting Requests For Information (RFI). Only Contractor can submit RFIs to Architect. RFI requests from subcontractors or material suppliers will not be considered.
B. All information indicated on the RFI to be provided by Contractor shall be complete before a request can be uploaded. Requests with incomplete information will not be accepted.
C. RFIs may contain more than 1 item when the items are related issues. Otherwise, only 1 item shall be addressed on each RFI request.

D. Architect's response to the RFI will be in writing and issued to Contractor and Owner electronically via Owner's ProjectMates website.
E. Responses from Architect will not change any requirement of the Contract Documents. Should Contractor believe an RFI response to cause a change to the Contract, Contractor shall give written notice to Architect in accordance with the requirements in the Contract. Written notice shall include specific reasons and an order of magnitude of Cost and/or Time that Contractor deems appropriate based on Architect's RFI response. Contractor's written notice does not constitute a Change Order, but provide a basis for further review and discussion with Architect.

1.6 PROGRESS MEETINGS

A. Schedule and administer meetings throughout progress of the Work at minimum monthly intervals.
B. Make arrangements for meetings.
C. Architect shall prepare Agenda and preside at meetings.
D. Attendance Required: Job superintendent, major Subcontractors and suppliers, Architect, and Owner as appropriate to agenda topics for each meeting.
E. Agenda:
    1. Refer to the attached Sample Agenda in Section E.1, Sample Agenda of the Preconstruction Guidelines.
F. Architect shall record minutes and distribute copies.

1.7 PREINSTALLATION MEETING

A. When required in individual specification Sections, convene a preinstallation meeting at Work site prior to commencing Work of the Section.
B. Require attendance of parties directly affecting, or affected by, Work of the specific Section.
C. Notify ODR and Architect 4 days in advance of meeting date.
D. Prepare agenda and preside at meeting.
    1. Review conditions of installation, preparation and installation procedures.
    2. Review coordination with related Work.
E. Record minutes and distribute copies within 3 days after meeting to participants, with 3 copies to ODR and Architect.

PART 2 - PRODUCTS

2.1 EQUIPMENT ELECTRICAL CHARACTERISTICS AND COMPONENTS

A. Motors: Specific motor type is specified in individual Specification Sections.
B. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Size terminal lugs to NFPA 70, include lugs for terminal box.
C. Cord and Plug: Provide minimum 6 foot cord and plug including grounding connector for connection to electric wiring system. Cord of longer length is specified in individual Specification Sections.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent Work. Beginning new Work means acceptance of existing conditions.
B. Examine and verify specific conditions described in individual Specification Sections.
C. Verify that utility services are available, of the correct characteristics, and in the correct location.

3.2 PREPARATION

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

3.3 CUTTING AND PATCHING

A. Employ skilled and experienced installer to perform cutting and patching.
B. Submit written request in advance of cutting or altering elements which affects:
    1. Structural integrity of element.
    2. Integrity of weather-exposed or moisture-resistant elements.
    3. Efficiency, maintenance, or safety of element.
    4. Visual qualities of sight-exposed elements.
    5. Work of Owner or separate contractor.
C. Execute cutting, fitting, and patching including excavation and fill, to complete Work, and to:
    1. Fit the several parts together, to integrate with other Work.
    2. Uncover Work to install or correct ill-timed Work.
    3. Remove and replace defective and non-conforming Work.
    4. Remove samples of installed Work for testing.
    5. Provide openings in elements of Work for penetrations of mechanical and electrical Work.
D. Execute Work by methods which will avoid damage to other Work and provide proper surfaces to receive patching and finishing.
E. Cut rigid materials using masonry saw or core drill.
F. Restore Work with new products in accordance with requirements of Contract Documents.
G. Fit Work tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
H. Maintain integrity of wall, ceiling, or floor construction; completely seal voids.

I. Refinish surfaces to match adjacent finishes. For continuous surfaces, refinish to nearest intersection; for an assembly, refinish entire unit.

J. Identify any hazardous substance or condition exposed during the Work to Architect for decision or remedy.

END OF SECTION

Parkhill

RFI No. _____

TO:

FROM:

SUBMITTED BY:

PROJECT NAME:

PROJECT NO.:

* Items to be completed by Contractor before submittal to Parkhill for review. RFI form must be fully completed for Parkhill to respond.

Issue Date:		***Requested Reply Date:**	

***RFI DESCRIPTION:** *(Fully describe the question or type of information requested. Provide photos and/or sketches as applicable to help with the description. Additional pages may be attached, if needed.)*

***REFERENCES/ATTACHMENTS:** *(List specific documents researched when seeking the information requested.)*

Specifications	Drawings	Other

**Disciplines involved (select one or more):*

☐Architect ☐Civil ☐Landscape Architect ☐Interior Designer ☐Structural ☐Mechanical ☐Plumbing
☐Electrical ☐Specialist Other _____

***CONTRACTOR PROPOSED SOLUTION:** *(If RFI concerns a site or construction condition, the sender shall provide a recommended solution, including cost and/or schedule considerations before Parkhill can respond. The proposal solution shall consist of a revised text, sketches, drawings, etc. as applicable to a full and complete explanation.)*

RESPONSE: *(Provide answer to RFI, including cost and/or schedule considerations, revised text, sketches, drawings, etc. as applicable to fully explain response. Additional pages may be attached, if needed.)*

Response by:_____ ☐ Attachments:

Copies: ☐ Owner ☐ Consultants

Note: This reply is not an authorization to proceed with work involving additional cost, time or both. If any reply requires a change to the Contract Documents, a Change Order, Construction Change Directive or a Construction Change Request must be executed in accordance with the Contract Documents.

SAMPLE

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Digital Data Licensing Agreement

AGREEMENT made as of the day of in the year
(In words, indicate day, month, and year.)

BETWEEN the Party transmitting Digital Data ("Transmitting Party"):
(Name, address, and contact information, including electronic addresses)

and the Party receiving the Digital Data ("Receiving Party"):
(Name, address, and contact information, including electronic addresses)

for the following Project:
(Name and location or address of the Project)

for the following Digital Data ("Digital Data"):
(Identify below, in detail, the information created or stored in digital form that the Parties intend to be subject to this Agreement.)

[Revit Models (.rvt files)]
[AutoCAD (.dwg files)]
[Portable Document Format (.pdf)]

The Transmitting Party and Receiving Party agree as follows.

ADDITIONS AND DELETIONS:
The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added necessary information and where the author has added to or deleted from the original AIA text.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

SAMPLE

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User Notes: (913993287)

TABLE OF ARTICLES

1 GENERAL PROVISIONS

2 TRANSMISSION OF DIGITAL DATA

3 LICENSE CONDITIONS

4 LICENSING FEE OR OTHER COMPENSATION

ARTICLE 1 GENERAL PROVISIONS

§ 1.1 The purpose of this Agreement is to grant a license from the Transmitting Party to the Receiving Party for the Receiving Party's use of Digital Data and to set forth the license terms.

§ 1.2 This Agreement is the entire and integrated agreement between the Parties. Except as specifically set forth herein, this Agreement does not create any other contractual relationship between the Parties.

§ 1.3 Confidential Digital Data is Digital Data containing confidential or business proprietary information that the Transmitting Party designates as "confidential."

ARTICLE 2 TRANSMISSION OF DIGITAL DATA

§ 2.1 The Transmitting Party grants to the Receiving Party a nonexclusive limited license to use the Digital Data solely and exclusively for the uses, and in accordance with the terms, set forth in Article 3.

§ 2.2 Only the Receiving Party is permitted to access and use the Digital Data. Unlicensed and unauthorized access or use by third parties is strictly prohibited except as set forth in Section 2.4.1.

§ 2.3 The transmission of Digital Data constitutes a warranty by the Transmitting Party to the Receiving Party that the Transmitting Party is the copyright owner of the Digital Data or otherwise has permission to transmit the Digital Data to the Receiving Party for its use on the Project in accordance with the terms and conditions of this Agreement.

§ 2.4 Where the Transmitting Party has designated information furnished pursuant to this Agreement as "confidential," the Receiving Party shall keep the information confidential and shall not disclose it to any other person or entity except as set forth in Section 2.4.1.

§ 2.4.1 The Receiving Party may disclose Confidential Digital Data after seven (7) days' notice to the Transmitting Party where disclosure is required by law, including a subpoena or other form of compulsory legal process issued by a court or governmental entity, or by court or arbitrator(s) order. The Receiving Party may also disclose Confidential Digital Data to its employees, consultants, sureties, subcontractors and their employees, sub-subcontractors, and others who need to know the content of such information solely and exclusively for the Project and who agree to maintain the confidentiality of such information.

§ 2.5 By transmitting Digital Data, the Transmitting Party does not convey any ownership right in the Digital Data or in the software used to generate the Digital Data. Unless otherwise granted in a separate license, the Receiving Party's right to use, modify, or further transmit Digital Data is specifically limited to those uses, and in accordance with the terms, set forth in Article 3, and nothing contained in this Agreement conveys any other right to use the Digital Data.

§ 2.6 To the fullest extent permitted by law, the Receiving Party shall indemnify and defend the Transmitting Party from and against all claims arising from or related to the Receiving Party's modification to, or unlicensed use of, the Digital Data.

§ 2.7 Transmission of the Digital Data does not abridge or extinguish the Transmitting Party's rights, including, to the extent applicable, exclusive ownership interest, in such information under all applicable state, federal, and international laws including, without limitation, laws governing the protection of copyrights and intellectual property.

§ 2.8 The provisions of this Article 2 shall survive the termination of this Agreement.

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User Notes: (913993287)

ARTICLE 3 LICENSE CONDITIONS

§ 3.1 The Receiving Party may use and rely upon the Digital Data to the extent set forth in this Article 3.

(Paragraph deleted)

[X] **§ 3.1.1** The Digital Data is transmitted solely for the Receiving Party's information. Receiving Party acknowledges that any use of the Digital Data shall be at Receiving Party's sole risk. The Receiving Party accepts the Digital Data "as is" without any warranty or representations from the Transmitting Party as to whether the Digital Data is accurate, complete, or fit for use as intended by the Receiving Party. The Receiving Party is solely responsible for verifying whether the Digital Data is accurate, complete, or fit for the Receiving Party's intended use.

(Paragraphs deleted)

§ 3.1.1.1 This Digital Data is part of the Transmitting Party's Instruments of Service and shall not be used by Receiving Party or anyone else receiving this data through or from the Receiving Party for any purpose other than as a convenience in the preparation of bid submittals, shop drawings, coordination drawings, construction phase submittals, and field layout and staking required by the Owner for the exclusive use of the referenced Project. Any use or reuse by the Receiving Party or by others will be at the Receiving Party's sole risk and without liability or legal exposure to Transmitting Party. The Receiving Party agrees to make no claim and hereby waive, to the fullest extent permitted by law, any claim or cause of action of any nature against Transmitting Party, its officers, directors, employees, or subconsultants that may arise out of or in connection with Receiving Party's use of this Digital Data.

§ 3.1.1.2 No representation as to the compatibility of this Digital Data with Receiving Party's hardware or software is provided.

§ 3.1.1.3 This Digital Data is not a Construction Document. Differences may exist between this Digital Data and corresponding two-dimensional hard-copy Construction Document. The Transmitting Party makes no representation regarding the accuracy or completeness of the Digital Data the Receiving Party receives. In the event that a conflict arises between the signed/sealed two-dimensional hard-copy Construction Document prepared by Transmitting Party and the Digital Data, the signed/sealed two-dimensional hard-copy Construction Document shall govern. The Receiving Party is responsible for determining if any conflict exists. By the Receiving Party's use of this Digital Data, Receiving Party is not relieved of their duty to fully comply with the Contract Documents, including, and without limitation, the need to check, confirm and coordinate all dimensions and details, field measurements, verify field conditions and coordination of work with that of other contractors for the Project.

§ 3.1.1.4 Because information presented in the Digital Data can be modified, unintentionally or otherwise, the Transmitting Party reserves the right to remove all indicia of ownership and/or involvement from each Digital Data.

§ 3.1.1.5 Under no circumstances shall delivery of this Digital Data for use by the Receiving Party be deemed a sale of document ownership by Transmitting Party, and no warranties, either express or implied, of merchantability or fitness for any particular purpose is made. In no event shall the Transmitting Party be liable for any loss of profit or any consequential damages as a result of the Receiving Party's use or reuse of this Digital Data.

§ 3.1.1.6 The Digital Data file does not necessarily contain all the information that is required to produce finished Construction Documents. Because of this, there may be data within the Digital Data that is missing, incomplete or even contradictory to the information provided in the final two dimensional Construction Documents.

§ 3.1.1.7 Professional judgment will need to be used by the Receiving Party, along with reasonable expectations and interpretations in order to use the Digital Data for its intended purpose. Should the Transmitting Party provide revised and updated copies of the Digital Data to the Receiving Party throughout the Project, all terms and conditions of this agreement will be applicable and unchanged for all subsequent transmissions of the Digital Data

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ARTICLE 4 LICENSING FEE OR OTHER COMPENSATION

The Receiving Party agrees to pay the Transmitting Party the following fee or other compensation for the Receiving Party's use of the Digital Data:

(State the fee, in dollars, or other method by which the Receiving Party will compensate the Transmitting Party for the Receiving Party's use of the Digital Data.)

This Agreement is entered into as of the day and year first written above and terminates one year from said date, except as set forth below.

(Indicate when this Agreement will terminate, if other than one year from the date it was entered into, and other conditions related to termination.)

N/A

PARKHILL	**[RECEIVING PARTY]**
TRANSMITTING PARTY *(Signature)*	**RECEIVING PARTY** *(Signature)*
(Printed name and title)	*(Printed name and title)*

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SECTION 01 31 00 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative provisions for coordinating construction operations on Project, including, but not limited to, the following:
   1. Coordination Drawings.

B. Each contractor shall participate in coordination requirements. Certain areas of responsibility are assigned to a specific contractor.

C. Related Requirements:
   1. Texas Facilities Commission - 2015 Uniform General Conditions.
   2. Texas Facilities Commission - Preconstruction Guidelines.
   3. Other Division 01 Specification Sections apply to Work of this Section.

1.2 COORDINATION DRAWINGS

A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely indicated on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than 1 entity.
   1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:
      a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
      b. Coordinate the addition of trade-specific information to coordination drawings by multiple contractors in a sequence that best provides for coordination of the information and resolution of conflicts between installed components before submitting for review.
      c. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
      d. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
      e. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
      f. Indicate required installation sequences.
      g. Indicate dimensions shown on Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternative sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

B. Coordination Drawing Organization: Organize coordination drawings as follows:
   1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement Plan Drawings with section Drawings where required to adequately represent the Work.
   2. Plenum Space: Indicate subframing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within plenums to accommodate layout of light fixtures and other components indicated on Drawings. Indicate areas of conflict between light fixtures and other components.
   3. Mechanical Rooms: Provide coordination drawings for mechanical rooms, showing Plans and elevations of mechanical, plumbing, fire-protection, fire-alarm, and electrical equipment.
   4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
   5. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.
   6. Mechanical and Plumbing Work: Show the following:
      a. Sizes and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, and support systems.
      b. Dimensions of major components, such as dampers, valves, diffusers, access doors, cleanouts and electrical distribution equipment.
      c. Fire-rated enclosures around ductwork.
   7. Electrical Work: Show the following:
      a. Runs of vertical and horizontal conduit 1-1/4 inches in diameter and larger.
      b. Light fixture, exit light, emergency battery pack, smoke detector, and other fire-alarm locations.
      c. Panel board, switchboard, switchgear, transformer, busway, generator, and motor-control center locations.
      d. Location of pull boxes and junction boxes, dimensioned from column center lines.
   8. Fire-Protection System: Show the following:
      a. Locations of standpipes, mains piping, branch lines, pipe drops, and sprinkler heads.
   9. Review: Architect will review coordination drawings to confirm that, in general, the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If Architect determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, Architect will so inform Contractor, who shall make suitable modifications and resubmit.

C. Coordination Drawing Process: Prepare coordination drawings in the following manner:
   1. Schedule submittal and review of Fire Sprinkler, Plumbing, HVAC, and Electrical Shop Drawings to make required changes prior to preparation of coordination drawings.
   2. Commence routing of coordination drawing files with HVAC Installer, who will provide Drawing Plan files denoting approved ductwork. HVAC Installer will locate ductwork and piping on a single layer, using orange color. Forward Drawings to Plumbing Installer.
   3. Plumbing Installer will locate plumbing and equipment on a single layer, using blue color.
   4. Fire Sprinkler Installer will locate piping and equipment, using red color. Fire Sprinkler Installer shall forward drawing files to Electrical Installer.
   5. Electrical Installer will indicate service and feeder conduit runs and equipment in green color. Electrical Installer shall forward drawing files to Communications and Electronic Safety and Security Installer.
   6. Communications and Electronic Safety and Security Installer will indicate cable trays and cabling runs and equipment in purple color. Communications and Electronic Safety and Security Installer shall forward completed drawing files to Contractor.
   7. Contractor shall perform the final coordination review. As each coordination drawing is completed, Contractor will meet with Architect to review and resolve conflicts on the coordination drawings.
   8. The purpose of the coordination drawings is to verify ceiling heights shown on the reflected ceiling drawings can be maintained at maximum height.

D. Coordination Digital Data Files: Prepare coordination digital data files according to the following requirements:
   1. File Preparation Format:
      a. Same digital data software program, version, and operating system as original Drawings.
   2. File Submittal Format: Submit or post coordination drawing files using PDF format.
   3. BIM File Incorporation: Develop and incorporate coordination drawing files into BIM established for Project.
      a. Perform 3-dimensional component conflict analysis as part of preparation of coordination drawings. Resolve component conflicts prior to submittal. Indicate where conflict resolution requires modification of design requirements by Architect.
   4. Architect will furnish Contractor one set of digital data files of Drawings for use in preparing coordination digital data files.
      a. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Drawings.
      b. Contractor shall execute a data licensing agreement in the form of Agreement form acceptable to Owner and Architect.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 33 00 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Review of Uniform General Conditions.
   2. Requirements for submitting Shop Drawings, product data, samples, and other data.
   3. Requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, product data, samples, and other submittals.

B. Related Requirements:
   1. Texas Facilities Commission – 2015 Uniform General Conditions.
   2. Texas Facilities Commission – Preconstruction Guidelines.
   3. Other Division 01 Specification Sections apply to Work of this Section
   4. Section 01 78 23 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
   5. Section 01 78 39 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
   6. Section 01 79 00 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.

1.2 DEFINITIONS

A. Submittals: Written and graphic information and physical samples that require Architect's responsive action.

B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."

1.3 SUBMITTALS

A. Coordinate requirements of this section with the requirements of the Uniform General Conditions and the Preconstruction Guidelines.

B. Submittal Schedule: Contractor shall within 21 days of the effective date of the Notice to Proceed with construction, submit to ODR and Architect, a submittal schedule/register, organized by Specification Section, listing all items to be furnished for review and approval by Architect and Owner. The list shall include Shop Drawings, manufacturer’s literature, certificates of compliance, materials samples, materials colors, guarantees, and all other items identified throughout the Specifications.

C. Contractor shall indicate the type of item, Contract requirements reference, and Contractor’s scheduled dates for submitting the item along with the requested dates for approval answers from Architect and Owner.

D. Contractor shall coordinate the Submittal Register with the Work Progress Schedule. Do not schedule Work requiring a submittal to begin prior to scheduling review and approval of the related submittal.

E. By submitting Shop Drawings, samples or other required information, Contractor represents that it has determined and verified all applicable field measurements, field construction criteria, materials, catalog numbers and similar data; and has checked and coordinated each Shop Drawing and sample with the requirements of the Work and the Contract Documents.

F. Electronic digital data files of the Contract Drawings will not be provided by Architect for Contractor's use in preparing submittals without a properly executed Parkhill release transfer of electronic documents.

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

H. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
   1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
   2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
   3. Resubmittal Review: Allow 15 days for review of each resubmittal.

I. Architect will review the submittals on Shop Drawings, product data, samples, and 1 resubmittal.
   1. Submittals in excess of 1 resubmittal, Contractor shall reimburse Architect and their consultants for these additional resubmittals.
   2. No additional time shall be given to Contractor for delays caused by excess number of resubmittals.

J. Identification: Place a permanent label or title block on each submittal item for identification.
   1. Indicate name of firm or entity that prepared each submittal on label or title block.
   2. Include the following information for processing and recording action taken:
      a. Project name.
      b. Date.
      c. Name of Architect.
      d. Name of Construction Manager.
      e. Name of subcontractor.

f. Submittal number or other unique identifier, including revision identifier.
   1) Submittal number shall use Specification Section number followed by a decimal point and then a sequential number (e.g., DPSLBB, 06100.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., DPSLBB, 06100.01.A).
g. Number and title of appropriate Specification Section.
h. Drawing number and detail references, as appropriate.
i. Location(s) where product is to be installed, as appropriate.
j. Other necessary identification.

K. Transmittal of Submittals: Identify and incorporate information in each electronic submittal file as follows:
   1. Assemble complete submittal package into a single file incorporating submittal requirements of a single Specification Section and transmittal form.
   2. Name file with submittal number or other unique identifier, including revision identifier.
      a. File name shall use project identifier and Specification Section number followed by a decimal point and then a sequential number (e.g., LNHS-06100.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., LNHS-06100.01.A).

L. Options: Identify options requiring selection by Architect.

M. Deviations and Additional Information: On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.

N. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
   1. Note date and content of previous submittal.
   2. Note date and content of revision in label or title block and clearly indicate extent of revision.
   3. Resubmit submittals until they are marked with approval notation from Architect.

O. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.
   1. Every submittal shall be logged/entered into Project website. This is the official submittal log. See ProjectMates Help site for a guide to submitting submittals.
   2. For samples, record that sample is being transmitted to Architect via the Project website. Sample may then be submitted to Architect.

P. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect.

Q. No color selections will be approved until ALL color samples are submitted. Color submittals shall be submitted within the first 60 days of the Project.

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
   1. Post electronic submittals as PDF electronic files directly to Project Web site specifically established for Project.
   2. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
      a. Provide a digital signature with digital certificate on electronically submitted certificates and certifications where indicated.
      b. Provide a notarized statement on original paper copy certificates and certifications where indicated.

B. Administrative Submittals: The minimum administrative submittals required are as follows:
   1. Performance Bond.
   2. Payment Bond.
   3. Worker’s Compensation.
   4. Employer’s Liability.
   5. Comprehensive General Liability, Bodily, and Property.
   6. Comprehensive Automobile Liability, Bodily, and Property.
   7. Owner’s and Contractor’s Protective Liability.
   8. Builder’s Risk.
   9. Contractor Price Breakdown (Schedule of Values).
   10. Construction Progress Schedule.
   11. Submittals Schedule.
   12. Construction Reports.
   13. Project Staffing and Resumes.
   14. Subcontractor’s List.

C. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
   1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
   2. Mark each copy of each submittal to show which products and options are applicable.
   3. Include the following information, as applicable:
      a. Manufacturer's catalog cuts.
      b. Manufacturer's product Specifications.
      c. Standard color charts.
      d. Statement of compliance with specified referenced standards.

e. Testing by recognized testing agency.
f. Application of testing agency labels and seals.
g. Notation of coordination requirements.
h. Availability and delivery time information.

4. For equipment, include the following in addition to the above, as applicable:
   a. Wiring diagrams showing factory-installed wiring.
   b. Printed performance curves.
   c. Operational range diagrams.
   d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
5. Submit Product Data before or concurrent with Samples.

D. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data, unless submittal based on Architect's digital data drawing files is otherwise permitted.
   1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
      a. Identification of products.
      b. Schedules.
      c. Compliance with specified standards.
      d. Notation of coordination requirements.
      e. Notation of dimensions established by field measurement.
      f. Relationship and attachment to adjoining construction clearly indicated.
      g. Seal and signature of professional engineer if specified.
   2. Sheet Size: Except for templates, patterns, and similar full-size Drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches, but no larger than 30 by 42 inches.
   3. Submit Shop Drawings in the following format:
      a. PDF electronic file.

E. Samples: Submit samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.
   1. Transmit samples that contain multiple, related components such as accessories together in 1 submittal package.
   2. Identification: Attach label on unexposed side of samples that includes the following:
      a. Generic description of sample.
      b. Product name and name of manufacturer.
      c. Sample source.
      d. Number and title of applicable Specification Section.
      e. Specification paragraph number and generic name of each item.
   3. For projects where electronic submittals are required, provide corresponding electronic submittal of sample transmittal, digital image file illustrating sample characteristics, and identification information for record.

4. Disposition: Maintain sets of approved samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
    a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such samples must be in an undamaged condition at time of use.
    b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
5. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
    a. Number of Samples: Submit 2 full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return one sample submittal with options selected.
6. Samples for Verification: Submit full-size units or samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
    a. Number of Samples: Submit 2 sets of Samples. Architect will retain 1 sample sets; remainder will be returned.
        1) Submit a single sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
        2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a sample, submit at least 2 sets of paired units that show approximate limits of variations.

F. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
2. Manufacturer and product name, and model number if applicable.
3. Number and name of room or space.
4. Location within room or space.
5. Submit product schedule in the following format:
    a. PDF electronic file.

G. Contractor's Construction Schedule: Comply with requirements in the Uniform General Conditions, Article 9 Construction Schedules.

H. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Section 01 40 00 "Quality Requirements."
I. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Section 01 77 00 "Closeout Procedures."
J. Maintenance Data: Comply with requirements specified in Section 01 78 23 "Operation and Maintenance Data."
K. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.
L. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.
M. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
N. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
O. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
P. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
Q. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
R. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
S. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
T. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.
B. Project Closeout and Maintenance Material Submittals: See requirements in Section 01 77 00 "Closeout Procedures."
C. Approval Stamp: Stamp each submittal with a uniform, approval stamp for required information on stamp.

3.2 ARCHITECT'S ACTION

A. Submittals: Architect will review each submittal, make marks to indicate corrections or revisions required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action.
B. Informational Submittals: Architect will review each submittal and will not return it or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.
C. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.
D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.
E. Submittals not required by the Contract Documents may be returned by Architect without action.

END OF SECTION

SECTION 01 40 00 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

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

B. Related Requirements:
   1. Texas Facilities Commission – 2015 Uniform General Conditions.
   2. Texas Facilities Commission – Preconstruction Guidelines.
   3. Other Division 01 Specification Sections apply to Work of this Section.

1.2 DEFINITIONS

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

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

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

D. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria.
E. Source Quality-Control Testing: Tests and inspections that are performed at the source, e.g., plant, mill, factory, or shop.
F. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
G. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.
H. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
    1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).
I. Experienced: When used with an entity or individual, "experienced" means having successfully completed a minimum of 5 previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.3 CONFLICTING REQUIREMENTS

A. Referenced Standards: If compliance with 2 or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Architect for a decision before proceeding.
B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.4 SUBMITTALS

A. Shop Drawings: Refer to Section 01 33 00 "Submittal Procedures."
B. Mock-ups:
    1. Field Mock-ups shall be constructed prior to commencement of a specified scope of work to confirm acceptable workmanship.
        a. As a minimum, field mock-ups shall be constructed for roofing systems, exterior veneer/finish systems, glazing systems, and other Work requiring a mock-up as identified throughout the Contract Documents. Mock-ups for systems not part of the Project scope shall not be required.

b. Mock-ups may be incorporated into the Work if allowed by the Contract Documents and if acceptable to ODR. If mock-ups are freestanding, they shall remain in place until otherwise directed by Owner.
c. Contractor shall include field mock-ups in their Work Progress Schedule and shall notify ODR and Architect of readiness for review sufficiently in advance to coordinate review without delay.

1.5 INFORMATIONAL SUBMITTALS

A. Contractor's Quality-Control Plan: For quality-assurance and quality-control activities and responsibilities.
B. Qualification Data: For Contractor's quality-control personnel.
C. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility sent to authorities having jurisdiction before starting Work on the following systems:
    1. Seismic-force-resisting system, designated seismic system, or component listed in the designated seismic system quality-assurance plan prepared by Architect.
    2. Main wind-force-resisting system or a wind-resisting component listed in the wind-force-resisting system quality-assurance plan prepared by Architect.
D. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.
E. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
    1. Specification Section number and title.
    2. Entity responsible for performing tests and inspections.
    3. Description of test and inspection.
    4. Identification of applicable standards.
    5. Identification of test and inspection methods.
    6. Number of tests and inspections required.
    7. Time schedule or time span for tests and inspections.
    8. Requirements for obtaining samples.
    9. Unique characteristics of each quality-control service.

1.6 CONTRACTOR'S QUALITY-CONTROL PLAN

A. Quality-Control Plan, General: Submit quality-control plan within 10 days of Notice to Proceed, and not less than 5 days prior to preconstruction conference. Submit in format acceptable to ODR and Architect. Identify personnel, procedures, controls, instructions, tests, records, and forms to be used to carry out Contractor's quality-assurance and quality-control responsibilities. Coordinate with Contractor's construction schedule.
B. Submittal Procedure: Describe procedures for ensuring compliance with requirements through review and management of submittal process. Indicate qualifications of personnel responsible for submittal review.

C. Testing and Inspection: Owner is responsible for coordinating and paying for routine and special tests required to confirm compliance with quality and performance requirements, except as stated below or otherwise required by the Contract Documents. Contractor shall provide the following testing:
   1. Any test of basic material or fabricated equipment included as part of a submittal for a required item in order to establish compliance with the Contract Documents.
   2. Any test of basic material or fabricated equipment offered as a substitute for a special item on which a test may be required in order to establish compliance with the Contract Documents.
   3. Preliminary, start-up, pre-functional and operational testing of building equipment and systems as necessary to confirm operational compliance with requirement of the Contract Documents.
   4. All subsequent tests on original or replaced materials conducted as a results of prior testing failure.

D. All testing shall be performed in accordance with standard test procedures by an accredited laboratory, or special consultant as appropriate, acceptable to Owner. Results of all tests shall be provided promptly to ODR, Architect, and Contractor.

E. Non-Compliance (Test Results): Contractor shall adhere to requirements of the Uniform General Conditions, Article 8, 8.2.3.

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

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

1.7 REPORTS AND DOCUMENTS

A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:
   1. Date of issue.
   2. Project title and number.
   3. Name, address, and telephone number of testing agency.
   4. Dates and locations of samples and tests or inspections.
   5. Names of individuals making tests and inspections.
   6. Description of the Work and test and inspection method.
   7. Identification of product and Specification Section.
   8. Complete test or inspection data.
   9. Test and inspection results and an interpretation of test results.
   10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.

11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and reinspecting.

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

C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:
1. Name, address, and telephone number of factory-authorized service representative making report.
2. Statement that equipment complies with requirements.
3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
4. Statement whether conditions, products, and installation will affect warranty.
5. Other required items indicated in individual Specification Sections.

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

1.8 QUALITY ASSURANCE

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

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

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

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

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

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

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

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

I. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:
   1. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected Work complies with or deviates from the Contract Documents.

1.9 QUALITY CONTROL

A. Owner Responsibilities: Refer to Article 8, 8.2 of the Uniform General Conditions.

B. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Section 01 33 00 "Submittal Procedures."

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

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

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

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

G. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents as a component of Contractor's quality-control plan. Coordinate and submit concurrently with Contractor's construction schedule. Update as the Work progresses.
   1. Distribution: Distribute schedule to ODR, Architect, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

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

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

3.2 REPAIR AND PROTECTION

A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
   1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 01 70 00 "Execution and Closeout Requirements."

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

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

END OF SECTION

SECTION 01 50 00 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Requirements for temporary utilities, support facilities, and security and protection facilities.

B. Related Requirements:
   1. Texas Facilities Commission – 2015 Uniform General Conditions.
   2. Texas Facilities Commission – Preconstruction Guidelines.
   3. Other Division 01 Specification Sections apply to Work of this Section.
   4. Section 01 10 00 "Summary" for limitations on Work restrictions and utility interruptions.

1.2 USE CHARGES

A. Contractor shall submit a Site Logistics Plan for review and acceptance by the ODR.

B. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Owner's construction forces, Architect, testing agencies, and authorities having jurisdiction.

C. Sewer Service: Pay sewer-service use charges for sewer usage by all entities for construction operations.

D. Water Service: Pay water-service use charges for water used by all entities for construction operations.

E. Electric Power Service: Pay electric-power-service use charges for electricity used by all entities for construction operations.

1.3 INFORMATIONAL SUBMITTALS

A. Contractor shall submit a Site Logistics Plan for review and acceptance by the ODR.

B. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.

C. Erosion- and Sedimentation-Control Plan: Show compliance with requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.

D. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire-prevention program.

E. Moisture-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage.
   1. Describe delivery, handling, and storage provisions for materials subject to water absorption or water damage.
   2. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and replacing water-damaged Work.
   3. Indicate sequencing of work that requires water, such as sprayed fire-resistive materials, plastering, and terrazzo grinding, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.

F. Dust- and HVAC-Control Plan: Submit coordination Drawing and narrative that indicates the dust- and HVAC-control measures proposed for use, proposed locations, and proposed time frame for their operation. Identify further options if proposed measures are later determined to be inadequate. Include the following:
   1. Locations of dust-control partitions at each phase of Work.
   2. HVAC system isolation schematic drawing.
   3. Location of proposed air-filtration system discharge.
   4. Waste handling procedures.
   5. Other dust-control measures.

1.4 QUALITY ASSURANCE

A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

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

PART 2 - PRODUCTS

2.1 MATERIALS

A. Chain-Link Fencing: Minimum 6 feet high with vehicular and personnel gates as necessary.

2.2 TEMPORARY FACILITIES

A. Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.

B. Common-Use Field Office: Of sufficient size to accommodate needs of Owner, Architect, and construction personnel office activities and to accommodate Project meetings specified in other Division 01 Sections. Keep office clean and orderly. Furnish and equip offices as follows:
   1. Furniture required for Project-site documents including file cabinets, plan tables, plan racks, and bookcases.

2. Conference room of sufficient size to accommodate meetings of a **minimum** of 12 individuals. Provide electrical power service and 120-V ac duplex receptacles, with no fewer than one receptacle on each wall. Furnish room with conference table and chairs.
3. Drinking water and private toilet.
4. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 degrees F.
5. Lighting fixtures capable of maintaining average illumination of 20 fc at desk height.

C. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.
1. Store combustible materials apart from building.

2.3 EQUIPMENT

A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.

B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.
1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
2. Heating Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction and marked for intended location and application.
3. Permanent HVAC System: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of 8 at each return-air grille in system and remove at end of construction and clean HVAC system as required in Section 01 77 00 "Closeout Procedures."

C. Air-Filtration Units: Primary and secondary HEPA-filter-equipped portable units with 4-stage filtration. Provide single switch for emergency shutoff. Configure to run continuously.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.
1. Locate facilities to limit site disturbance as specified in Section 01 10 00 "Summary."

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

3.2 TEMPORARY UTILITY INSTALLATION

A. General: Install temporary service or connect to existing service.
   1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.

B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.
   1. Connect temporary sewers to municipal system as directed by authorities having jurisdiction.

C. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction.

D. Water Service: Connect to Owner's existing water service facilities. Clean and maintain water service facilities in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.

E. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.
   1. Toilets: Use of Owner's existing toilet facilities will be permitted, as long as facilities are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.

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

G. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.
   1. Provide dehumidification systems when required to reduce substrate moisture levels to level required to allow installation or application of finishes.

H. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.

I. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.

J. Telephone Service: Provide temporary telephone service for field office.

K. Electronic Communication Service: Provide a desktop computer in the primary field office adequate for use by Architect and Owner to access Project electronic documents and maintain electronic communications.

3.3 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:
   1. Provide construction for temporary offices, shops, and sheds located within construction area or within 30 feet of building lines that is noncombustible according to ASTM E136. Comply with NFPA 241.
   2. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

B. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate for construction operations.
   1. Provide dust-control treatment that is nonpolluting and nontracking. Reapply treatment as required to minimize dust.

C. Traffic Controls: Comply with requirements of authorities having jurisdiction.
   1. Protect existing site improvements to remain including curbs, pavement, and utilities.
   2. Maintain access for fire-fighting equipment and access to fire hydrants.

D. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.
   1. Identification Signs: Provide Project identification signs as indicated on Drawings.
   2. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.
      a. Provide temporary, directional signs for construction personnel and visitors.
   3. Maintain and touchup signs so they are legible at all times.

E. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with progress cleaning requirements in Section 01 70 00 "Execution and Closeout Requirements."

F. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.

G. Temporary Stairs: Until permanent stairs are available, provide temporary stairs where ladders are not adequate.

H. Temporary Use of Permanent Stairs: Use of new stairs for construction traffic will be permitted, provided stairs are protected and finishes restored to new condition at time of Substantial Completion.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.

B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.
   1. Comply with work restrictions specified in Section 01 10 00 "Summary."

C. Temporary Erosion and Sedimentation Control: Comply with requirements of 2003 EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.

D. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.

E. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using environmentally safe materials.

F. Site Enclosure Fence: Before construction operations begin, furnish and install site enclosure fence in a manner that will prevent people and animals from easily entering site except by entrance gates.
   1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations.
   2. Maintain security by limiting number of keys and restricting distribution to authorized personnel.

G. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each work day.

H. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.

I. Temporary Egress: Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.

J. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.
   1. Where heating or cooling is needed and permanent enclosure is incomplete, insulate temporary enclosures.

K. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire-prevention program.
   1. Prohibit smoking in construction areas.
   2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
   3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
   4. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

3.5 MOISTURE AND MOLD CONTROL

A. Contractor's Moisture-Protection Plan: Avoid trapping water in finished Work. Document visible signs of mold that may appear during construction.

3.6 OPERATION, TERMINATION, AND REMOVAL

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

B. Maintenance: Maintain facilities in good operating condition until removal.
   1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.

C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.

D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
   1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
   2. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
   3. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 01 77 00 "Closeout Procedures."

END OF SECTION

SECTION 01 50 01 - EROSION AND SEDIMENT CONTROL DURING CONSTRUCTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes TPDES Construction General Permit and City of Florence Erosion Control provisions.
B. Prepare a Stormwater Pollution Prevention Plan (SWPPP), obtain permits, and furnish labor, materials, equipment, and incidentals necessary to provide erosion and sediment control during construction including furnishing, installing, and maintaining erosion and sediment control structures, and procedures and proper removal when no longer required.
C. Related Requirements:
   1. Division 01 Specification Sections apply to Work of this Section.

1.2 SUBMITTALS

A. Submittals shall be in accordance with Project requirements and shall include copies of submitted forms and copies of inspection reports as the Project progresses.

1.3 TPDES PERMIT

A. Permit Provisions:
   1. In accordance with the TPDES Construction General Permit (TXR 150000) for Stormwater Discharge associated with construction activity, Contractor shall prepare an SWPPP.
   2. Contractor shall be Operator of the SWPPP and will install and maintain the physical measures detailed in the Plan and shall provide administrative oversight of the Plan.
   3. Therefore, Contractor shall:
      a. Prepare and submit a Notice of Intent (NOI) to TCEQ with a copy to Owner.
      b. Sign and post on-site the completed NOI and provide copy to operator of any separate municipal storm sewer system per permit requirements.
      c. Install Best Management Practices (BMPs) noted on Contractor's SWPPP Site Plan.
      d. Maintain BMPs during construction.
      e. Periodically inspect BMPs, monitor the Plan, and file reports and other items required by the TPDES Construction General Permit. Contractor shall maintain a Master Copy of the SWPPP at the job site and insert copies of required periodic inspection reports into the Master Copy of the SWPPP.
      f. Make revisions to the BMPs if needed as construction progresses or make revisions in the event that the BMPs shown do not adequately limit sediments leaving the site.
      g. Prepare and submit a Notice of Termination (NOT) to TCEQ with a copy to Owner.
      h. Remove BMPs from the Project Site.

4. Requirements of the General Permit shall supersede the above items in the event of a conflict.
5. For assistance in filling out the NOI or NOT, Contractor may access the TCEQ website at www.tceq.state.tx.us.

1.4 CITY OF FLORENCE EROSION CONTROL

A. Temporary Drainage Provisions:
   1. Contractor shall install and maintain BMPs noted on Plan Sheet "Erosion Control Plan."
   2. Contractor shall provide for the drainage of stormwater and such water as may be applied or discharged on the site in performance of the Work. Drainage facilities shall be adequate to prevent damage to the Work, the site, and adjacent property.
   3. Existing drainage channels and conduits shall be cleaned, enlarged, or supplemented as necessary to carry all increased runoff attributable to Contractor's operations. Dikes shall be constructed as necessary to divert increased runoff from entering adjacent property (except in natural channels), to protect Owner's facilities and the Work, and to direct water to drainage channels or conduits. Ponding shall be provided as necessary to prevent downstream flooding.

B. Dust Control: Dust control shall mean that no construction activity shall take place without applying such reasonable measures as may be required to prevent particulate matter from becoming airborne, so it remains visible beyond the limits of construction. Reasonable measures may include the application of water or chemical dust suppressants, paving, frequent road cleaning, and planting vegetative ground cover. Utilize methods and practices of construction to eliminate blowing dust in full observance of state and federal regulations. If dust complaints are received by the local municipality or Owner, reasonable control measures shall be applied by Contractor.

1.5 JOB CONDITIONS; CODES AND ORDINANCES

A. Comply with the local codes and ordinances. If local codes and ordinances require more stringent or additional erosion and sediment control measures during construction, Contractor shall provide such measures.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 57 13 - TEMPORARY EROSION AND SEDIMENT CONTROL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Obtain permits and furnish labor, materials, equipment, and incidentals necessary to provide erosion and sediment control during construction including furnishing, installing, and maintaining erosion and sediment control structures and procedures and the proper removal when no longer required.

B. Related Requirements:
   1. Texas Facilities Commission – 2015 Uniform General Conditions.
   2. Texas Facilities Commission – Preconstruction Guidelines.
   3. Other Division 01 Specification Sections apply to Work of this Section.

1.2 SUBMITTALS

A. Submittals shall be in accordance with project requirements and shall include: Copies of submitted forms and copies of inspection reports as the Project progresses.

1.3 PERMIT

A. Permit Provisions:
   1. In accordance with the local and State codes for Storm Water Discharge associated with construction activity.
   2. Contractor shall install and maintain the physical measures required and shall provide administrative oversight.
   3. Therefore, Contractor shall:
      a. Install the Best Management Practices (BMP’s).
      b. Maintain the BMP’s during the construction.
      c. Periodically inspect the BMPs, monitor the Plan, and file reports and other items required by the permit.

B. Temporary Drainage Provisions:
   1. Contractor shall provide for the drainage of storm water and such water as may be applied or discharged on the site in performance of Work. Drainage facilities shall be adequate to prevent damage to Work, the site, and adjacent property.
   2. Existing drainage channels and conduits shall be cleaned, enlarged, or supplemented as necessary to carry all increased runoff attributable to Contractor's operations. Dikes shall be constructed as necessary to divert increased runoff from entering adjacent property (except in natural channels), to protect Owner's facilities and Work, and to direct water to drainage channels or conduits. Ponding shall be provided as necessary to prevent downstream flooding.

C. Dust Control:

1. Dust control shall mean that no construction activity shall take place without applying such reasonable measures as may be required to prevent particulate matter from becoming airborne, so it remains visible beyond the limits of construction. Reasonable measures may include the application of water or chemical dust suppressants, paving, frequent road cleaning, and planting vegetative ground cover. Utilize methods and practices of construction to eliminate blowing dust in full observance of State and Federal regulations. If dust complaints are received by the local municipality or Owner, reasonable control measures shall be applied by Contractor.

1.4 JOB CONDITIONS; CODES AND ORDINANCES

A. Comply with the local codes and ordinances. If local codes and ordinances require more stringent or additional erosion and sediment control measures during construction, Contractor shall provide such measures.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 60 00 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.

B. Related Requirements:
   1. Texas Facilities Commission – 2015 Uniform General Conditions.
   2. Texas Facilities Commission – Preconstruction Guidelines.
   3. Other Division 01 Specification Sections apply to Work of this Section.
   4. Section 01 25 00 "Substitution Procedures" for requests for substitutions.

1.2 DEFINITIONS

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

B. Basis-of-Design Product Specification: A Specification in which a specific manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of additional manufacturers named in the specification.

1.3 SUBMITTALS

A. Comparable Product Requests: Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
   1. Include data to indicate compliance with the requirements specified in "Comparable Products" Article.
   2. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within 1 week of receipt of a comparable product request. Architect will notify Contractor of approval or rejection of proposed comparable product request within 15 days of receipt of request.
      a. Form of Approval: As specified in Section 01 33 00 "Submittal Procedures."
      b. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.

B. Basis-of-Design Product Specification Submittal: Comply with requirements in Section 01 33 00 "Submittal Procedures." Show compliance with requirements.

1.4 QUALITY ASSURANCE

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

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

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

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

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

1.6 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
   1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
   2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.

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

C. Submittal Time: Comply with requirements in Section 01 77 00 "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.
   1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.

2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected," Architect will make selection.
5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
6. Or Equal: For products specified by name and accompanied by the term "or equal," or "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.

B. Product Selection Procedures:
1. Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will be considered under requirements for substitutions under “Comparable Products”.
2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
3. Products:
   a. Restricted List: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will be considered.
   b. Nonrestricted List: Where Specifications include a list of names of both available manufacturers and products, provide 1 of the products listed, or an unnamed product, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product.
4. Manufacturers:
   a. Restricted List: Where Specifications include a list of manufacturers' names, provide a product by 1 of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will be considered.
   b. Nonrestricted List: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed, or a product by an unnamed manufacturer, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed manufacturer's product.

5. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by 1 of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.

C. Visual Matching Specification: Where Specifications require "match Architect's sample", provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.
   1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Section 01 25 00 "Substitution Procedures," for proposal of product.

D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 COMPARABLE PRODUCTS

A. Conditions for Consideration: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements:
   1. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
   2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
   3. Evidence that proposed product provides specified warranty.
   4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
   5. Samples, if requested.

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 70 00 - EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. General administrative and procedural requirements governing execution of the Work including, but not limited to, the following:
      a. Construction layout.
      b. Installation of the Work.
      c. Cutting and patching.
      d. Progress cleaning.
      e. Starting and adjusting.
      f. Protection of installed construction.
      g. Correction of the Work.

B. Related Requirements:
   1. Texas Facilities Commission – 2015 Uniform General Conditions.
   2. Texas Facilities Commission – Preconstruction Guidelines.
   3. Other Division 01 Specification Sections apply to Work of this Section.
   4. Section 01 10 00 "Summary:" Limits on use of Project Site.
   5. Section 01 33 00 "Submittal Procedures" for submitting surveys.
   6. Section 01 77 00 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.

1.2 DEFINITIONS

A. Cutting: Removal of in-place construction necessary to permit installation or performance of other Work.

B. Patching: Fitting and repair Work required to restore construction to original conditions after installation of other Work.

1.3 QUALITY ASSURANCE

A. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.
   1. Structural Elements: When cutting and patching structural elements, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection

B. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Existing Conditions: 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, mechanical and electrical systems, and other construction affecting the Work.
   1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping, underground electrical services, and other utilities.
   2. Furnish location data for work related to Project that must be performed by public utilities serving Project Site.

B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with installer or applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
   1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.

C. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
   1. Description of the Work.
   2. List of detrimental conditions, including substrates.
   3. List of unacceptable installation tolerances.
   4. Recommended corrections.

D. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Existing Utility Information: Furnish information to local utility that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction. Notify Owner of necessary changes required.

B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a request for information to Architect.
E. Surface and Substrate Preparation: Comply with manufacturer's written recommendations for preparation of substrates to receive subsequent work.

3.3 CONSTRUCTION LAYOUT

A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect promptly.
B. General: Engage a land surveyor or professional engineer to lay out the Work using accepted surveying practices.
    1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
    2. Establish limits on use of Project site.
    3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
    4. Inform installers of lines and levels to which they must comply.
    5. Check the location, level, and plumb, of every major element as the Work progresses.
    6. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
    7. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.
C. Site Improvements: Locate and layout site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.
D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.
E. Record Log: Maintain a log of layout control Work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect.

3.4 INSTALLATION

A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
    1. Make vertical Work plumb and make horizontal Work level.
    2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
    3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.
D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.
E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.
F. Templates: Obtain and distribute to the parties involved templates for Work specified to be factory prepared and field installed. Check Shop Drawings of other Work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.
G. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.
    1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
    2. Allow for building movement, including thermal expansion and contraction.
    3. Coordinate installation of anchorages. Furnish setting Drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
H. Joints: Make joints of uniform width. Where joint locations in exposed Work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.
I. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.5 PROGRESS CLEANING

A. Contractor shall adhere to the requirements of and provide the plan to maintain the site to the subcontractors.
B. General: Clean Project site and Work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.
    1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
    2. Do not hold waste materials more than 7 days during normal weather or three days if the temperature is expected to rise above 80 degrees F.

3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
    a. Use containers intended for holding waste materials of type to be stored.
4. Coordinate progress cleaning for joint-use areas where Contractor and other contractors are working concurrently.

C. Site: Maintain Project site free of waste materials and debris.

D. Work Areas: Clean areas where Work is in progress to the level of cleanliness necessary for proper execution of the Work.
1. Remove liquid spills promptly.
2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

E. Installed Work: Keep installed Work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

F. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

G. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

H. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Section 01 50 00 "Temporary Facilities and Controls."

I. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

J. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

K. Limiting Exposures: Supervise construction operations 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.

3.6 STARTING AND ADJUSTING

A. Coordinate startup and adjusting of equipment and operating components with requirements in individual Sections.

B. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

C. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.

D. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

E. Manufacturer's Field Service: Comply with qualification requirements in Section 01 40 00 “Quality Requirements.”

3.7 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.
B. Comply with manufacturer's written instructions for temperature and relative humidity.

END OF SECTION

SECTION 01 77 00 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Administrative and procedural requirements for contract closeout, including, but not limited to, the following:
      a. Pre-Substantial Completion Documentation.
      b. Substantial Completion procedures.
      c. Final completion procedures.
      d. Warranties.
      e. Final cleaning.
      f. Repair of the Work.

B. Related Requirements:
   1. Texas Facilities Commission – 2015 Uniform General Conditions.
   2. Texas Facilities Commission – Preconstruction Guidelines.
   3. Other Division 01 Specification Sections apply to Work of this Section.
   4. Section 01 70 00 "Execution and Closeout Requirements" for progress cleaning of Project site.
   5. Section 01 78 23 "Operation and Maintenance Data" for operation and maintenance manual requirements.
   6. Section 01 78 39 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
   7. Section 01 79 00 "Demonstration and Training" for requirements for instructing Owner's personnel.

1.2 SUBMITTALS

A. Product Data: For cleaning agents.
B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.

1.3 CLOSEOUT SUBMITTALS

A. Certificates of Release: From authorities having jurisdiction.
B. Certificate of Insurance: For continuing coverage.
C. Field Report: For pest control inspection.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Schedule of Maintenance Material Items: For maintenance material submittal items specified in other Sections.

1.5 SUBSTANTIAL COMPLETION PROCEDURES

A. Contractor shall furnish to the Architect the items listed in the Preconstruction Guidelines, I Pre-substantial Completion Documentation prior to or in conjunction with the request for Request for Substantial Completion.
B. Once the Pre-substantial Completion Documents are reviewed, and any discrepancies corrected and resubmitted for acceptance by the ODR, the Contractor shall follow the procedures of the Uniform General Conditions, Article 12, Project Completion and Acceptance requirements.

1.6 FINAL INSPECTION

A. Contractor shall adhere to the requirements of the Uniform General Conditions, Article 12, Project Completion and Acceptance, Paragraph 12.1.2, Final Inspection.
    1. Contractor shall complete the list of items identified on the pre-final punchlist prior to requesting a final inspection.
    2. Correct or complete all items on the final punchlist before requesting Final Payment.

1.7 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
    1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.
    2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
    3. Include the following information at the top of each page:
        a. Project name.
        b. Date.
        c. Name of Architect.
        d. Name of Contractor.
        e. Page number.
    4. Submit list of incomplete items in the following format:
        a. PDF electronic file. Architect will return annotated file.

1.8 SUBMITTAL OF PROJECT WARRANTIES

A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated, or when delay in submittal of warranties might limit Owner's rights under warranty.

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

C. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.
   1. Bind warranties and bonds in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2- by 11-inch paper.
   2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
   3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
   4. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.

D. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

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

PART 3 - EXECUTION

3.1 FINAL CLEANING

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

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
   1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:
      a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.

b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
d. Remove tools, construction equipment, machinery, and surplus material from Project site.
e. Remove snow and ice to provide safe access to building.
f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
h. Sweep concrete floors broom clean in unoccupied spaces.
i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
k. Remove labels that are not permanent.
l. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
m. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
n. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
o. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.
p. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
q. Leave Project clean and ready for occupancy.

C. Pest Control: Comply with pest control requirements in Section 01 50 00 "Temporary Facilities and Controls." Prepare written report.

D. Construction Waste Disposal: Comply with waste disposal requirements in Section 01 50 00 "Temporary Facilities and Controls."

3.2 REPAIR OF THE WORK

A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.

B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.

1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that that already show evidence of repair or restoration.
    a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.
3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

END OF SECTION

SECTION 01 78 23 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
      a. Operation and maintenance documentation directory.
      b. Emergency manuals.
      c. Operation manuals for systems, subsystems, and equipment.
      d. Product maintenance manuals.
      e. Systems and equipment maintenance manuals.

B. Related Requirements:
   1. Texas Facilities Commission – 2015 Uniform General Conditions.
   2. Texas Facilities Commission – Preconstruction Guidelines.
   3. Other Division 01 Specification Sections apply to Work of this Section.
   4. Section 01 33 00 "Submittal Procedures:" Submitting copies of submittals for operation and maintenance manuals.

1.2 DEFINITIONS

A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.
B. Subsystem: A portion of a system with characteristics similar to a system.

1.3 CLOSEOUT SUBMITTALS

A. Manual Content: Operations and maintenance manual content is specified in individual Specification Sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
   1. Architect will comment on whether content of operations and maintenance submittals are acceptable.
   2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

B. Format: Submit operations and maintenance manuals in the following format:
   1. PDF electronic file. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to Architect.
      a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.
      b. Enable inserted reviewer comments on draft submittals.
   2. Three paper copies. Include a complete operation and maintenance directory. Enclose title pages and directories in clear plastic sleeves. Architect will return 2 copies.

C. Initial Manual Submittal: Submit draft copy of each manual at least 30 days before commencing demonstration and training. Architect will comment on whether general scope and content of manual are acceptable.
D. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect will return copy with comments.
    1. Correct or revise each manual to comply with Architect's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's comments and prior to commencing demonstration and training.

PART 2 - PRODUCTS

2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

A. Directory: Prepare a single, comprehensive directory of emergency, operation, and maintenance data and materials, listing items and their location to facilitate ready access to desired information. Include a section in the directory for each of the following:
    1. List of documents.
    2. List of systems.
    3. List of equipment.
    4. Table of contents.
B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.
C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.
D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.
E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

2.2 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

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

B. Title Page: Include the following information:
   1. Subject matter included in manual.
   2. Name and address of Project.
   3. Name and address of Owner.
   4. Date of submittal.
   5. Name and contact information for Contractor.
   6. Name and contact information for Construction Manager.
   7. Name and contact information for Architect.
   8. Name and contact information for Commissioning Authority.
   9. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
   10. Cross-reference to related systems in other operation and maintenance manuals.

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

D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of 1 system into a single binder.

E. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.
   1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
   2. File Names and Bookmarks: Enable bookmarking of individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

F. Manuals, Paper Copy: Submit manuals in the form of hard copy, bound and labeled volumes.
   1. Binders: Heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2- by 11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
      a. If 2 or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.

b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, subject matter of contents, and indicate Specification Section number on bottom of spine. Indicate volume number for multiple-volume sets.

2. Dividers: Heavy-paper dividers with plastic-covered tabs for each Section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the Section on each divider, cross-referenced to Specification Section number and title of Project Manual.
3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment.
4. Supplementary Text: Prepared on 8-1/2- by 11-inch white bond paper.
5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
   a. If oversize Drawings are necessary, fold Drawings to same size as text pages and use as foldouts.
   b. If Drawings are too large to be used as foldouts, fold and place Drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating Drawing titles, descriptions of contents, and drawing locations.

2.3 EMERGENCY MANUALS

A. Content: Organize manual into a separate section for each of the following:
   1. Type of emergency.
   2. Emergency instructions.
   3. Emergency procedures.

B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:
   1. Fire.
   2. Gas leak.
   3. Water leak.
   4. Power failure.
   5. Water outage.
   6. System, subsystem, or equipment failure.

C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.

D. Emergency Procedures: Include the following, as applicable:
   1. Instructions on stopping.
   2. Shutdown instructions for each type of emergency.
   3. Operating instructions for conditions outside normal operating limits.
   4. Required sequences for electric or electronic systems.
   5. Special operating instructions and procedures.

2.4 OPERATION MANUALS

A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
   1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
   2. Performance and design criteria if Contractor has delegated design responsibility.
   3. Operating standards.
   4. Operating procedures.
   5. Operating logs.
   6. Wiring diagrams.
   7. Control diagrams.
   8. Piped system diagrams.
   9. Precautions against improper use.
   10. License requirements including inspection and renewal dates.

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

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

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

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

2.5 PRODUCT MAINTENANCE MANUALS

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

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

C. Product Information: Include the following, as applicable:
   1. Product name and model number.
   2. Manufacturer's name.
   3. Color, pattern, and texture.
   4. Material and chemical composition.
   5. Reordering information for specially manufactured products.

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

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

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

2.6 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

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

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

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

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

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

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

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

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

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

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

B. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.

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

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

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

F. Drawings: Prepare Drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these Drawings with information contained in record Drawings to ensure correct illustration of completed installation.
   1. Do not use original Project record documents as part of operation and maintenance manuals.
   2. Comply with requirements of newly prepared record Drawings in Section 01 78 39 "Project Record Documents."

G. Comply with Section 01 77 00 "Closeout Procedures," for schedule for submitting operation and maintenance documentation.

END OF SECTION

SECTION 01 78 39 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Administrative and procedural requirements for Project record documents, including the following:
      a. Record Drawings.
      b. Record Specifications.
      c. Record Product Data.
      d. Miscellaneous record submittals.

B. Related Requirements:
   1. Texas Facilities Commission – 2015 Uniform General Conditions.
   2. Texas Facilities Commission – Preconstruction Guidelines.
   3. Other Division 01 Specification Sections apply to Work of this Section.
   4. Section 01 70 00 "Execution and Closeout Requirements" for final property survey.
   5. Section 01 77 00 "Closeout Procedures" for general closeout procedures.
   6. Section 01 78 23 "Operation and Maintenance Data" for operation and maintenance manual requirements.

1.2 CLOSEOUT SUBMITTALS

A. Final Acceptance:
   1. Submit copies of record Drawings as follows:
      a. Submit 2 complete sets of professionally drafted “As Constructed” Drawings.
      b. Submit one PDF electronic file.
      c. Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.
   2. Submit 2 complete sets of “As Constructed” Specifications in bound volumes and 2 PDF’s.
   3. Contractor’s written statement regarding disposition of all items and copy of Completed Final Punchlist.
   4. Contractor’s written statement of completion of Final Cleanup.
   5. Written statement from Contractor acknowledging conditions of the Uniform General Conditions, Article 12.3.8, Effect on Warranty.
   6. Acceptance Letter/Certificate from ODR establishing date of Final Completion.
   7. Consent(s) of Surety to Final Payment; original and 1 PDF.
   8. Final Release of Claims and Liens; original and 1 PDF.
   9. Affidavit of Payment of Debit Claims; original and 1 PDF.
   10. Completed SWPPP Documentation and Notice of Termination (NOT); original and one PDF.
   11. Final Historically Underutilized Business (HUB) Plan. One copy in addition to that attached to Final Application for Payment.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

A. Record Prints: During construction, maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised Drawings as modifications are issued.
   1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.
      a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
      b. Accurately record information in an acceptable drawing technique.
      c. Record data as soon as possible after obtaining it.
      d. Record and check the markup before enclosing concealed installations.
      e. Cross-reference record prints to corresponding archive photographic documentation.
   2. Content: Types of items requiring marking include, but are not limited to, the following:
      a. Dimensional changes to Drawings.
      b. Revisions to details shown on Drawings.
      c. Depths of foundations below first floor.
      d. Locations and depths of underground utilities.
      e. Revisions to routing of piping and conduits.
      f. Revisions to electrical circuitry.
      g. Actual equipment locations.
      h. Duct size and routing.
      i. Locations of concealed internal utilities.
      j. Changes made by Change Order or supplemental information / instruction.
      k. Changes made following Architect's written orders.
      l. Details not on the original Contract Drawings.
      m. Field records for variable and concealed conditions.
      n. Record information on the Work that is shown only schematically.
   3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
   4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
   5. Mark important additional information that was either shown schematically or omitted from original Drawings.
   6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

B. Final Format: Record As Constructed Drawings shall be professionally drafted prior to Final Acceptance.
   1. Organize digital data information into separate electronic files that correspond to each sheet of the Contract Documents. Name each file with the sheet identification.
   2. Each electronic file shall include the following:
      a. Project Name.
      b. Date.
      c. Designation “As Constructed.”
      d. Name of Architect.
      e. Name of Contractor.

2.2 RECORD SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
   1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
   2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
   3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
   4. For each principal product, indicate whether record Product Data has been submitted in operation and maintenance manuals instead of submitted as record Product Data.
   5. Note related Change Orders, record Product Data, and record Drawings where applicable.

B. Format: Submit record Specifications as scanned PDF electronic file(s) of marked-up paper copy of Specifications.

2.3 RECORD PRODUCT DATA

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

B. Format: Submit record Product Data as scanned PDF electronic file(s) of marked-up paper copy of Product Data.
   1. Include record Product Data directory organized by Specification Section number and title, electronically linked to each item of record Product Data.

2.4 MISCELLANEOUS RECORD SUBMITTALS

A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.
B. Format: Submit miscellaneous record submittals as scanned PDF electronic file(s) of marked-up miscellaneous record submittals.
   1. Include miscellaneous record submittals directory organized by Specification Section number and title, electronically linked to each item of miscellaneous record submittals.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

A. Recording: Maintain 1 copy of each submittal during the construction period for Project record document purposes. Post changes and revisions to Project record documents as they occur; do not wait until end of Project.
B. Maintenance of Record Documents and Samples: Store record documents and Samples in the field office apart from the Contract Documents used for construction. Do not use Project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to Project record documents for Architect's reference during normal working hours.

END OF SECTION

SECTION 01 79 00 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Administrative and procedural requirements for instructing Owner's personnel, including the following:
      a. Demonstration of operation of systems, subsystems, and equipment when indicated in specific Specification Sections.
      b. Training in operation and maintenance of systems, subsystems, and equipment for the following, but not limited to:
         1) HVAC systems and equipment.
         2) Plumbing systems and equipment.
         3) Electrical systems and equipment.
         4) Items specified in specific Specification Sections.

B. Related Requirements:
   1. Texas Facilities Commission – 2015 Uniform General Conditions.
   2. Texas Facilities Commission – Preconstruction Guidelines.
   3. Other Division 01 Specification Sections apply to Work of this Section.

1.2 SUBMITTALS

A. Training Manuals: Submit manufacturer’s training materials.
   1. Include necessary sections of the O & M documents.
   2. Include additional documents necessary to supplement the O & M documents.
   3. Provide 3 copies of training manuals.

B. Qualification Data: For instructor.

C. Training Reports:
   1. Attendance Record: For each training module, submit date, time, length of instruction time, and a list of participants.

D. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

1.3 QUALITY ASSURANCE

A. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 01 40 00 "Quality Requirements," experienced in operation and maintenance procedures and training.

B. Preconstruction Conference: Conduct conference at Project site. Review methods and procedures related to demonstration and training including, but not limited to, the following:
   1. Inspect and discuss locations and other facilities required for instruction.
   2. Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment, and facilities needed to avoid delays.
   3. Review required content of instruction.
   4. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

1.4 COORDINATION

A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.
B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.
C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Architect.

PART 2 - PRODUCTS

2.1 INSTRUCTION PROGRAM

A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.
B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:
   1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
      a. System, subsystem, and equipment descriptions.
      b. Performance and design criteria if Contractor is delegated design responsibility.
      c. Operating standards.
      d. Regulatory requirements.
      e. Equipment function.
      f. Operating characteristics.
      g. Limiting conditions.
      h. Performance curves.

2. Documentation: Review the following items in detail:
   a. Emergency manuals.
   b. Operations manuals.
   c. Maintenance manuals.
   d. Project record documents.
   e. Identification systems.
   f. Warranties and bonds.
   g. Maintenance service agreements and similar continuing commitments.
3. Emergencies: Include the following, as applicable:
   a. Instructions on meaning of warnings, trouble indications, and error messages.
   b. Instructions on stopping.
   c. Shutdown instructions for each type of emergency.
   d. Operating instructions for conditions outside of normal operating limits.
   e. Sequences for electric or electronic systems.
   f. Special operating instructions and procedures.
4. Operations: Include the following, as applicable:
   a. Startup procedures.
   b. Equipment or system break-in procedures.
   c. Routine and normal operating instructions.
   d. Regulation and control procedures.
   e. Control sequences.
   f. Safety procedures.
   g. Instructions on stopping.
   h. Normal shutdown instructions.
   i. Operating procedures for emergencies.
   j. Operating procedures for system, subsystem, or equipment failure.
   k. Seasonal and weekend operating instructions.
   l. Required sequences for electric or electronic systems.
   m. Special operating instructions and procedures.
5. Adjustments: Include the following:
   a. Alignments.
   b. Checking adjustments.
   c. Noise and vibration adjustments.
   d. Economy and efficiency adjustments.
6. Troubleshooting: Include the following:
   a. Diagnostic instructions.
   b. Test and inspection procedures.
7. Maintenance: Include the following:
   a. Inspection procedures.
   b. Types of cleaning agents to be used and methods of cleaning.
   c. List of cleaning agents and methods of cleaning detrimental to product.
   d. Procedures for routine cleaning.
   e. Procedures for preventive maintenance.
   f. Procedures for routine maintenance.
   g. Instruction on use of special tools.

8. Repairs: Include the following:
    a. Diagnosis instructions.
    b. Repair instructions.
    c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
    d. Instructions for identifying parts and components.
    e. Review of spare parts needed for operation and maintenance.

C. All instructional programs and training modules are to be recorded to DVD video. Provide Owner with 3 DVD's labeled according to training module and recorded date.

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Commissioning Authority will be hired by Mechanical Contractor and directly report to Owner. This section provided for informational purposes only.
   2. Commissioning Authority shall provide services necessary to comply with Section C408 of the 2021 International Energy Conservation Code.
   3. Contractor shall perform and assist in the commissioning process. Perform commissioning in a systematic process to ensure that all building systems perform interactively according to design intent and Owner's operational needs. Commissioning process shall encompass and coordinate separate functions of system documentation, equipment startup, control system calibration, testing and balancing, performance testing, and training.
   4. Commissioning during construction phase is intended to achieve the following specific objectives according to the Contract Documents:
      a. Verify applicable equipment and systems are installed in accordance with manufacturer's recommendations and to industry accepted minimum standards and that they receive adequate operational checkout by installing contractors.
      b. Verify and document proper performance of equipment and systems.
      c. Verify operation and maintenance documentation left on-site is complete.
   5. Commissioning process shall not take away from or reduce responsibility of Contractor to provide finished and fully functioning product.

B. Related Requirements:
   1. Other Division 01 Specification Sections apply to Work of this Section.

1.2 DEFINITIONS

A. Acceptance Phase: Phase of construction after startup and initial checkout when functional performance tests, operation and maintenance documentation review, and training occurs.
B. Approval: Acceptance that a piece of equipment or system has been properly installed and is functioning in tested modes according to Contract Documents.
C. Architect: Prime consultant and subconsultants who comprise design team, generally HVAC Mechanical Designer/Engineer and Electrical Designer/Engineer.
D. Commissioning Authority: Commissioning Authority directs and coordinates day-to-day commissioning activities. Commissioning Authority does not take an oversight role like Construction Manager. Commissioning Authority is part of Construction Manager team or shall report directly to Construction Manager.
E. Commissioning Plan: An overall plan, developed before or after bidding, that provides structure, schedule, and coordination planning for commissioning process.
F. Contractor: Provider of labor, materials, equipment, and services to complete the Work as outlined in the Contract Documents.

G. Control System: Central building energy management control system.

H. Construction Checklist: A list of items to inspect and elementary component tests to conduct to verify proper installation of equipment, provided by Commissioning Authority to subcontractor. Construction checklists are primarily static inspections and procedures to prepare equipment or system for initial operation (e.g., belt tension, oil levels OK, labels affixed, gages in place, sensors calibrated, etc.). However, some construction checklist items entail simple testing of function of a component, a piece of equipment or system (such as measuring voltage imbalance on a three-phase motor). Construction checklists augment and are combined with manufacturer's startup checklist.

I. Construction Manager:
   1. Owner's representative in day-to-day activities of construction. In general, construction management services Contractor is hired by Owner to assist in overall management of Project including supervising and on-site managing authority over a Project's construction. General Contractor reports to Construction Manager. Construction Manager is Owner's on-site representative.
   2. When Commissioning Authority is hired by Contractor or Architect, Construction Manager referred to in commissioning process is a member of Construction Manager team (staff or independent contractor) who shall have direct significant mechanical engineering and commissioning experience. That person designated from Construction Manager team is Owner's Representative verifying adequacy of commissioning process. In this case, Construction Manager will be more involved in commissioning work and in witnessing portions of process (selected startup and functional tests) and reviewing documents (test approvals, etc.) than in following case.
   3. When Commissioning Authority is hired by Construction Manager (on staff or as a subcontractor), or directly by Owner, there may not need to be another Construction Manager representative reviewing and approving work of Commissioning Authority, other than schedule approvals and consultation during problem solving. In that case, references to Construction Manager in these Specifications would actually mean Commissioning Authority, except that Commissioning Authority progress reports would go to Project Manager rather than Construction Manager.

J. Deferred Functional Tests: Functional tests that are performed later, after Substantial Completion, due to partial occupancy, equipment, seasonal requirements, design or other site conditions that disallow test from being performed.

K. Deficiency: A condition in installation or function of a component, piece of equipment, or system that is not in compliance with Contract Documents (that is, does not perform properly or is not complying with design intent).

L. Design Intent: A dynamic document that provides explanation of ideas, concepts and criteria that are considered to be very important to owner. It is initially outcome of programming and conceptual design phases.

M. Design Narrative or Design Documentation: Sections of either Design Intent or Basis of Design.

N. Factory Testing: Testing of equipment on-site or at factory by factory personnel with Owner's Representative present.

O. Functional Performance Test: Test of dynamic function and operation of equipment and systems using manual (direct observation) or monitoring methods. Functional testing is dynamic testing of systems (rather than just components) under full operation (e.g., chiller pump is tested interactively with chiller functions to see if pump ramps up and down to maintain differential pressure setpoint). Systems are tested under various modes, such as during low cooling or heating loads, high loads, component failures, unoccupied, varying outside air temperatures, fire alarm, power failure, etc. Systems are run through all control system's sequences of operation and components are verified to be responding as sequences state. Traditional air or water test and balancing is not functional testing, in the commissioning sense of the word. Testing and balancing contractor's primary work is setting up system flows and pressures as specified, while functional testing is verifying that which has already been set up. Commissioning Authority develops functional test procedures in a sequential written form, coordinates, oversees and documents actual testing, which is usually performed by installing contractor or vendor. Functional tests are performed after construction checklists, and startup are complete.

P. Indirect Indicators: Indicators of a response or condition, such as a reading from a control system screen reporting a damper to be 100 percent closed.

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

R. Monitoring: Recording of parameters (flow, current, status, pressure, etc.) of equipment operation using data loggers or trending capabilities of control systems.

S. Noncompliance: See "Deficiency."

T. Nonconformance: See "Deficiency."

U. Overwritten Value: Writing over a sensor value in control system to see response of a system (e.g., changing outside air temperature value from 50 to 75 degrees F to verify economizer operation). See also "Simulated Signal."

V. Owner-Contracted Tests: Tests paid for by Owner outside of the Agreement with Contractor and for which Commissioning Authority does not oversee. Tests will not be repeated during functional tests if properly documented.

W. Phased Commissioning: Commissioning that is completed in phases (by floors, for example) due to size of structure or other scheduling issues, in order minimize total construction time.

X. Project Manager: Contracting and managing authority for Owner over design and/or construction of Project, a staff position.

Y. Sampling: Functionally testing only a fraction of total number of identical or near identical pieces of equipment. Refer to article "Functional Performance Testing" for additional details.

Z. Seasonal Performance Tests: Functional Tests that are deferred until system(s) will experience conditions closer to their design conditions.

AA. Simulated Condition: Condition that is created for purpose of testing response of a system (e.g., applying a hair blower to a space sensor to see response in a VAV box).

BB. Simulated Signal: Disconnecting a sensor and using a signal generator to send an amperage, resistance, or pressure to transducer and DDC system to simulate a sensor value.

CC. Startup: Initial starting or activating of dynamic equipment, including executing construction checklists.
DD. Subcontractors: Specialty contractors who hold contracts with Contractor to furnish and install building components and systems.
EE. Test Procedures: Step-by-step process which must be executed to fulfill test requirements. The test procedures are developed by Commissioning Authority.
FF. Test Requirements: Requirements specifying what modes and functions, etc., shall be tested. The test requirements are not detailed test procedures. The test requirements are specified in Contract Documents.
GG. Trending: Monitoring using building control system.
HH. Vendor: Supplier of equipment.

1.3 SUBMITTALS

A. Commissioning Authority will provide appropriate subcontractors with specific request for type of submittal documentation Commissioning Authority requires to facilitate commissioning work. Requests will be integrated into normal submittal process and protocol of construction team. At minimum, request will include manufacturer and model number, manufacturer's printed installation and detailed startup procedures, full sequences of operation, operation and maintenance data, performance data, any performance test procedures, Control Drawings and details of Owner-contracted tests. In addition, installation and checkout materials that are actually shipped inside equipment and actual field checkout sheet forms to be used by factory or field technicians shall be submitted to Commissioning authority. All documentation requested by Commissioning Authority will be included by subcontractors in their operation and maintenance data manual contributions.
B. Commissioning Authority will review submittals related to commissioned equipment for conformance to Contract Documents as it relates to commissioning process, to functional performance of equipment, and adequacy for developing test procedures. Review will be primarily to aid in development of functional testing procedures and only secondarily to verify compliance with equipment specifications. Commissioning Authority will notify Construction Manager, Project Manager, or Architect as requested, of items missing or areas that are not in conformance with Contract Documents and which require resubmission.
C. Commissioning Authority may request additional design narrative from Architect and controls contractor, depending on completeness of design intent documentation and sequences provided with Specifications.
D. Submittals to Commissioning Authority do not constitute compliance for operation and maintenance manual documentation. Operation and maintenance manuals are responsibility of Contractor, though Commissioning Authority will review them.

E. Written Work Products: Commissioning process generates a number of written work products described in various parts of Specifications. Commissioning plan lists all formal written work products, describes briefly their contents, who is responsible to create them, their due dates, who receives and approves them and location of specification to create them. Written products are:

Product	Developed By
Final commissioning plan	Commissioning Authority
Commissioning meeting minutes	Commissioning Authority
Commissioning schedules	Commissioning Authority with Contractor and Project Manager / Construction Manager
Equipment documentation submittals	Subcontractors
Sequence clarifications	Subcontractors and Architect as needed
Construction checklists	Commissioning Authority
Startup and initial checkout plan	Subcontractors and Commissioning Authority (compilation of existing documents)
Startup and initial checkout forms filled out	Subcontractors
Final TAB report	TAB Subcontractor
Issues log (deficiencies)	Commissioning Authority
Commissioning Progress Record	Commissioning Authority
Deficiency reports	Commissioning Authority
Functional test forms	Commissioning Authority
Filled out functional tests	Commissioning Authority with Contractor
O&M manuals	Subcontractors
Commissioning record book	Commissioning Authority
Final commissioning report	Commissioning Authority
Misc. approvals	Commissioning Authority

1.4 QUALITY ASSURANCE

A. Meetings:
1. Scoping Meeting: Within 14 days of commencement of construction, Commissioning Authority will schedule, plan, and conduct a commissioning scoping meeting with entire commissioning team in attendance. Meeting minutes will be distributed to all parties by Commissioning Authority. Information gathered from this meeting will allow Commissioning Authority to revise commissioning plan to its “final” version, which will also be distributed to all parties.

2. Miscellaneous Meetings: Other meetings will be planned and conducted by Commissioning Authority as construction progresses. Meetings will cover coordination, deficiency resolution, and planning issues with particular subcontractors. Commissioning Authority will plan meetings and will minimize unnecessary time being spent by subcontractors. For large projects, meetings may be held monthly, until final three months of construction when they may be held as frequently as one per week.

B. Coordination:
1. Members of commissioning team shall consist of Commissioning Authority, Project Manager, designated representative of Owner's Construction Management firm, Contractor, Architect, and design engineers (particularly mechanical engineer), mechanical subcontractor, electrical subcontractor, testing and balancing representative, controls subcontractor, and other installing subcontractors or vendors. Owner's building or plant operator/engineer shall also be a member of commissioning team.
2. Management: Commissioning Authority shall direct and coordinate commissioning activities and report to the Construction Manager, Project Manager and Owner. Members of commissioning team shall work together to fulfill their contracted responsibilities and meet objectives of the Contract Documents.

C. Reporting:
1. Commissioning Authority will provide regular reports to Construction Manager, Project Manager, or Owner, depending on management structure, with increasing frequency as construction and commissioning progresses. Standard forms are provided and referenced in commissioning plan.
2. Commissioning Authority will regularly communicate with all members of commissioning team, keeping them apprised of commissioning progress and scheduling changes through memos, progress reports, etc.
3. Testing or review approvals and nonconformance and deficiency reports are made regularly with review and testing as described in later Sections.
4. Final summary report by Commissioning Authority will be provided to Construction Manager, Project Manager, or Owner, focusing on evaluating commissioning process issues and identifying areas where process could be improved. Acquired documentation, logs, minutes, reports, deficiency lists, communications, findings, unresolved issues, etc., will be compiled in appendices and provided with summary report. Construction checklists, functional tests, and monitoring reports will not be part of final report, but will be stored in Commissioning Record in operation and maintenance manuals.

1.5 ENGINEER'S RESPONSIBILITIES

A. Construction and Acceptance Phase:
1. Perform normal submittal review, construction observation, etc., as contracted. On-site observation shall be completed just prior to system startup.

2. Provide design narrative and sequences documentation requested by Commissioning Authority. Engineer shall assist (along with subcontractors) in clarifying operation and control of commissioned equipment in areas where Specifications, Control Drawings, or equipment documentation is not sufficient for writing detailed testing procedures.
3. Attend commissioning scoping meetings and other selected commissioning team meetings.
4. Participate in resolution of system deficiencies identified during commissioning, according to Contract Documents.
5. Witness testing of selected pieces of equipment and systems: for example, air handlers, exhaust fans, controls systems, etc., if requested.

B. Warranty Period: Participate in resolution of noncompliance, nonconformance, and design deficiencies identified during commissioning during warranty period commissioning.

C. Attend commissioning scoping meeting and additional meetings, as necessary.

D. Follow commissioning plan.

1.6 COMMISSIONING AUTHORITY'S RESPONSIBILITIES

A. Commissioning Authority shall not be responsible for design concept, design criteria, compliance with codes, design or general construction scheduling, cost estimating, or construction management. Commissioning Authority may assist with problem-solving, nonconformance, or deficiencies. Primary role of Commissioning Authority shall be to develop and coordinate execution of testing plan, observe, and document performance that systems are functioning in accordance with documented design intent and in accordance with Contract Documents. Contractor shall provide tools and labor to start, check-out and functionally test equipment and systems.

B. Construction and Acceptance Phase:
1. Coordinate and direct commissioning activities in a logical, sequential, and efficient manner using consistent protocols and forms, centralized documentation, clear and regular communications and consultations with necessary parties, frequently updated timelines and schedules, and technical expertise.
2. Coordinate commissioning work and, with Contractor and Project/Construction Manager, ensure that commissioning activities are being scheduled into master schedule.
3. Revise commissioning plan as necessary.
4. Plan and conduct commissioning scoping meeting and other commissioning meetings.
5. Request and review additional information required to perform commissioning tasks, including operation and maintenance materials, Contractor startup, and checkout procedures.
6. Before startup, gather and review current control sequences and interlocks and work with subcontractors and design engineers until sufficient clarity has been obtained, in writing, to be able to write detailed testing procedures.
7. Review Contractor submittals applicable to systems being commissioned for compliance with commissioning needs, concurrent with Architect reviews.
8. Write and distribute construction checklists.

9. Perform site visits, as necessary, to observe component and system installations. Attend selected planning and job-site meetings to obtain information on construction progress. Review construction meeting minutes for revisions/substitutions relating to commissioning process. Assist in resolving any discrepancies.
10. Notify Owner of pre-functional tests and construction checklist completion by reviewing prefunctional checklist reports and by selected site observation and spot checking.
11. Notify Owner of systems startup by reviewing startup reports and by selected site observation.
12. With necessary assistance and review from installing subcontractors, write functional performance test procedures for equipment and systems. Test procedures may include energy management control system trending, stand-alone data logger monitoring, or manual functional testing. Submit to Owner for review, and for approval if required.
13. Analyze functional performance trend logs and monitoring data to verify performance.
14. Coordinate and witness functional performance tests performed by installing subcontractors. Coordinate retesting as necessary until satisfactory performance is achieved.
15. Maintain master deficiency and resolution log and separate testing record. Provide Owner with written progress reports and test results with recommended actions.
16. Compile and maintain commissioning record and building systems book(s).
17. Review operation and maintenance manuals.
18. Provide final commissioning report.

C. Warranty Period:
1. Coordinate and supervise required seasonal or deferred testing and deficiency corrections.
2. Prepare and submit final Commission Record report to Owner.

D. Attend commissioning scoping meeting and additional meetings, as necessary.

E. Follow commissioning plan.

1.7 CONSTRUCTION MANAGER'S RESPONSIBILITIES

A. Construction and Acceptance Phase:
1. Facilitate coordination of commissioning work by Commissioning Authority, and, with Contractor and Commissioning Authority, ensure that commissioning activities are being scheduled into master schedule.
2. Attend commissioning scoping meeting and other commissioning team meetings.
3. Perform normal review of Contractor submittals.
4. Furnish copy of construction documents, addenda, change orders and approved submittals and Shop Drawings related to commissioned equipment to Commissioning Authority.
5. Prior to testing, review and approve functional performance test procedures submitted by Commissioning Authority.
6. When necessary, observe and witness construction checklists, startup and functional testing of selected equipment.

7. Review commissioning progress and deficiency reports.
8. Coordinate resolution of noncompliance and design deficiencies identified in all phases of commissioning.
9. Sign-off (final approval) on individual commissioning tests as completed and passing. Recommend completion of commissioning process to Project Manager.
10. Assist Contractor in coordinating training of Owner personnel.

B. Warranty period: Assist Commissioning Authority as necessary in seasonal or deferred testing and deficiency corrections required by Specifications.
C. Attend commissioning scoping meeting and additional meetings, as necessary.
D. Follow commissioning plan.

1.8 OWNER'S PROJECT MANAGER'S RESPONSIBILITIES

A. Construction and Acceptance Phase:
1. Manage contract of Architect and of Contractor.
2. Arrange for facility operating and maintenance personnel to attend various field commissioning activities and field training sessions according to commissioning plan - construction phase.
3. Provide final approval for completion of commissioning work.

B. Warranty period: Ensure seasonal or deferred testing and deficiency issues are addressed.
C. Attend commissioning scoping meeting and additional meetings, as necessary.
D. Follow commissioning plan.

1.9 CONTRACTOR'S RESPONSIBILITIES

A. Construction and Acceptance Phase:
1. Facilitate coordination of commissioning work by Commissioning Authority, and, with Commissioning Authority, ensure that commissioning activities are being scheduled into master schedule.
2. Include cost of commissioning in total Contract Price.
3. Furnish copy of construction documents, addenda, change orders and approved submittals and Shop Drawings related to commissioned equipment to Commissioning Authority.
4. In each Purchase Order or subcontract written, include requirements for submittal data, operation and maintenance data, commissioning tasks and training.
5. Ensure subcontractors execute commissioning responsibilities according to Contract Documents and schedule.
6. Representative shall attend commissioning scoping meeting and other necessary meetings scheduled by Commissioning Authority to facilitate commissioning process.
7. Coordinate training of Owner's personnel.
8. Prepare operation and maintenance manuals, according to Contract Documents, including clarifying and updating original sequences of operation to record "as-built" conditions.

B. Warranty Period:
   1. Ensure subcontractors execute seasonal or deferred functional performance testing, witnessed by Commissioning Authority, according to Contract Documents.
   2. Ensure subcontractors correct deficiencies and make necessary adjustments to operation and maintenance manuals and “as-built” Record Drawings for applicable issues identified in seasonal testing.
C. Attend commissioning scoping meeting and additional meetings, as necessary.
D. Follow commissioning plan.

1.10 VENDOR’S RESPONSIBILITIES

A. Provide requested submittal data, including detailed startup procedures and specific responsibilities of Owner to keep warranties in force.
B. Assist in equipment testing per agreements with subcontractors.
C. Include special tools and instruments (only available from vendor, specific to a piece of equipment) required for testing equipment in accordance with Contract Documents in bid price, except for standalone data logging equipment that may be used by Commissioning Authority.
D. Analyze specified products and verify that designer has specified newest most updated equipment reasonable for Project’s scope and budget.
E. Provide information requested by Commissioning Authority regarding equipment sequence of operation and testing procedures.
F. Review test procedures for equipment installed by manufacturer’s factory representatives.
G. Attend commissioning scoping meeting and additional meetings, as necessary.
H. Follow commissioning plan.

1.11 SCHEDULING

A. Commissioning Authority shall work with Owner and Contractor according to established protocols to schedule commissioning activities. Commissioning Authority shall provide sufficient notice to Owner and Contractor for scheduling commissioning activities. Contractor shall integrate commissioning activities into master schedule. Commissioning Authority, Owner, and Contractor shall address scheduling problems and make necessary notifications in timely manner in order to expedite commissioning process.
B. Commissioning Authority shall provide initial schedule of primary commissioning events at commissioning scoping meeting. Commissioning plan shall provide format for schedule. As construction progresses, more detailed schedules shall be developed by Commissioning Authority. Commissioning plan shall also provide format for detailed schedules.

1.12 OWNER’S INSTRUCTION

A. Contractor shall be responsible for training coordination and scheduling and ultimately for ensuring training is completed.

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

A. Standard testing equipment required to perform startup and initial checkout and required functional performance testing shall be provided by each contractor for equipment being tested. For example, mechanical subcontractor shall ultimately be responsible for standard testing equipment for HVAC system and controls system, except for equipment specific to and used by testing and balancing contractor in their commissioning responsibilities. Two-way radios shall be provided by Contractor for equipment being tested.

B. Special equipment, tools and instruments which are only available from vendor, specific to a piece of equipment and required for testing equipment shall be provided, left on site, and shall become property of Owner.

C. Testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance with tolerances specified.

PART 3 - EXECUTION

3.1 COMMISSIONING PROCESS

A. Commissioning plan shall provide guidance in execution of commissioning process. Immediately after initial commissioning scoping meeting, Commissioning Authority will update plan submitted with Bid which is then considered “final” plan. Plan will continue to evolve and expand as Project progresses.

B. Commissioning Tasks and Sequence:

1. Commissioning during construction shall begin with scoping meeting conducted by Commissioning Authority to review commissioning process with commissioning team members.
2. Additional meetings required during construction shall be scheduled by Commissioning Authority with necessary parties attending, to plan, scope, coordinate, schedule future activities and resolve problems.
3. Equipment documentation shall be submitted to Commissioning Authority during normal submittals, including detailed startup procedures.
4. Commissioning Authority shall work with subcontractors in developing startup plans and startup documentation formats, including providing subcontractors with construction checklists to be completed, during startup process.
5. Checkout and performance verification shall proceed from simple to complex; from component level to equipment to systems and intersystem levels with construction checklists being completed before functional testing.
6. Subcontractors shall execute and document construction checklists and perform startup and initial checkout. Commissioning Authority shall document that checklists and startup were completed according to approved plans. Commissioning Authority may witness startup of selected equipment.
7. Commissioning Authority shall develop specific equipment and system functional performance test procedures. Subcontractors shall review procedures.

8. Procedures shall be executed by subcontractors, under direction of, and documented by Commissioning Authority.
9. Items of noncompliance in material, installation, or setup shall be corrected at subcontractor's expense and system shall be retested.
10. Commissioning Authority shall review operation and maintenance documentation for completeness.
11. Commissioning shall be completed prior to Substantial Completion.
12. Deferred testing shall be conducted, as specified or required.

3.2 STARTUP, CONSTRUCTION CHECKLISTS, AND INITIAL CHECKOUT

A. Perform following procedures on equipment to be commissioned. Some systems that are not comprised, e.g., electrical system power quality, may have very simplified construction checklists and startup.

B. Construction checklists shall verify that equipment and systems are hooked up and operational. It ensures that functional performance testing (in-depth system checkout) may proceed without unnecessary delays. Each piece of equipment receives full checkout. No sampling strategies are used. Prefunctional testing for a given system must be successfully completed prior to formal functional performance testing of equipment or subsystems of given system.

3.3 FUNCTIONAL PERFORMANCE TESTING

A. Functional performance testing shall demonstrate that each system is operating in accordance with documented design intent and Contract Documents. Functional testing shall facilitate bringing systems from state of Substantial Completion to full dynamic operation. During testing process, areas of deficient performance shall be identified and corrected, improving operation and functioning of systems.

B. Each system shall be operated through all modes of operation (seasonal, occupied, unoccupied, warm-up, cool-down, part- and full-load) where there is a specified system response. Verify each sequence in sequences of operation is required. Development of test procedures: Before test procedures are written, Commissioning Authority shall obtain all requested documentation and a current list of change orders affecting equipment or systems, including an updated points list, program code, control sequences and parameters. Commissioning Authority shall develop specific test procedures and forms to verify and document proper operation of each piece of equipment and system. Each subcontractor or vendor responsible to execute a test shall provide limited assistance to Commissioning Authority in developing procedures review (answering questions about equipment, operation, sequences, etc.). Prior to execution, Commissioning Authority shall provide a copy of test procedures to subcontractor(s) who shall review tests for feasibility, safety, equipment and warranty protection. Commissioning Authority may submit tests to Architect for review, if requested.

C. Commissioning Authority shall review Owner-contracted, factory testing or required Owner acceptance tests which Commissioning Authority is not responsible to oversee, including documentation format, and shall determine what further testing or format changes may be required to comply with Specifications. Redundancy of testing shall be minimized.

3.4 PHASED COMMISSIONING

A. Startup and initial checkout may be executed in phases.
B. Phasing shall be planned and scheduled during coordination meeting of Commissioning Authority, Construction Manager, Contractor and mechanical, testing and balancing, and controls contractors.
C. Results shall be incorporated into master and commissioning schedule.

3.5 FINAL DOCUMENTATION

A. Standard operation and maintenance manuals: Specific content and format requirements for standard operation and maintenance manuals shall be as specified in Section 01 70 00 "Execution and Closeout Requirements."
B. Final report details: Final commissioning report shall include executive summary, list of participants and roles, brief system description, overview of commissioning and testing scope and a general description of testing and verification methods. For each piece of commissioned equipment, report shall contain disposition of commissioning authority regarding adequacy of equipment, documentation and training meeting Contract Documents in following areas:
    1. Equipment meeting equipment Specifications.
    2. Equipment installation.
    3. Functional performance and efficiency.
    4. Equipment documentation and design intent.
C. Outstanding noncompliance items shall be specifically listed. Recommendations for improvement to equipment or operations, future actions, commissioning process changes, etc. shall also be listed.
D. Each noncompliance issue shall be referenced to specific functional test, inspection, trend log, etc. where deficiency is documented.
E. Functional performance and efficiency section for each piece of equipment shall include brief description of verification method used (manual testing, BAS trend logs, data loggers, etc.) and include observations and conclusions from testing.
F. Other documentation will be retained by Commissioning Authority.

END OF SECTION

SECTION 02 41 13 – SELECTIVE SITE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Methods and procedures for demolishing, salvaging, recycling and removing sitework items designated to be removed in whole or in part, and for backfilling resulting trenches and excavations.
B. Related Requirements:
   1. Division 01 Specification Sections apply to the Work of this Section.

1.2 SUBMITTALS

A. Shop Drawings:
   1. Submit for approval Drawings, diagrams or details showing sequence of demolition work and supporting structures and underpinning, where required by authorities having jurisdiction.
   2. Submit Drawings stamped and signed by qualified Professional Engineer licensed in the state of Texas.
B. Hazardous Materials: provide description of Hazardous Materials and Notification of Filing with proper authorities prior to beginning of Work as required.
C. Submit plan indicating:
   1. Descriptions of and anticipated quantities of materials to be salvaged, reused, recycled and landfilled.
   2. Schedule of selective demolition.
   3. Number and location of dumpsters.
   4. Anticipated frequency of tippage.
D. Submit copies of certified weigh bills, bills of lading from authorized disposal sites and reuse and recycling facilities for material removed upon request from Owner's Representative.

1.3 QUALITY ASSURANCE

A. Convene pre-installation meeting one week prior to beginning Work of this Section to:
   1. Verify project requirements.
   2. Review installation and substrate conditions.
   3. Co-ordination with building subtrades.
B. Arrange for site visit with Owner's Representative to examine existing site conditions adjacent to demolition work, prior to start of Work.
C. Hold Project meetings every month.
   1. Ensure key personnel, site supervisor, Project Manager, subcontractor representatives attend.

1.4 DELIVERY, STORAGE AND HANDLING

A. Protect existing items designated to remain and items designated for salvage. In event of damage to such items, immediately replace or make repairs to approval of Owner's Representative and at no cost to Owner's Representative.
B. Remove and store materials to be salvaged, in manner to prevent damage.
C. Store and protect in accordance with requirements for maximum preservation of material.

1.5 SITE CONDITIONS

A. In all circumstances ensure that demolition work does not adversely affect adjacent water courses groundwater and wildlife or contribute to excess air and noise pollution.
B. Do not dispose, of waste or volatile materials such as mineral spirits, oil, petroleum-based lubricants, or toxic cleaning solutions into watercourses, storm or sanitary sewers. Ensure proper disposal procedures are maintained throughout Project.
C. Do not pump water containing suspended materials into watercourses, storm or sanitary sewers, or onto adjacent properties.
D. Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with local authorities.
E. Protect trees, plants and foliage on site and adjacent properties where indicated.

1.6 EXISTING CONDITIONS

A. Prior to start of any demolition work remove contaminated or hazardous materials as defined by authorities having jurisdiction from site and dispose of at designated disposal facilities

1.7 SCHEDULING

A. Employ necessary means to meet project timelines without compromising specified minimum rates of material diversion.
B. Notify Owner's Representative in writing when unforeseen delays occur.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 PREPARATION

A. Inspect site with Owner's Representative and verify extent and location of items designated for removal, disposal, alternative disposal, recycling, salvage and items to remain.
B. Locate and protect utilities. Preserve active utilities traversing site in operating condition.
C. Notify and obtain approval of utility companies before starting demolition.

3.2 REMOVAL OPERATIONS

A. Remove items as indicated.
B. Do not disturb items designated to remain in place.
C. Removal of Pavements, Curbs and Gutters:
    1. Square up adjacent surfaces to remain in place by saw cutting or other method approved by Owner's Representative.
    2. Protect adjacent joints and load transfer devices.
    3. Protect underlying and adjacent granular material.
D. When removing asphalt pavement for subsequent incorporation into hot mix asphalt concrete paving, prevent contamination with base course aggregates.
E. When removing pipes under existing or future pavement area, excavate at least 12 inches below pipe invert.
F. Decommission water wells and monitoring wells in accordance with state guidelines and regulations.
G. Removal from site:
    1. Interim removal of stockpiled material will be required by Owner's Representative, if it is deemed to interfere with operations of Owner's Representative, Owner, or other Contractors.
H. Sealing:
    1. Seal pipe ends and walls of manholes or catch basins as indicated. Securely plug to form watertight seal.
I. Backfill:
    1. Backfill in areas as indicated.

3.3 RESTORATION

A. Restore areas and existing works outside areas of demolition to match conditions of adjacent, undisturbed areas.
B. Use soil treatments and procedures which are not harmful to health, are not injurious to plants, and do not endanger wildlife, adjacent water courses or ground water.

3.4 CLEAN UP

A. Upon completion of Work, remove debris, trim surfaces and leave work site clean.
B. Use cleaning solutions and procedures which are not harmful to health, are not injurious to plants, and do not endanger wildlife, adjacent water courses or ground water.

END OF SECTION

SECTION 03 10 00 - CONCRETE FORMING AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Form-facing material for cast-in-place concrete.
   2. Shoring, bracing, and anchoring.
B. Related Requirements:
   1. Division 01 Specification Sections apply to Work of this Section.

1.2 DEFINITIONS

A. Form-Facing Material: Temporary structure or mold for the support of concrete while the concrete is setting and gaining sufficient strength to be self-supporting.
B. Formwork: The total system of support of freshly placed concrete, including the mold or sheathing that contacts the concrete, as well as supporting members, hardware, and necessary bracing.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Concrete Formwork: Design, engineer, erect, shore, brace, and maintain formwork, shores, and reshores in accordance with ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads, so that resulting concrete conforms to the required shapes, lines, and dimensions.
   1. Design wood panel forms in accordance with APA's "Concrete Forming Design/Construction Guide."
   2. Design formwork to limit deflection of form-facing material to 1/240 of center-to-center spacing of supports.
B. Design, engineer, erect, shore, brace, and maintain insulating concrete forms in accordance with ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads, so that resulting concrete conforms to the required shapes, lines, and dimensions.

2.2 FORM-FACING MATERIALS

A. As-Cast Surface Form-Facing Material:
   1. Provide continuous, true, and smooth concrete surfaces.
   2. Furnish in largest practicable sizes to minimize number of joints.

3. Acceptable Materials: As required to comply with Surface Finish designations specified in Section 03 30 00 "Cast-In-Place Concrete, and as follows:
    a. Plywood, metal, or other approved panel materials.
    b. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
        1) APA HDO (high-density overlay).
        2) APA MDO (medium-density overlay); mill-release agent treated and edge sealed.
        3) APA Structural 1 Plyform, B-B or better; mill oiled and edge sealed.
        4) APA Plyform Class I, B-B or better; mill oiled and edge sealed.

B. Concealed Surface Form-Facing Material: Lumber, plywood, metal, plastic, or another approved material.
    1. Provide lumber dressed on at least 2 edges and 1 side for tight fit.

2.3 RELATED MATERIALS

A. Reglets: Fabricate reglets of not less than 0.022-inch thick, galvanized-steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.
B. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4- by 3/4-inch, minimum.
C. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.
D. Form-Release Agent: Commercially formulated form-release agent that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces.
    1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
    2. Form release agent for form liners shall be acceptable to form liner manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION OF FORMWORK

A. Comply with ACI 301.
B. Construct formwork, so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117 and to comply with the Surface Finish designations specified in Section 03 30 00 "Cast-In-Place Concrete" for as-cast finishes.
C. Limit concrete surface irregularities as follows:
    1. Surface Finish-2.0: ACI 117 Class B, 1/4-inch.
D. Construct forms tight enough to prevent loss of concrete mortar.
    1. Minimize joints.
    2. Exposed Concrete: Symmetrically align joints in forms.

E. Construct removable forms for easy removal without hammering or prying against concrete surfaces.
   1. Provide crush or wrecking plates where stripping may damage cast-concrete surfaces.
   2. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
   3. Install keyways, reglets, recesses, and other accessories, for easy removal.

F. Do not use rust-stained, steel, form-facing material.

G. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces.
   1. Provide and secure units to support screed strips
   2. Use strike-off templates or compacting-type screeds.

H. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible.
   1. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar.
   2. Locate temporary openings in forms at inconspicuous locations.

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

J. At construction joints, overlap forms onto previously placed concrete not less than 12 inches.

K. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work.
   1. Determine sizes and locations from trades providing such items.
   2. Obtain written approval of Architect prior to forming openings not indicated on Drawings.

L. Construction and Movement Joints:
   1. Construct joints true to line with faces perpendicular to surface plane of concrete.
   2. Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
   3. Place joints perpendicular to main reinforcement.
   4. Locate joints for beams, slabs, joists, and girders in the middle third of spans.
      a. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
   5. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
   6. Space vertical joints in walls as indicated on Drawings.
      a. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.

M. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection.
   1. Locate ports and openings in bottom of vertical forms, in inconspicuous location, to allow flushing water to drain.
   2. Close temporary ports and openings with tight-fitting panels, flush with inside face of form, and neatly fitted, so joints will not be apparent in exposed concrete surfaces.

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

O. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
P. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 INSTALLATION OF EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete.
   1. Use setting Drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC 303.
   3. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
   4. Install dovetail anchor slots in concrete structures, as indicated on Drawings.
   5. Clean embedded items immediately prior to concrete placement.

3.3 REMOVING AND REUSING FORMS

A. Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 degrees F for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations, and curing and protection operations need to be maintained.
   1. Leave formwork for beam soffits, joists, slabs, and other structural elements that support weight of concrete in place until concrete has achieved at least 70 percent of its 28-day design compressive strength.
   2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
B. Clean and repair surfaces of forms to be reused in the Work.
   1. Split, frayed, delaminated, or otherwise damaged form-facing material are unacceptable for exposed surfaces.
   2. Apply new form-release agent.
C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints.
   1. Align and secure joints to avoid offsets.
   2. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.4 SHORING AND RESHORING INSTALLATION

A. Comply with ACI 318 and ACI 301 for design, installation, and removal of shoring and reshoring.
   1. Do not remove shoring or reshoring until measurement of slab tolerances is complete.

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

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

3.5 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Inspections:

1. Inspect formwork for shape, location, and dimensions of the concrete member being formed.
2. Inspect insulating concrete forms for shape, location, and dimensions of the concrete member being formed.

END OF SECTION

SECTION 03 20 00 - CONCRETE REINFORCING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Steel reinforcement bars.
B. Related Requirements:
   1. Division 01 Specification Sections apply to Work of this Section.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project Site.
   1. Review the following:
      a. Special inspection and testing and inspecting agency procedures for field quality control.
      b. Construction contraction and isolation joints.
      c. Steel-reinforcement installation.

1.3 ACTION SUBMITTALS

A. Product Data: For the following:
   1. Each type of steel reinforcement.
   2. Bar supports.
B. Shop Drawings: Comply with ACI SP-066:
   1. Include placing Drawings that detail fabrication, bending, and placement.
   2. Include bar sizes, lengths, materials, grades, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, location of splices, lengths of lap splices, details of mechanical splice couplers, details of welding splices, tie spacing, hoop spacing, and supports for concrete reinforcement.
C. Construction Joint Layout: Indicate proposed construction joints required to build the structure.
   1. Location of construction joints is subject to approval of the Architect.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified in accordance with ASTM C1077 and ASTM E329 for testing indicated.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.
   1. Store reinforcement to avoid contact with earth.
   2. Do not allow dual-coated reinforcement to be stored outdoors for more than 60 days without being stored under an opaque covering.
   3. Do not allow stainless steel reinforcement to come into contact with uncoated reinforcement.

PART 2 - PRODUCTS

2.1 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A615, Grade 60, deformed.
B. Low-Alloy Steel Reinforcing Bars: ASTM A706, deformed.

2.2 REINFORCEMENT ACCESSORIES

A. Joint Dowel Bars: ASTM A615, Grade 60, plain-steel bars, cut true to length with ends square and free of burrs.
B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place.
   1. Manufacture bar supports from steel wire, plastic, or precast concrete in accordance with CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
      a. For concrete surfaces exposed to view, where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire, all-plastic bar supports, or CRSI Class 2 stainless steel bar supports.

2.3 FABRICATING REINFORCEMENT

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

PART 3 - EXECUTION

3.1 PREPARATION

A. Protection of In-Place Conditions:
   1. Do not cut or puncture vapor retarder.
   2. Repair damage and reseal vapor retarder before placing concrete.
B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.

3.2 INSTALLATION OF STEEL REINFORCEMENT

A. Comply with CRSI's "Manual of Standard Practice" for placing and supporting reinforcement.
B. Accurately position, support, and secure reinforcement against displacement.
   1. Locate and support reinforcement with bar supports to maintain minimum concrete cover.
   2. Do not tack weld crossing reinforcing bars.
C. Preserve clearance between bars of not less than 1-inch, not less than 1 bar diameter, or not less than 1-1/3 times size of large aggregate, whichever is greater.
D. Provide concrete coverage in accordance with ACI 318.
E. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
F. Splices: Lap splices as indicated on Drawings.
   1. Bars indicated to be continuous, and all vertical bars shall be lapped as indicated in Drawings.
   2. Stagger splices in accordance with ACI 318.

3.3 JOINTS

A. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
   1. Place joints perpendicular to main reinforcement.
   2. Continue reinforcement across construction joints unless otherwise indicated.
   3. Do not continue reinforcement through sides of strip placements of floors and slabs.
B. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat 1/2 of dowel length, to prevent concrete bonding to 1 side of joint.

3.4 INSTALLATION TOLERANCES

A. Comply with ACI 117.

3.5 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

END OF SECTION

SECTION 03 30 00 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Cast-in-place concrete, including concrete materials, mixture design, placement procedures, and finishes.

B. Related Requirements:
1. Division 01 Specification Sections apply to Work of this Section.
2. Section 03 10 00 "Concrete Forming and Accessories" for form-facing materials, form liners, insulating concrete forms, and waterstops.
3. Section 03 20 00 "Concrete Reinforcing" for steel reinforcing bars and welded-wire reinforcement.
4. Section 31 20 00.10 "Earth Moving for Facility" for drainage fill under slabs-on-ground.

1.2 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with 1 or more of the following: blended hydraulic cement, fly ash, slag cement, other pozzolans, and silica fume; materials subject to compliance with requirements.

B. Water/Cement Ratio (w/cm): The ratio by weight of water to cementitious materials.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project Site.
1. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
a. Contractor's superintendent.
b. Independent testing agency responsible for concrete design mixtures.
c. Ready-mix concrete manufacturer.
d. Concrete Subcontractor.
2. Review the following:
a. Special inspection and testing and inspecting agency procedures for field quality control.
b. Construction joints, control joints, isolation joints, and joint-filler strips.
c. Semirigid joint fillers.
d. Vapor-retarder installation.
e. Anchor rod and anchorage device installation tolerances.
f. Cold and hot weather concreting procedures.
g. Concrete finishes and finishing.
h. Curing procedures.
i. Forms and form-removal limitations.
j. Shoring and reshoring procedures.
k. Methods for achieving specified floor and slab flatness and levelness.

l. Floor and slab flatness and levelness measurements.
m. Concrete repair procedures.
n. Concrete protection.
o. Initial curing and field curing of field test cylinders (ASTM C31).
p. Protection of field cured field test cylinders.

1.4 ACTION SUBMITTALS

A. Product Data: For each of the following.
1. Portland cement.
2. Fly ash.
3. Aggregates.
4. Admixtures:
a. Include limitations of use, including restrictions on cementitious materials, supplementary cementitious materials, air entrainment, aggregates, temperature at time of concrete placement, relative humidity at time of concrete placement, curing conditions, and use of other admixtures.
5. Floor and slab treatments.
6. Liquid floor treatments.
7. Curing materials.
a. Include documentation from color pigment manufacturer, indicating that proposed methods of curing are recommended by color pigment manufacturer.
8. Joint fillers.
9. Repair materials.

B. Design Mixtures: For each concrete mixture, include the following:
1. Mixture identification.
2. Minimum 28-day compressive strength.
3. Durability exposure class.
4. Maximum w/cm.
5. Calculated equilibrium unit weight, for lightweight concrete.
6. Slump limit.
7. Air content.
8. Nominal maximum aggregate size.
9. Steel-fiber reinforcement content.
10. Synthetic micro-fiber content.
11. Indicate amounts of mixing water to be withheld for later addition at Project Site if permitted.

C. Shop Drawings:
1. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
a. Location of construction joints is subject to approval of the Architect.

D. Concrete Schedule: For each location of each Class of concrete indicated in "Concrete Mixtures" Article, including the following:
1. Concrete Class designation.
2. Location within Project.
3. Exposure Class designation.
4. Formed Surface Finish designation and final finish.

5. Final finish for floors.
6. Curing process.
7. Floor treatment if any.

1.5 INFORMATIONAL SUBMITTALS

A. Material Certificates: For each of the following, signed by manufacturers:
   1. Cementitious materials.
   2. Admixtures.
   3. Fiber reinforcement.
   4. Curing compounds.
   5. Floor and slab treatments.
   6. Bonding agents.
   7. Adhesives.
   8. Vapor retarders.
   9. Semirigid joint filler.
   10. Joint-filler strips.
   11. Repair materials.

B. Material Test Reports: For the following, from a qualified testing agency:
   1. Portland cement.
   2. Fly ash.
   3. Aggregates.
   4. Admixtures:
      a. Permeability-Reducing Admixture: Include independent test reports, indicating compliance with specified requirements, including dosage rate used in test.

C. Floor surface flatness and levelness measurements report, indicating compliance with specified tolerances.

D. Research Reports:
   1. For concrete admixtures in accordance with ICC's Acceptance Criteria AC198.
   2. For sheet vapor retarder/termite barrier, showing compliance with ICC AC380.

E. Preconstruction Test Reports: For each mix design.

F. Field quality-control reports.

G. Minutes of preinstallation conference.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs Project personnel qualified as an ACI-certified Flatwork Technician and Finisher and a supervisor who is a certified ACI Flatwork Concrete Finisher/Technician or an ACI Concrete Flatwork Technician.
   1. Post-Installed Concrete Anchors Installers: ACI-certified Adhesive Anchor Installer.

B. Ready-Mixed Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94 requirements for production facilities and equipment.
   1. Manufacturer certified in accordance with NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

1.7 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on each concrete mixture.
   1. Include the following information in each test report:
      a. Admixture dosage rates.
      b. Slump.
      c. Air content.
      d. 7-day compressive strength.
      e. 28-day compressive strength.
      f. Permeability.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Comply with ASTM C94 and ACI 301.

1.9 FIELD CONDITIONS

A. Cold-Weather Placement: Comply with ACI 301 and ACI 306.1 and as follows:
   1. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
   2. When average high and low temperature is expected to fall below 40 degrees F for 3 successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
   3. Do not use frozen materials or materials containing ice or snow.
   4. Do not place concrete in contact with surfaces less than 35 degrees F, other than reinforcing steel.
   5. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

B. Hot-Weather Placement: Comply with ACI 301 and ACI 305.1, and as follows:
   1. Maintain concrete temperature at time of discharge to not exceed 95 degrees F.
   2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

1.10 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to furnish replacement sheet vapor retarder/termite barrier material and accessories for sheet vapor retarder/ termite barrier and accessories that do not comply with requirements or that fail to resist penetration by termites within specified warranty period.
   1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

A. ACI Publications: Comply with ACI 301 unless modified by requirements in the Contract Documents.

2.2 CONCRETE MATERIALS

A. Source Limitations:
   1. Obtain all concrete mixtures from a single ready-mixed concrete manufacturer for entire Project.
   2. Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant.
   3. Obtain aggregate from single source.
   4. Obtain each type of admixture from single source from single manufacturer.

B. Cementitious Materials:
   1. Portland Cement: ASTM C150, Type I/II.
   2. Fly Ash: ASTM C618, Class C or F.

C. Normal-Weight Aggregates: ASTM C33, Class 1N, coarse aggregate or better, graded. Provide aggregates from a single source.
   1. Alkali-Silica Reaction: Comply with 1 of the following:
      a. Expansion Result of Aggregate: Not more than 0.04 percent at 1-year when tested in accordance with ASTM C1293.
      b. Expansion Results of Aggregate and Cementitious Materials in Combination: Not more than 0.10 percent at an age of 16 days when tested in accordance with ASTM C1567.
      c. Alkali Content in Concrete: Not more than 4 lb./cu. yd. for moderately reactive aggregate or 3 lb./cu. yd. for highly reactive aggregate, when tested in accordance with ASTM C1293 and categorized in accordance with ASTM C1778, based on alkali content being calculated in accordance with ACI 301.
   2. Maximum Coarse-Aggregate Size: 1-1/2-inch-nominal.
   3. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

D. Air-Entraining Admixture: ASTM C260.

E. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
   1. Water-Reducing Admixture: ASTM C494, Type A.
   2. Retarding Admixture: ASTM C494, Type B.
   3. Water-Reducing and -Retarding Admixture: ASTM C494, Type D.
   4. High-Range, Water-Reducing Admixture: ASTM C494, Type F.
   5. High-Range, Water-Reducing and -Retarding Admixture: ASTM C494, Type G.

6. Plasticizing and Retarding Admixture: ASTM C1017, Type II.
    a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
        1) BASF Corporation.
        2) Euclid Chemical Company (The); an RPM company.
        3) GCP Applied Technologies Inc.
        4) Sika Corporation.
7. Permeability-Reducing Admixture: ASTM C494, Type S, hydrophilic, permeability-reducing crystalline admixture, capable of reducing water absorption of concrete exposed to hydrostatic pressure (PRAH).
    a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
        1) AQUAFIN, Inc.
        2) Kryton International Inc.
        3) Xypex Chemical Corporation.
    b. Permeability: No leakage when tested in accordance with U.S. Army Corps of Engineers CRC C48 at a hydraulic pressure of 200 psi for 14 days.

F. Water and Water Used to Make Ice: ASTM C94, potable.

2.3 VAPOR RETARDERS

A. Sheet Vapor Retarder, Class A: ASTM E1745, Class A; not less than 10 mils thick. Include manufacturer's recommended adhesive or pressure-sensitive tape.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    a. Barrier-Bac; Inteplast Group, Ltd.
    b. Fortifiber Building Systems Group.
    c. ISI Building Products.
    d. Poly-America, L.P.
    e. Raven Industries, Inc.
    f. Reef Industries, Inc.
    g. Stego Industries, LLC.
    h. Tex-Trude, LP.
    i. W.R. Meadows, Inc.

2.4 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    a. BASF Corporation.
    b. Bon Tool Co.
    c. Brickform; a division of Solomon Colors.

d. ChemMasters, Inc.
e. Dayton Superior.
f. Euclid Chemical Company (The); an RPM company.
g. Kaufman Products, Inc.
h. Lambert Corporation.
i. Laticrete International, Inc.
j. Metalcrete Industries.
k. Nox-Crete Products Group.
l. Sika Corporation.
m. SpecChem, LLC.
n. TK Products.
o. Vexcon Chemicals Inc.
p. W.R. Meadows, Inc.

B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.

C. Moisture-Retaining Cover: ASTM C171, polyethylene film burlap-polyethylene sheet.
1. Color:
a. Ambient Temperature Below 50 degrees F: Black.
b. Ambient Temperature between 50 degrees F and 85 degrees F: Any color.
c. Ambient Temperature Above 85 degrees F: White.

D. Water: Potable or complying with ASTM C1602.

E. Clear, Waterborne, Membrane-Forming, Dissipating Curing Compound: ASTM C309, Type 1, Class B.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
a. Anti-Hydro International, Inc.
b. ChemMasters, Inc.
c. Dayton Superior.
d. Euclid Chemical Company (The); an RPM company.
e. Kaufman Products, Inc.
f. Lambert Corporation.
g. Laticrete International, Inc.
h. Nox-Crete Products Group.
i. SpecChem, LLC.
j. TK Products.
k. Vexcon Chemicals Inc.
l. W.R. Meadows, Inc.

F. Clear, Waterborne, Membrane-Forming, Curing and Sealing Compound: ASTM C1315, Type 1, Class A.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
a. ChemMasters, Inc.
b. Concrete Sealers USA.
c. Dayton Superior.
d. Euclid Chemical Company (The); an RPM company.

e. Kaufman Products, Inc.
f. Lambert Corporation.
g. Laticrete International, Inc.
h. Metalcrete Industries.
i. Nox-Crete Products Group.
j. Right Pointe.
k. SpecChem, LLC.
l. TK Products.
m. Vexcon Chemicals Inc.
n. W.R. Meadows, Inc.

2.5 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D1751, asphalt-saturated cellulosic fiber.
B. Semirigid Joint Filler: 2-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 in accordance with ASTM D2240.
C. Bonding Agent: ASTM C1059, Type II, nonredispersible, acrylic emulsion or styrene butadiene.
D. Epoxy Bonding Adhesive: ASTM C881, 2-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade and class to suit requirements, and as follows:
    1. Types I and II, nonload bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

2.6 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8-inch and that can be feathered at edges to match adjacent floor elevations.
    1. Cement Binder: ASTM C150 portland cement or hydraulic or blended hydraulic cement, as defined in ASTM C219.
    2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
    3. Aggregate: Well-graded, washed gravel, 1/8- to 1/4-inch or coarse sand, as recommended by underlayment manufacturer.
    4. Compressive Strength: Not less than 4,100 psi at 28 days when tested in accordance with ASTM C109.
B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4-inch and that can be filled in over a scarified surface to match adjacent floor elevations.
    1. Cement Binder: ASTM C150 portland cement or hydraulic or blended hydraulic cement, as defined in ASTM C219.
    2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
    3. Aggregate: Well-graded, washed gravel, 1/8- to 1/4-inch or coarse sand as recommended by topping manufacturer.
    4. Compressive Strength: Not less than 5,000 psi at 28 days when tested in accordance with ASTM C109.

2.7 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, in accordance with ACI 301.
   1. Use a qualified testing agency for preparing and reporting proposed mixture designs, based on laboratory trial mixtures.

B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
   1. Fly Ash or Other Pozzolans: 25 percent by mass.
   2. Silica Fume: 10 percent by mass.
   3. Total of Fly Ash or Other Pozzolans, Slag Cement, and Silica Fume: 50 percent by mass, with fly ash or pozzolans not exceeding 25 percent by mass and silica fume not exceeding 10 percent by mass.
   4. Total of Fly Ash or Other Pozzolans and Silica Fume: 35 percent by mass with fly ash or pozzolans not exceeding 25 percent by mass and silica fume not exceeding 10 percent by mass.

C. Admixtures: Use admixtures in accordance with manufacturer's written instructions.
   1. Use water-reducing, high-range water-reducing, or plasticizing admixture in concrete, as required, for placement and workability.
   2. Use permeability-reducing admixture in concrete mixtures where indicated.

2.8 CONCRETE MIXTURES

A. Class A: Normal-weight concrete used for stiffened slab on grade.
   1. Minimum Compressive Strength: 4,000 psi at 28 days.
   2. Maximum w/cm: 0.45.
   3. Slump Limit: 4 inches, plus or minus 1-inch, before adding high-range water-reducing admixture or plasticizing admixture at Project Site.
   4. Air Content:
      a. Do not use an air-entraining admixture or allow total air content to exceed 3 percent for concrete used in trowel-finished floors.

2.9 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete in accordance with ASTM C94, and furnish batch ticket information.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions:
   1. Before placing concrete, verify that installation of concrete forms, accessories, and reinforcement, and embedded items is complete and that required inspections have been performed.
   2. Do not proceed until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide reasonable auxiliary services to accommodate field testing and inspections, acceptable to testing agency, including the following:
   1. Daily access to the Work.
   2. Incidental labor and facilities necessary to facilitate tests and inspections.
   3. Secure space for storage, initial curing, and field curing of test samples, including source of water and continuous electrical power at Project Site during site curing period for test samples.
   4. Security and protection for test samples and for testing and inspection equipment at Project Site.

3.3 INSTALLATION OF EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining Work that is attached to or supported by cast-in-place concrete.
   1. Use setting Drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of ANSI/AISC 303.

3.4 INSTALLATION OF VAPOR RETARDER

A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder in accordance with ASTM E1643 and manufacturer's written instructions.
   1. Install vapor retarder with longest dimension parallel with direction of concrete pour.
   2. Face laps away from exposed direction of concrete pour.
   3. Lap vapor retarder over footings and grade beams not less than 6 inches, sealing vapor retarder to concrete.
   4. Lap joints 6 inches and seal with manufacturer's recommended tape.
   5. Terminate vapor retarder at the top of floor slabs, grade beams, and pile caps, sealing entire perimeter to floor slabs, grade beams, foundation walls, or pile caps.
   6. Seal penetrations in accordance with vapor retarder manufacturer's instructions.
   7. Protect vapor retarder during placement of reinforcement and concrete.
      a. Repair damaged areas by patching with vapor retarder material, overlapping damages area by 6 inches on all sides, and sealing to vapor retarder.

B. Bituminous Vapor Retarders: Place, protect, and repair bituminous vapor retarder in accordance with manufacturer's written instructions.

3.5 JOINTS

A. Construct joints true to line, with faces perpendicular to surface plane of concrete.

B. Construction Joints: Coordinate with floor slab pattern and concrete placement sequence.
   1. Install so strength and appearance of concrete are not impaired, at locations indicated on Drawings or as approved by Architect.
   2. Place joints perpendicular to main reinforcement.
      a. Continue reinforcement across construction joints unless otherwise indicated.
      b. Do not continue reinforcement through sides of strip placements of floors and slabs.
   3. Locate joints for beams, slabs, joists, and girders at third points of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
   4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
   5. Space vertical joints in walls as indicated on Drawings. Unless otherwise indicated on Drawings, locate vertical joints beside piers integral with walls, near corners, and in concealed locations where possible.
   6. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
   7. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

3.6 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, embedded items, and vapor retarder is complete and that required inspections are completed.
   1. Immediately prior to concrete placement, inspect vapor retarder for damage and deficient installation, and repair defective areas.
   2. Provide continuous inspection of vapor retarder during concrete placement and make necessary repairs to damaged areas as Work progresses.

B. Notify Architect and testing and inspection agencies 24 hours prior to commencement of concrete placement.

C. Do not add water to concrete during delivery, at Project Site, or during placement unless approved by Architect in writing, but not to exceed the amount indicated on the concrete delivery ticket.
   1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

D. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301, but not to exceed the amount indicated on the concrete delivery ticket.
   1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

E. Deposit concrete continuously in 1 layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness.
   1. If a section cannot be placed continuously, provide construction joints as indicated.
   2. Deposit concrete to avoid segregation.

3. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
4. Consolidate placed concrete with mechanical vibrating equipment in accordance with ACI 301.
    a. Do not use vibrators to transport concrete inside forms.
    b. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer.
    c. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity.
    d. At each insertion, limit duration of vibration to time necessary to consolidate concrete, and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

F. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
1. Do not place concrete floors and slabs in a checkerboard sequence.
2. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
3. Maintain reinforcement in position on chairs during concrete placement.
4. Screed slab surfaces with a straightedge and strike off to correct elevations.
5. Level concrete, cut high areas, and fill low areas.
6. Slope surfaces uniformly to drains where required.
7. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface.
8. Do not further disturb slab surfaces before starting finishing operations.

3.7 FINISHING FORMED SURFACES

A. As-Cast Surface Finishes:
1. ACI 301 Surface Finish SF-1.0: As-cast concrete texture imparted by form-facing material.
    a. Patch voids larger than 1-1/2-inch wide or 1/2-inch deep.
    b. Remove projections larger than 1-inch.
    c. Tie holes do not require patching.
    d. Surface Tolerance: ACI 117 Class D.
    e. Apply to concrete surfaces.
2. ACI 301 Surface Finish SF-2.0: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams.
    a. Patch voids larger than 3/4-inch wide or 1/2-inch deep.
    b. Remove projections larger than 1/4-inch.
    c. Patch tie holes.
    d. Surface Tolerance: ACI 117 Class B.
3. ACI 301 Surface Finish SF-3.0:
    a. Patch voids larger than 3/4-inch wide or 1/2-inch deep.

b. Remove projections larger than 1/8-inch.
c. Patch tie holes.
d. Surface Tolerance: ACI 117 Class A.

B. Rubbed Finish: Apply the following to as cast surface finishes where indicated on Drawings:
1. Smooth-Rubbed Finish:
a. Perform no later than 1 day after form removal.
b. Moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture.
c. If sufficient cement paste cannot be drawn from the concrete by the rubbing process, use a grout made from the same cementitious materials used in the in-place concrete.
d. Maintain required patterns or variances as shown on Drawings or to match mockups.

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

3.8 FINISHING FLOORS AND SLABS

A. Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Scratch Finish:
1. While still plastic, texture concrete surface that has been screeded and bull-floated or darbied.
2. Use stiff brushes, brooms, or rakes to produce a profile depth of 1/4-inch in 1 direction.
3. Apply scratch finish to surfaces to receive concrete floor toppings.

C. Float Finish:
1. When bleedwater sheen has disappeared and concrete surface has stiffened sufficiently to permit operation of specific float apparatus, consolidate concrete surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats.
2. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture and complies with ACI 117 tolerances for conventional concrete.
3. Apply float finish to surfaces to receive trowel finish and to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.

D. Trowel Finish:
1. After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel.
2. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance.
3. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.

4. Do not add water to concrete surface.
5. Do not apply hard-troweled finish to concrete, which has a total air content greater than 3 percent.
6. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
7. Finish surfaces to the following tolerances, in accordance with ASTM E1155, for a randomly trafficked floor surface:
    a. Slabs on Ground:
        1) Specified overall values of flatness, FF 35; and of levelness, FL 25; with minimum local values of flatness, FF 24; and of levelness, FL 17.

E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces where ceramic or quarry tile is to be installed by either thickset or thinset method. While concrete is still plastic, slightly scarify surface with a fine broom perpendicular to main traffic route.
1. Coordinate required final finish with Architect before application.
2. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.

F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and locations indicated on Drawings.
1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route.
2. Coordinate required final finish with Architect before application.

3.9 INSTALLATION OF MISCELLANEOUS CONCRETE ITEMS

A. Filling In:
1. Fill in holes and openings left in concrete structures after Work of other trades is in place unless otherwise indicated.
2. Mix, place, and cure concrete, as specified, to blend with in-place construction.
3. Provide other miscellaneous concrete filling indicated or required to complete the Work.

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

C. Equipment Bases and Foundations:
1. Coordinate sizes and locations of concrete bases with actual equipment provided.
2. Construct concrete bases 6 inches high unless otherwise indicated on Drawings, and extend base not less than 6 inches in each direction beyond the maximum dimensions of supported equipment unless otherwise indicated on Drawings, or unless required for seismic anchor support.
3. Minimum Compressive Strength: 3,000 psi at 28 days.
4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.

5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete substrate.
6. Prior to pouring concrete, place and secure anchorage devices.
    a. Use setting Drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
    b. Cast anchor-bolt insert into bases.
    c. Install anchor bolts to elevations required for proper attachment to supported equipment.

3.10 CONCRETE CURING

A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
    1. Comply with ACI 301 and ACI 306.1 for cold weather protection during curing.
    2. Comply with ACI 301 and ACI 305.1 for hot-weather protection during curing.
    3. Maintain moisture loss no more than 0.2 lb/sq. ft. x h, calculated in accordance with ACI 305.1, before and during finishing operations.

B. Curing Formed Surfaces: Comply with ACI 308.1 as follows:
    1. Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces.
    2. Cure concrete containing color pigments in accordance with color pigment manufacturer's instructions.
    3. If forms remain during curing period, moist cure after loosening forms.
    4. If removing forms before end of curing period, continue curing for remainder of curing period, as follows:
        a. Continuous Fogging: Maintain standing water on concrete surface until final setting of concrete.
        b. Continuous Sprinkling: Maintain concrete surface continuously wet.
        c. Absorptive Cover: Pre-dampen absorptive material before application; apply additional water to absorptive material to maintain concrete surface continuously wet.
        d. Water-Retention Sheeting Materials: Cover exposed concrete surfaces with sheeting material, taping, or lapping seams.
        e. Membrane-Forming Curing Compound: Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.
            1) Recoat areas subject to heavy rainfall within 3 hours after initial application.
            2) Maintain continuity of coating and repair damage during curing period.

C. Curing Unformed Surfaces: Comply with ACI 308.1 as follows:
    1. Begin curing immediately after finishing concrete.
    2. Interior Concrete Floors:
        a. Floors to Receive Floor Coverings Specified in Other Sections: Contractor has option of the following:

1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
   a) Lap edges and ends of absorptive cover not less than 12 inches.
   b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than 7 days.
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.
   a) Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
   b) Cure for not less than 7 days.
3) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than 7 days, utilizing 1, or a combination of, the following:
   a) Water.
   b) Continuous water-fog spray.

b. Floors to Receive Penetrating Liquid Floor Treatments: Contractor has option of the following:
   1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
      a) Lap edges and ends of absorptive cover not less than 12 inches.
      b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than 7 days.
   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.
      a) Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
      b) Cure for not less than 7 days.
   3) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than 7 days, utilizing 1, or a combination of, the following:
      a) Water.
      b) Continuous water-fog spray.

c. Floors to Receive Polished Finish: Contractor has option of the following:
   1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
      a) Lap edges and ends of absorptive cover not less than 12 inches.
      b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than 7 days.

2) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than 7 days, utilizing 1, or a combination of, the following:
   a) Water.
   b) Continuous water-fog spray.

d. Floors to Receive Chemical Stain:
   1) As soon as concrete has sufficient set to permit application without marring concrete surface, install curing paper over entire area of floor.
   2) Install curing paper square to building lines, without wrinkles, and in a single length without end joints.
   3) Butt sides of curing paper tight; do not overlap sides of curing paper.
   4) Leave curing paper in place for duration of curing period, but not less than 28 days.

e. Floors to Receive Urethane Flooring:
   1) As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
   2) Rewet absorptive cover, and cover immediately with polyethylene moisture-retaining cover with edges lapped 6 inches and sealed in place.
   3) Secure polyethylene moisture-retaining cover in place to prohibit air from circulating under polyethylene moisture-retaining cover.
   4) Leave absorptive cover and polyethylene moisture-retaining cover in place for duration of curing period, but not less than 28 days.

f. Floors to Receive Curing Compound:
   1) Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.
   2) Recoat areas subjected to heavy rainfall within 3 hours after initial application.
   3) Maintain continuity of coating, and repair damage during curing period.
   4) Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound does not interfere with bonding of floor covering used on Project.

g. Floors to Receive Curing and Sealing Compound:
   1) Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller in accordance with manufacturer's written instructions.
   2) Recoat areas subjected to heavy rainfall within 3 hours after initial application.
   3) Repeat process 24 hours later, and apply a second coat. Maintain continuity of coating, and repair damage during curing period.

3.11 TOLERANCES

A. Conform to ACI 117.

3.12 APPLICATION OF LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment in accordance with manufacturer's written instructions.
   1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
   2. Do not apply to concrete that is less than 7 days' old.
   3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing.
   4. Rinse with water; remove excess material until surface is dry.
   5. Apply a second coat in a similar manner if surface is rough or porous.
B. Sealing Coat: Uniformly apply a continuous sealing coat of curing and sealing compound to hardened concrete by power spray or roller in accordance with manufacturer's written instructions.

3.13 JOINT FILLING

A. Prepare, clean, and install joint filler in accordance with manufacturer's written instructions.
   1. Defer joint filling until concrete has aged at least 1 month(s).
   2. Do not fill joints until construction traffic has permanently ceased.
B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joints clean and dry.
C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints.
D. Overfill joint, and trim joint filler flush with top of joint after hardening.

3.14 CONCRETE SURFACE REPAIRS

A. Defective Concrete:
   1. Repair and patch defective areas when approved by Architect.
   2. Remove and replace concrete that cannot be repaired and patched to Architect's approval.
B. Patching Mortar: Mix dry-pack patching mortar, consisting of 1 part portland cement to 2-1/2 parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.
C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
   1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2-inch in any dimension to solid concrete.
      a. Limit cut depth to 3/4-inch.
      b. Make edges of cuts perpendicular to concrete surface.

c. Clean, dampen with water, and brush-coat holes and voids with bonding agent.
d. Fill and compact with patching mortar before bonding agent has dried.
e. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.

2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement, so that, when dry, patching mortar matches surrounding color.
   a. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching.
   b. Compact mortar in place and strike off slightly higher than surrounding surface.
3. Repair defects on concealed formed surfaces that will affect concrete's durability and structural performance as determined by Architect.

D. Repairing Unformed Surfaces:
1. Test unformed surfaces, such as floors and slabs, for finish, and verify surface tolerances specified for each surface.
   a. Correct low and high areas.
   b. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
2. Repair finished surfaces containing surface defects, including spalls, popouts, honeycombs, rock pockets, crazing, and cracks in excess of 0.01-inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
3. After concrete has cured at least 14 days, correct high areas by grinding.
4. Correct localized low areas during, or immediately after, completing surface-finishing operations by cutting out low areas and replacing with patching mortar.
   a. Finish repaired areas to blend into adjacent concrete.
5. Correct other low areas scheduled to receive floor coverings with a repair underlayment.
   a. Prepare, mix, and apply repair underlayment and primer in accordance with manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
   b. Feather edges to match adjacent floor elevations.
6. Correct other low areas scheduled to remain exposed with repair topping.
   a. Cut out low areas to ensure a minimum repair topping depth of 1/4-inch to match adjacent floor elevations.
   b. Prepare, mix, and apply repair topping and primer in accordance with manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
7. Repair defective areas, except random cracks and single holes 1-inch or less in diameter, by cutting out and replacing with fresh concrete.
   a. Remove defective areas with clean, square cuts, and expose steel reinforcement with at least a 3/4-inch clearance all around.
   b. Dampen concrete surfaces in contact with patching concrete and apply bonding agent.

c. Mix patching concrete of same materials and mixture as original concrete, except without coarse aggregate.
d. Place, compact, and finish to blend with adjacent finished concrete.
e. Cure in same manner as adjacent concrete.

8. Repair random cracks and single holes 1-inch or less in diameter with patching mortar.
   a. Groove top of cracks and cut out holes to sound concrete, and clean off dust, dirt, and loose particles.
   b. Dampen cleaned concrete surfaces and apply bonding agent.
   c. Place patching mortar before bonding agent has dried.
   d. Compact patching mortar and finish to match adjacent concrete.
   e. Keep patched area continuously moist for at least 72 hours.

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

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

3.15 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a special inspector to perform field tests and inspections and prepare testing and inspection reports.

B. Testing Agency: Owner will engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

1. Testing agency shall be responsible for providing curing container for composite samples on Site and verifying that field-cured composite samples are cured in accordance with ASTM C31.
2. Testing agency shall immediately report to Architect, Contractor, and concrete manufacturer any failure of Work to comply with Contract Documents.
3. Testing agency shall report results of tests and inspections, in writing, to Owner, Architect, Contractor, and concrete manufacturer within 48 hours of inspections and tests.
   a. Test reports shall include reporting requirements of ASTM C31, ASTM C39, and ACI 301, including the following as applicable to each test and inspection:
      1) Project name.
      2) Name of testing agency.
      3) Names and certification numbers of field and laboratory technicians performing inspections and testing.
      4) Name of concrete manufacturer.
      5) Date and time of inspection, sampling, and field testing.
      6) Date and time of concrete placement.
      7) Location in Work of concrete represented by samples.
      8) Date and time sample was obtained.
      9) Truck and batch ticket numbers.
      10) Design compressive strength at 28 days.
      11) Concrete mixture designation, proportions, and materials.
      12) Field test results.

13) Information on storage and curing of samples before testing, including curing method and maximum and minimum temperatures during initial curing period.
14) Type of fracture and compressive break strengths at 7 days and 28 days.

C. Batch Tickets: For each load delivered, submit 3 copies of batch delivery ticket to testing agency, indicating quantity, mix identification, admixtures, design strength, aggregate size, design air content, design slump at time of batching, and amount of water that can be added at Project Site.

D. Inspections:
1. Headed bolts and studs.
2. Verification of use of required design mixture.
3. Concrete placement, including conveying and depositing.
4. Curing procedures and maintenance of curing temperature.
5. Verification of concrete strength before removal of shores and forms from beams and slabs.
6. Batch Plant Inspections: On a random basis, as determined by Architect.

E. Concrete Tests: Testing of composite samples of fresh concrete obtained in accordance with ASTM C172 shall be performed in accordance with the following requirements:
1. Testing Frequency: Obtain 1 composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus 1 set for each additional 50 cu. yd. or fraction thereof.
   a. When frequency of testing provides fewer than 5 compressive-strength tests for each concrete mixture, testing shall be conducted from at least 5 randomly selected batches or from each batch if fewer than 5 are used.
2. Slump: ASTM C143:
   a. One test at point of placement for each composite sample, but not less than 1 test for each day's pour of each concrete mixture.
   b. Perform additional tests when concrete consistency appears to change.
3. Slump Flow: ASTM C1611:
   a. One test at point of placement for each composite sample, but not less than 1 test for each day's pour of each concrete mixture.
   b. Perform additional tests when concrete consistency appears to change.
4. Air Content: ASTM C231 pressure method, for normal-weight concrete:
   a. One test for each composite sample, but not less than 1 test for each day's pour of each concrete mixture.
5. Concrete Temperature: ASTM C1064:
   a. One test hourly when air temperature is 40 degrees F and below or 80 degrees F and above, and 1 test for each composite sample.
6. Unit Weight: ASTM C567 fresh unit weight of structural lightweight concrete.
   a. One test for each composite sample, but not less than 1 test for each day's pour of each concrete mixture.
7. Compression Test Specimens: ASTM C31:
   a. Cast and laboratory cure 2 sets of two 6-inch by 12-inch or 4-inch by 8-inch cylinder specimens for each composite sample.

8. Compressive-Strength Tests: ASTM C39.
    a. Test 1 laboratory-cured specimen at 7 days and 2 specimens at 28 days and 1 specimen for reserve.
    b. A compressive-strength test shall be the average compressive strength from a set of 2 specimens obtained from same composite sample and tested at age indicated.
9. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
10. Strength of each concrete mixture will be satisfactory if every average of any 3 consecutive compressive-strength tests equals or exceeds specified compressive strength, and no compressive-strength test value falls below specified compressive strength by more than 500 psi if specified compressive strength is 5,000 psi, or no compressive strength test value is less than 10 percent of specified compressive strength if specified compressive strength is greater than 5,000 psi.
11. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
12. Additional Tests:
    a. Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.
    b. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42 or by other methods as directed by Architect.
        1) Acceptance criteria for concrete strength shall be in accordance with ACI 301 Section 1.6.6.3.
13. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional Work with specified requirements.
14. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

F. Measure floor and slab flatness and levelness in accordance with ASTM E1155 within 48 hours of completion of floor finishing and promptly report test results to Architect.

3.16 PROTECTION

A. Protect concrete surfaces as follows:
1. Protect from petroleum stains.
2. Diaper hydraulic equipment used over concrete surfaces.
3. Prohibit vehicles from interior concrete slabs.
4. Prohibit use of pipe-cutting machinery over concrete surfaces.
5. Prohibit placement of steel items on concrete surfaces.
6. Prohibit use of acids or acidic detergents over concrete surfaces.

7. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.
8. Protect concrete surfaces scheduled to receive surface hardener or polished concrete finish using Floor Slab Protective Covering.

END OF SECTION

SECTION 04 20 00 - UNIT MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Brick.
2. Decorative concrete masonry units.
3. Mortar and grout.
4. Steel reinforcing bars.
5. Masonry-joint reinforcement.
6. Ties and anchors.
7. Embedded flashing.
8. Miscellaneous masonry accessories.
9. Masonry-cell fill.

B. Products Installed but not Furnished under This Section:
1. Steel lintels in unit masonry.

C. Related Requirements:
1. Division 01 Specification Sections apply to Work of this Section.
2. Section 05 12 00 "Structural Steel Framing" for installing anchor sections of adjustable masonry anchors for connecting to structural steel frame.
3. Section 07 19 00 "Water Repellents" for water repellents applied to unit masonry assemblies.
4. Section 07 62 00 "Sheet Metal Accessories" for exposed sheet metal flashing and for furnishing manufactured reglets installed in masonry joints.

1.2 DEFINITIONS

A. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For the following:
1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
2. Stone Trim Units: Show sizes, profiles, and locations of each stone trim unit required.
3. Reinforcing Steel: Detail bending, lap lengths, and placement of unit masonry reinforcing bars. Comply with ACI 315. Show elevations of reinforced walls.

4. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.

C. Samples for Verification: For each type and color of the following:
   1. Decorative CMUs.
   2. Pigmented mortar. Make Samples using same sand and mortar ingredients to be used on Project.
   3. Weep holes and cavity vents.
   4. Accessories embedded in masonry.

1.5 INFORMATIONAL SUBMITTALS

A. List of Materials Used in Constructing Mockups: List generic product names together with manufacturers, manufacturers' product names, model numbers, lot numbers, batch numbers, source of supply, and other information as required to identify materials used. Include mix proportions for mortar and grout and source of aggregates.
   1. Submittal is for information only. Receipt of list does not constitute approval of deviations from the Contract Documents unless such deviations are specifically brought to the attention of Primary Designer and approved in writing.

B. Qualification Data: For testing agency.

C. Material Certificates: For each type and size of the following:
   1. Masonry units.
      a. Include data on material properties.

      b. For masonry units used in structural masonry, include data and calculations establishing average net-area compressive strength of units.
   2. Integral water repellent used in CMUs.
   3. Cementitious materials. Include name of manufacturer, brand name, and type.
   4. Mortar admixtures.
   5. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
   6. Grout mixes. Include description of type and proportions of ingredients.
   7. Reinforcing bars.
   8. Joint reinforcement.
   9. Anchors, ties, and metal accessories.

D. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
   1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C109 for compressive strength, ASTM C1506 for water retention, and ASTM C91 for air content.
   2. Include test reports, according to ASTM C1019, for grout mixes required to comply with compressive strength requirement.

E. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to TMS 602/ACI 530.1/ASCE 6.
F. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM C1093 for testing indicated.
B. Mockup: Build mockup to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution. Contractor SHALL NOT order materials until the Mockup is approved by Owner.
    1. Build mockup of typical wall area as shown on Drawings.
    2. Approval of mockup does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
    3. Build mockup for typical exterior wall by full thickness, including face and backup wythes and accessories.
        a. Include a sealant-filled joint at least 16 inches long in mockup.
        b. Include lower corner of window opening at upper corner of exterior wall mockup. Make opening approximately 12 inches wide by 16 inches high.
        c. Include through-wall flashing installed for a 24-inch length in corner of exterior wall mockup approximately 16 inches down from top of mockup, with a 12-inch length of flashing left exposed to view (omit masonry above half of flashing).
        d. Include metal studs, sheathing, sheathing joint-and-penetration treatment air barrier, veneer anchors, flashing, cavity drainage material, and weep holes in exterior masonry-veneer wall mockup.
    4. Clean 1/2 of exposed faces of mockups with masonry cleaner as indicated.
    5. Protect accepted mockups from the elements with weather-resistant membrane.
    6. Approval of mockups is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; and aesthetic qualities of workmanship.
        a. Approval of mockups is also for other material and construction qualities specifically approved by Primary Designer in writing.
        b. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Primary Designer specifically approves such deviations in writing.
    7. Subject to compliance with requirements, approved mockup SHALL NOT become part of the completed Work.

1.7 DELIVERY, STORAGE, AND HANDLING

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

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

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

D. Deliver preblended, dry mortar mix in moisture-resistant containers. Store preblended, dry mortar mix in delivery containers on elevated platforms in a dry location or in covered weatherproof dispensing silos.

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

1.8 FIELD CONDITIONS

A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
   1. Extend cover a minimum of 24 inches down both sides of walls, and hold cover securely in place.
   2. Where 1 wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe and hold cover in place.

B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least 3 days after building masonry walls or columns.

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

D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.
   1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 degrees F and higher and will remain so until masonry has dried, but not less than 7 days after completing cleaning.

E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

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

2.2 PERFORMANCE REQUIREMENTS

A. Provide structural unit masonry that develops indicated net-area compressive strengths at 28 days.

1. Determine net-area compressive strength of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to TMS 602/ACI 530.1/ASCE 6.
2. Determine net-area compressive strength of masonry by testing masonry prisms according to ASTM C1314.

2.3 UNIT MASONRY, GENERAL

A. Masonry Standard: Comply with TMS 602/ACI 530.1/ASCE 6, except as modified by requirements in the Contract Documents.

B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects are exposed in the completed Work and will be within 20 feet vertically and horizontally of a walking surface.

C. Fire-Resistance Ratings: Comply with requirements for fire-resistance-rated assembly designs indicated.

1. Where fire-resistance-rated construction is indicated, units shall be listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction.

2.4 MASONRY LINTELS

A. Provide one of the following:

B. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam CMUs matching adjacent CMUs in color, texture, and density classification, with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.

2.5 BRICK

A. Clay Face Brick: Facing brick complying with ASTM C216.
   1. Basis of Design Products: Provide products by Acme Brick.
      a. Masonry Type A: Dark Brick - Slate Gray 167 Velour.
      b. Masonry Type B: Light Brick - Steel Gray 160 Velour.
   2. Grade: SW.

   3. Type: FBS/Texture: Velour.

   4. Initial Rate of Absorption: Less than 30 g/30 sq. in. per minute when tested according to ASTM C67.

   5. Efflorescence: Provide brick that has been tested according to ASTM C67 and is rated "not effloresced."

   6. Size (Actual Dimensions): 2-3/4 inches wide by 2-5/8 inches high by 9-5/8 inches long (Western King - not Commercial King).

2.6 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
   1. Alkali content shall not be more than 0.1 percent when tested according to ASTM C114.

B. Hydrated Lime: ASTM C207, Type S.

C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.

D. Masonry Cement: ASTM C91.

E. Mortar Cement: ASTM C1329.

F. Colored Cement Products: Packaged blend made from portland cement and hydrated lime or masonry cement and mortar pigments, all complying with specified requirements, and containing no other ingredients.
   1. Colored Portland Cement-Lime Mix:
      a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
         1) Essroc.
         2) Holcim (US) Inc.
         3) Lafarge North America Inc.
         4) Lehigh Hanson; HeidelbergCement Group.

2. Colored Masonry Cement:
   a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      1) Cemex S.A.B. de C.V.
      2) Essroc.
      3) Holcim (US) Inc.
      4) Lafarge North America Inc.
      5) Lehigh Hanson; HeidelbergCement Group.
3. Formulate blend as required to produce color indicated or, if not indicated, as selected from manufacturer's standard colors.

4. Pigments shall not exceed 10 percent of portland cement by weight.
5. Pigments shall not exceed 5 percent of masonry cement or mortar cement by weight.

G. Aggregate for Mortar: ASTM C144.
1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
2. For joints less than 1/4-inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
3. White-Mortar Aggregates: Natural white sand or crushed white stone.
4. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.

H. Aggregate for Grout: ASTM C404.

I. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C494, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. BASF Corp. - Construction Chemicals.
   b. Euclid Chemical Company (The); an RPM company.
   c. GCP Applied Technologies Inc.

J. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with CMUs containing integral water repellent from same manufacturer.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. ACM Chemistries.
   b. BASF Corp. - Construction Chemicals.
   c. Euclid Chemical Company (The); an RPM company.
   d. GCP Applied Technologies Inc.

K. Water: Potable.

2.7 REINFORCEMENT

A. Uncoated-Steel Reinforcing Bars: ASTM A615 or ASTM A996, Grade 60.
B. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and to hold reinforcing bars in center of cells. Units

are formed from 0.148-inch steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Dur-O-Wal; a Hohmann & Barnard company.
   b. Heckmann Building Products, Inc.
   c. Hohmann & Barnard, Inc.
   d. Lock Rite.
   e. Wire-Bond.

C. Masonry-Joint Reinforcement, General: ASTM A951.
1. Interior Walls: Hot-dip galvanized carbon steel.
2. Exterior Walls: Hot-dip galvanized carbon steel.
3. Wire Size for Side Rods: 0.148-inch diameter.
4. Wire Size for Cross Rods: 0.148-inch iameter.

5. Wire Size for Veneer Ties: 0.148-inch iameter.
6. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches o.c.
7. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units.

D. Masonry-Joint Reinforcement for Single-Wythe Masonry: Ladder type with single pair of side rods.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Wire-Bond.

E. Masonry-Joint Reinforcement for Multiwythe Masonry:
1. Adjustable (2-piece) type, either ladder or truss design, with 1 side rod at each face shell of backing wythe and with separate adjustable ties with pintle-and-eye connections having a maximum horizontal play of 1/16-inch and maximum vertical adjustment of 1-1/4 inches. Size ties to extend at least halfway through facing wythe but with at least 5/8-inch cover on outside face. Ties have hooks or clips to engage a continuous horizontal wire in the facing wythe.

2.8 TIES AND ANCHORS

A. General: Ties and anchors shall extend at least 1-1/2 inches into veneer but with at least a 5/8-inch cover on outside face.

B. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated:
1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A82, with ASTM A153, Class B-2 coating.

C. Individual Wire Ties: Rectangular units with closed ends and not less than 4 inches wide.
1. Use adjustable ties with pintle-and-eye connections having a maximum adjustment of 1-1/4 inches.

2. Wire: Fabricate from 3/16-inch diameter, hot-dip galvanized steel wire. Mill-galvanized wire ties may be used in interior walls unless otherwise indicated.

D. Adjustable Anchors for Connecting to Structural Steel Framing: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
1. Anchor Section for Welding to Steel Frame: Crimped 1/4-inch diameter, hot-dip galvanized steel wire.

2. Tie Section: Triangular-shaped wire tie made from 0.187-inch diameter, hot-dip galvanized steel wire.

E. Partition Top Anchors: 0.105-inch thick metal plate with a 3/8-inch diameter metal rod 6 inches long welded to plate and with closed-end plastic tube fitted over rod that allows rod to move in and out of tube. Fabricate from steel, hot-dip galvanized after fabrication.

F. Adjustable Masonry-Veneer Anchors:
1. General: Provide anchors that allow vertical adjustment but resist a 100-lbf load in both tension and compression perpendicular to plane of wall without deforming or developing play in excess of 1/16-inch.
2. Fabricate sheet metal anchor sections and other sheet metal parts from 0.105-inch thick steel sheet, galvanized after fabrication.
3. Fabricate wire ties from 0.25-inch diameter, hot-dip galvanized-steel wire unless otherwise indicated.

4. Screw-Attached, Masonry-Veneer Anchors: Wire tie and a rib-stiffened, sheet metal anchor section with screw holes top and bottom, with projecting tabs having holes for inserting vertical legs of wire tie formed to fit anchor section.
a. Basis of Design Product: Hohmann & Barnard Inc., HB-213 Adjustable Veneer Anchor.
b. Subject to compliance with requirements, available:
1) Heckmann Building Products, Inc.
2) Wire-Bond.
5. Polymer-Coated, Steel Drill Screws for Steel Studs: ASTM C954 except manufactured with hex washer head and neoprene or EPDM washer, No. 10 diameter by length required to penetrate steel stud flange with not less than 3 exposed threads, and with organic polymer coating with salt-spray resistance to red rust of more than 800 hours according to ASTM B117.

2.9 EMBEDDED FLASHING MATERIALS
A. Metal Flashing: Provide metal flashing complying with SMACNA's "Architectural Sheet Metal Manual" and as follows:
1. Fabricate metal drip edges from stainless steel. Extend at least 3 inches into wall and 1/4-inch out from wall, with outer edge bent down 30 degrees and hemmed.
2. Solder metal items at corners.

B. Flexible Flashing: Use the following unless otherwise indicated:
   1. Copper-Laminated Flashing: 7-oz./sq. ft. copper sheet bonded between 2 layers of glass-fiber cloth. Use only where flashing is fully concealed in masonry.
      a. Manufacturers: Subject to compliance with requirements, provide products by 1 of the following:
         1) Advanced Building Products Inc.
         2) Hohmann & Barnard, Inc.
         3) York Manufacturing, Inc.

C. Application: Unless otherwise indicated, use the following:
   1. Where flashing is indicated to receive counterflashing, use metal flashing.
   2. Where flashing is indicated to be turned down at or beyond the wall face, use metal flashing.
   3. Where flashing is partly exposed and is indicated to terminate at the wall face, use metal flashing with a drip edge or flexible flashing with a metal drip edge.
   4. Where flashing is fully concealed, use flexible flashing.

D. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

E. Termination Bars for Flexible Flashing: Aluminum sheet 0.064-inch by 1-1/2 inches with a 3/8-inch sealant flange at top.

2.10 MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler: Premolded filler strips complying with ASTM D1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene.

B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D2000, Designation M2AA-805 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

C. Bond-Breaker Strips: Asphalt-saturated felt complying with ASTM D226, Type I (No. 15 asphalt felt).

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

E. Tape: Transition anchor tape for use behind masonry anchors to seal around the shafts of screws at the point of penetration through the sheathing and membrane air barrier. Tape to be a reinforced polyolefin base, laminated to polypropylene layer with an adhesive backed removable release liner. UV resistant for 90 days.

1. Basis of Design Product: Hohmann & Benard Inc., X-Seal Transition Tape.

F. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Advanced Building Products Inc.
      b. CavClear/Archovations, Inc.
      c. Heckmann Building Products, Inc.
   2. Configuration: Provide the following:
      a. Strips, full depth of cavity and 10 inches high, with dovetail-shaped notches 7 inches deep that prevent clogging with mortar droppings.

2.11 MASONRY-CELL FILL

A. Loose-Fill Insulation: Perlite complying with ASTM C549, Type II (surface treated for water repellency and limited moisture absorption) or Type IV (surface treated for water repellency and to limit dust generation).

2.12 MASONRY CLEANERS

A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Diedrich Technologies, Inc.; a Hohmann & Barnard company.
      b. EaCo Chem, Inc.
      c. PROSOCO, Inc.

2.13 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.
   1. Do not use calcium chloride in mortar or grout.
   2. Use portland cement-lime mortar unless otherwise indicated.
   3. For exterior masonry, use portland cement-lime mortar.
   4. For reinforced masonry, use portland cement-lime mortar.
   5. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

B. Mortar for Unit Masonry: Comply with ASTM C270, Proportion pecification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.
   1. For masonry below grade or in contact with earth, use Type M.
   2. For reinforced masonry, use Type S.

3. For mortar parge coats, use Type N.
4. For exterior, above-grade, load-bearing and nonload-bearing walls and parapet walls; for interior load-bearing walls; for interior nonload-bearing partitions; and for other applications where another type is not indicated, use Type N.
5. For interior nonload-bearing partitions, Type O may be used instead of Type N.

C. Pigmented Mortar: Use colored cement product or select and proportion pigments with other ingredients to produce color required. Do not add pigments to colored cement products.
1. Pigments shall not exceed 10 percent of portland cement by weight.

2. Application: Use pigmented mortar for exposed mortar joints with the following units:
a. Decorative CMUs.
b. Clay face brick.
c. Cast-stone trim units.

D. Grout for Unit Masonry: Comply with ASTM C476.
1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with TMS 602/ACI 530.1/ASCE 6 for dimensions of grout spaces and pour height.
2. Proportion grout in accordance with ASTM C476, paragraph 4.2.2 for specified 28-day compressive strength indicated, but not less than 2,000 psi.
3. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C143.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
2. Verify that foundations are within tolerances specified.
3. Verify that reinforcing dowels are properly placed.
4. Verify that substrates are free of substances that impair mortar bond.

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

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

3.2 INSTALLATION, GENERAL

A. Thickness: Build cavity and composite walls and other masonry construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated.

B. Build chases and recesses to accommodate items specified in this and other Sections.
C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match construction immediately adjacent to opening.
D. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.
E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures. Mix units from several pallets or cubes as they are placed.

3.3 TOLERANCES

A. Dimensions and Locations of Elements:
   1. For dimensions in cross section or elevation, do not vary by more than plus 1/2-inch or minus 1/4-inch.
   2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2-inch.
   3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4-inch in a story height or 1/2-inch total.
B. Lines and Levels:
   1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4-inch in 10 feet, or 1/2-inch maximum.
   2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8-inch in 10 feet, 1/4-inch in 20 feet, or 1/2-inch maximum.
   3. For vertical lines and surfaces, do not vary from plumb by more than 1/4-inch in 10 feet, 3/8-inch in 20 feet, or 1/2-inch maximum.
   4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8-inch in 10 feet, 1/4-inch in 20 feet, or 1/2-inch maximum.
   5. For lines and surfaces, do not vary from straight by more than 1/4-inch in 10 feet, 3/8-inch in 20 feet, or 1/2-inch maximum.
   6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4-inch in 10 feet or 1/2-inch maximum.

C. Joints:
   1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8-nch, with a maximum thickness limited to 1/2-inch.
   2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8-inch.
   3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8-inch or minus 1/4-inch.
   4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8-inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8-inch.

5. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16-inch from 1 masonry unit to the next.

3.4 LAYING MASONRY WALLS

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

B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.

C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 4 inches. Bond and interlock each course of each wythe at corners. Do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.

D. Stopping and Resuming Work: Stop work by stepping back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.

E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

F. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below, and rod mortar or grout into core.

H. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

I. Build nonload-bearing interior partitions full height of story to underside of solid floor or roof structure above unless otherwise indicated.

1. Install compressible filler in joint between top of partition and underside of structure above.

2. Fasten partition top anchors to structure above and build into top of partition. Grout cells of CMUs solidly around plastic tubes of anchors and push tubes down into grout to provide 1/2-inch clearance between end of anchor rod and end of tube. Space anchors 48 inches o.c. unless otherwise indicated.
3. Wedge nonload-bearing partitions against structure above with small pieces of tile, slate, or metal. Fill joint with mortar after dead-load deflection of structure above approaches final position.
4. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Section 07 84 43 "Joint Firestopping."

3.5 MORTAR BEDDING AND JOINTING

A. Lay CMUs as follows:

1. Bed face shells in mortar and make head joints of depth equal to bed joints.
2. Bed webs in mortar in all courses of piers, columns, and pilasters.
3. Bed webs in mortar in grouted masonry, including starting course on footings.
4. Fully bed entire units, including areas under cells, at starting course on footings where cells are not grouted.
5. Fully bed units and fill cells with mortar at anchors and ties as needed to fully embed anchors and ties in mortar.

B. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

D. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.

E. Cut joints flush where indicated to receive air barriers unless otherwise indicated.

3.6 CAVITY WALLS

A. Bond wythes of cavity walls together as follows:
   1. Individual Metal Ties: Provide ties as shown installed in horizontal joints, but not less than 1 metal tie for 2.67 sq. ft. of wall area spaced not to exceed 16 inches o.c. horizontally and 16 inches o.c. vertically. Stagger ties in alternate courses. Provide additional ties within 12 inches of openings and space not more than 36 inches apart around perimeter of openings. At intersecting and abutting walls, provide ties at no more than 24 inches o.c. vertically.
      a. Where bed joints of wythes do not align, use adjustable-type (2-piece-type) ties.
      b. Where 1 wythe is of clay masonry and the other of concrete masonry, use adjustable-type (2-piece-type) ties to allow for differential movement regardless of whether bed joints align.
   2. Masonry-Joint Reinforcement: Installed in horizontal mortar joints.
      a. Where bed joints of both wythes align, use ladder-type reinforcement extending across both wythes.
      b. Where bed joints of wythes do not align, use adjustable-type (2-piece-type) reinforcement.
   3. Masonry-Veneer Anchors: Comply with requirements for anchoring masonry veneers.

B. Bond wythes of cavity walls together using bonding system indicated on Drawings.

C. Keep cavities clean of mortar droppings and other materials during construction. Bevel beds away from cavity, to minimize mortar protrusions into cavity. Do not attempt to trowel or remove mortar fins protruding into cavity.

D. Parge cavity face of backup wythe in a single coat approximately 3/8-inch thick. Trowel face of parge coat smooth.

E. Installing Cavity Wall Insulation: Place small dabs of adhesive, spaced approximately 12 inches o.c. both ways, on inside face of insulation boards, or attach with plastic fasteners designed for this purpose. Fit courses of insulation between wall ties and other confining obstructions in cavity, with edges butted tightly both ways. Press units firmly against inside wythe of masonry or other construction as shown.
   1. Fill cracks and open gaps in insulation with crack sealer compatible with insulation and masonry.

3.7 ANCHORED MASONRY VENEERS

A. Anchor masonry veneers to wall framing and concrete and masonry backup with masonry-veneer anchors to comply with the following requirements:
   1. Apply tape in continuous lengths only at masonry veneer anchors.
   2. Fasten screw-attached anchors through tape and sheathing to wall framing and to concrete and masonry backup with metal fasteners of type indicated. Use 2 fasteners unless anchor design only uses 1 fastener.
   3. Embed tie sections in masonry joints.
   4. Locate anchor sections to allow maximum vertical differential movement of ties up and down.

   5. Space anchors as indicated, but not more than 16 inches o.c. vertically and 25 inches o.c. horizontally, with not less than 1 anchor for each 2.67 sq. ft. of wall area. Install additional anchors within 12 inches of openings and at intervals, not exceeding 36 inches, around perimeter.

B. Provide not less than 2 inches of airspace between back of masonry veneer and face of insulation.
   1. Keep airspace clean of mortar droppings and other materials during construction. Bevel beds away from airspace, to minimize mortar protrusions into airspace. Do not attempt to trowel or remove mortar fins protruding into airspace.

3.8 MASONRY-JOINT REINFORCEMENT

A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8-inch on exterior side of walls, 1/2-inch elsewhere. Lap reinforcement a minimum of 6 inches.
   1. Space reinforcement not more than 16 inches o.c.
B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.

C. Provide continuity at wall intersections by using prefabricated T-shaped units.
D. Provide continuity at corners by using prefabricated L-shaped units.

3.9 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE

A. Anchor masonry to structural steel and concrete, where masonry abuts or faces structural steel or concrete, to comply with the following:
   1. Provide an open space not less than 2 inches wide between masonry and structural steel or concrete unless otherwise indicated. Keep open space free of mortar and other rigid materials.
   2. Anchor masonry with anchors embedded in masonry joints and attached to structure.
   3. Space anchors as indicated, but not more than 24 inches o.c. vertically and 36 inches o.c. horizontally.

3.10 CONTROL AND EXPANSION JOINTS

A. General: Install control- and expansion-joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.

B. Form control joints in concrete masonry as follows:
   1. Install preformed control-joint gaskets designed to fit standard sash block.

C. Form expansion joints in brick as follows:
   1. Build in compressible joint fillers where indicated.
   2. Form open joint full depth of brick wythe and of width indicated, but not less than 3/8-inch for installation of sealant and backer rod specified in Section 07 92 00 "Joint Sealants."

D. Provide horizontal, pressure-relieving joints by either leaving an airspace or inserting a compressible filler of width required for installing sealant and backer rod specified in Section 07 92 00 "Joint Sealants," but not less than 3/8-inch.
   1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.

3.11 LINTELS

A. Install steel lintels where indicated.

B. Provide masonry lintels where shown and where openings of more than 12 inches for brick-size units and 24 inches for block-size units are shown without structural steel or other supporting lintels.

C. Provide minimum bearing of 8 inches at each jamb unless otherwise indicated.

3.12 FLASHING, WEEP HOLES, AND CAVITY VENTS

A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated. Install cavity vents at shelf angles, ledges, and other obstructions to upward flow of air in cavities, and where indicated.

B. Install flashing as follows unless otherwise indicated:
   1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.

   2. At masonry-veneer walls, extend flashing through veneer, across airspace behind veneer, and up face of sheathing at least 8 inches; with upper edge tucked under air barrier, lapping at least 4 inches. Fasten upper edge of flexible flashing to sheathing through termination bar.
   3. At lintels and shelf angles, extend flashing a minimum of 6 inches into masonry at each end. At heads and sills, extend flashing 6 inches at ends and turn up not less than 2 inches to form end dams.
   4. Install metal with ribbed sheet metal flashing by interlocking hemmed edges to form hooked seam. Seal seam with elastomeric sealant complying with requirements in Section 07 92 00 "Joint Sealants" for application indicated.

   5. Install metal flashing termination beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2-inch back from outside face of wall, and adhere flexible flashing to top of metal flashing termination.

C. Install single-wythe CMU flashing system in bed joints of CMU walls where indicated to comply with manufacturer's written instructions. Install CMU cell pans with upturned edges located below face shells and webs of CMUs above and with weep spouts aligned with face of wall. Install CMU web covers so that they cover upturned edges of CMU cell pans at CMU webs and extend from face shell to face shell.

D. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.

E. Install weep holes in exterior wythes and veneers in head joints of first course of masonry immediately above embedded flashing and at tops of walls.
   1. Use specified weep/cavity vent products to form weep holes.
   2. Space weep holes 24 inches o.c. unless otherwise indicated.

   3. Cover cavity side of weep holes with plastic insect screening at cavities insulated with loose-fill insulation.

F. Place cavity drainage material in airspace behind veneers to comply with configuration requirements for cavity drainage material in "Miscellaneous Masonry Accessories" Article.

G. Install cavity vents in head joints in exterior wythes at spacing indicated. Use specified weep/cavity vent products to form cavity vents.
   1. Close cavities off vertically and horizontally with blocking in manner indicated. Install through-wall flashing and weep holes above horizontal blocking.

3.13 REINFORCED UNIT MASONRY

A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
   1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
   2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and that of other loads that may be placed on them during construction.

B. Placing Reinforcement: Comply with requirements in TMS 602/ACI 530.1/ASCE 6.

C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
   1. Comply with requirements in TMS 602/ACI 530.1/ASCE 6 for cleanouts and for grout placement, including minimum grout space and maximum pour height.

   2. Limit height of vertical grout pours to not more than 60 inches.

3.14 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.

B. Inspections: Special inspections according to Level B in TMS 402/ACI 530/ASCE 5.
   1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
   2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
   3. Place grout only after inspectors have verified proportions of site-prepared grout.

C. Testing Prior to Construction: One set of tests.

D. Testing Frequency: One set of tests for each 5,000 sq. ft. of wall area or portion thereof.

E. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C140 for compressive strength.

F. Mortar Test (Property Specification): For each mix provided, according to ASTM C780. Test mortar for mortar air content and compressive strength.

G. Grout Test (Compressive Strength): For each mix provided, according to ASTM C1019.

H. Prism Test: For each type of construction provided, according to ASTM C1314 at 7 days and at 28 days.

3.15 PARGING

A. Parge exterior faces of below-grade masonry walls, where indicated, in 2 uniform coats to a total thickness of 3/4-inch. Dampen wall before applying first coat, and scarify first coat to ensure full bond to subsequent coat.
B. Use a steel-trowel finish to produce a smooth, flat, dense surface with a maximum surface variation of 1/8-inch per foot. Form a wash at top of parging and a cove at bottom.
C. Damp-cure parging for at least 24 hours and protect parging until cured.

3.16 REPAIRING, POINTING, AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.
B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.
C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
    1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
    2. Test cleaning methods on sample wall panel; leave 1/2 of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
    3. Protect nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
    4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
    5. Clean concrete masonry by applicable cleaning methods indicated in NCMA TEK 8-4A.
    6. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.
    7. Clean stone trim to comply with stone supplier's written instructions.
    8. Clean limestone units to comply with recommendations in ILI's "Indiana Limestone Handbook."

3.17 MASONRY WASTE DISPOSAL

A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

B. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.
   1. Crush masonry waste to less than 4 inches in each dimension.
   2. Mix masonry waste with at least 2 parts of specified fill material for each part of masonry waste. Fill material is specified in Section 31 20 00 "Earth Moving."
   3. Do not dispose of masonry waste as fill within 18 inches of finished grade.

C. Masonry Waste Recycling: Return broken CMUs not used as fill to manufacturer for recycling.

D. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above or recycled, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION

SECTION 05 12 00 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Structural steel.
2. Shear stud connectors.
3. Shrinkage-resistant grout.

B. Related Requirements:
1. Division 01 Specification Sections apply to Work of this Section.
2. Section 05 31 00 "Steel Decking" for field installation of shear stud connectors through deck.
3. Section 05 50 00 "Metal Fabrications" for steel lintels and shelf angles not attached to structural-steel frame, miscellaneous steel fabrications, and other steel items not defined as structural steel.
4. Section 09 96 00 "High-Performance Coatings" for exterior painting requirements and Section 09 91 23 "Interior Painting" for interior painting requirements.

1.2 DEFINITIONS

A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in ANSI/AISC 303.

1.3 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with 1 another.

B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

1.4 ACTION SUBMITTALS

A. Product Data:
1. Structural-steel materials.
2. High-strength, bolt-nut-washer assemblies.
3. Shear stud connectors.
4. Anchor rods.
5. Threaded rods.
6. Shop primer.
7. Galvanized-steel primer.
8. Etching cleaner.
9. Galvanized repair paint.
10. Shrinkage-resistant grout.

B. Shop Drawings: Show fabrication of structural-steel components.
   1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
   2. Include embedment Drawings.
   3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
   4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical, high-strength bolted connections.
   5. Identify members not to be shop primed.

1.5 INFORMATIONAL SUBMITTALS

A. Welding certificates.
B. Mill test reports for structural-steel materials, including chemical and physical properties.

1.6 QUALITY ASSURANCE

A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category BU or is accredited by the IAS Fabricator Inspection Program for Structural Steel (Acceptance Criteria 172).
B. Installer Qualifications: A qualified Installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category ACSE.
C. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.1.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.
   1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.
B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.
   1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
   2. Clean and relubricate bolts and nuts that become dry or rusty before use.
   3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F3125, Grade F1852 bolt assemblies and for retesting bolt assemblies after lubrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Comply with applicable provisions of the following Specifications and documents:
   1. ANSI/AISC 303.
   2. ANSI/AISC 360.
   3. RCSC's "Specification for Structural Joints Using High-Strength Bolts."
B. Connection Design Information:
   1. Design connections and final configuration of member reinforcement at connections in accordance with ANSI/AISC 303 by fabricator's qualified professional engineer.
      a. Use Allowable Stress Design; data are given at service-load level.
C. Moment Connections: Type FR, fully restrained.

2.2 STRUCTURAL-STEEL MATERIALS

A. W-Shapes: ASTM A992.
B. Channels, Angles: ASTM A36.
C. Plate and Bar: ASTM A36.
D. Cold-Formed Hollow Structural Sections: ASTM A500, Grade B structural tubing.
E. Welding Electrodes: Comply with AWS requirements.

2.3 BOLTS AND CONNECTORS

A. High-Strength A325 Bolts, Nuts, and Washers: ASTM F3125, Grade A325, Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436, Type 1, hardened carbon-steel washers; all with plain finish.
   1. Direct-Tension Indicators: ASTM F959, Type 325-1, compressible-washer type with plain finish.
B. High-Strength A490 Bolts, Nuts, and Washers: ASTM F3125, Grade A490, Type 1, heavy-hex steel structural bolts or Grade F2280 tension-control, bolt-nut-washer assemblies with splined ends; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436, Type 1, hardened carbon-steel washers; all with plain finish.
   1. Direct-Tension Indicators: ASTM F959, Type 490-1, compressible-washer type with plain finish.
C. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F3125, Grade F1852, Type 1, heavy-hex head assemblies, consisting of steel structural bolts with splined ends; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436, Type 1, hardened carbon-steel washers.
   1. Finish: Plain Mechanically deposited zinc coating.
D. Shear Stud Connectors: ASTM A108, AISI C-1015 through C-1020, headed-stud type, cold-finished carbon steel; AWS D1.1, Type B.

2.4 RODS

A. Unheaded Anchor Rods: ASTM F1554, Grade 36.
   1. Configuration: Straight Hooked.
   2. Nuts: ASTM A563 heavy-hex carbon steel.
   3. Plate Washers: ASTM A36 carbon steel.
   4. Washers: ASTM F436, Type 1, hardened carbon steel.
   5. Finish: Plain.

B. Headed Anchor Rods: ASTM F1554, Grade 36 ASTM F1554, Grade 55, weldable ASTM A354 ASTM A449, straight.
   1. Nuts: ASTM A563 heavy-hex carbon steel.
   2. Plate Washers: ASTM A36 carbon steel.
   3. Washers: ASTM F436, Type 1, hardened carbon steel.
   4. Finish: Plain.

C. Threaded Rods: ASTM A36.
   1. Nuts: ASTM A63 heavy-hex carbon steel.
   2. Washers: ASTM F436, Type 1, hardened carbon steel.
   3. Finish: Plain.

2.5 PRIMER

A. Steel Primer: Tnemec Series V10 or approved equal.
   1. Comply with Section 09 96 00 "High-Performance Coatings" for exterior painting requirements and Section 09 91 23 "Interior Painting" for interiror painting requirements.

2.6 SHRINKAGE-RESISTANT GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.7 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate in accordance with ANSI/AISC 303 and to ANSI/AISC 360.
   1. Camber structural-steel members where indicated.
   2. Fabricate beams with rolling camber up.
   3. Identify high-strength structural steel in accordance with ASTM A6 and maintain markings until structural-steel framing has been erected.
   4. Mark and match-mark materials for field assembly.
   5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.

B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
   1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1.

C. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.

D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.

E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted in accordance with SSPC-SP 3.

F. Shear Stud Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Weld using automatic end welding of headed-stud shear connectors in accordance with AWS D1.1 and manufacturer's written instructions.

G. Holes: Provide holes required for securing other Work to structural steel and for other Work to pass through steel members.
   1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
   2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
   3. Weld threaded nuts to framing and other specialty items indicated to receive other Work.

2.8 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for type of bolt and type of joint specified.
   1. Joint Type: Snug tightened.

B. Weld Connections: Comply with AWS D1.1 for tolerances, appearances, welding procedure Specifications, weld quality, and methods used in correcting welding Work.

2.9 SHOP PRIMING

A. Shop prime steel surfaces, except the following:
   1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
   2. Surfaces to be field welded.
   3. Surfaces of high-strength bolted, slip-critical connections.
   4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
   5. Galvanized surfaces.
   6. Surfaces enclosed in interior construction.

B. Surface Preparation of Steel: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces in accordance with the following Specifications and standards:
   1. SSPC-SP 3.

C. Priming: Immediately after surface preparation, apply primer in accordance with manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
   1. Apply 2 coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify, with certified steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
   1. Prepare a certified survey of existing conditions. Include bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.

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

3.2 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated on Drawings.
   1. Do not remove temporary shoring supporting composite deck construction and structural-steel framing until cast-in-place concrete has attained its design compressive strength.

3.3 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and in accordance with ANSI/AISC 303 and ANSI/AISC 360.

B. Baseplates Bearing Plates and Leveling Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
   1. Set plates for structural members on wedges, shims, or setting nuts as required.
   2. Weld plate washers to top of baseplate.
   3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
   4. Promptly pack shrinkage-resistant grout solidly between bearing surfaces and plates, so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for grouting.

C. Maintain erection tolerances of structural steel within ANSI/AISC 303.

D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that are in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
   1. Level and plumb individual members of structure. Slope roof framing members to slopes indicated on Drawings.
   2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.

E. Splice members only where indicated.

F. Do not use thermal cutting during erection.

G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

3.4 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for bolt and joint type specified.
   1. Joint Type: Snug tightened.

B. Weld Connections: Comply with AWS D1.1 for tolerances, appearances, welding procedure Specifications, weld quality, and methods used in correcting welding Work.
   1. Comply with ANSI/AISC 303 and ANSI/AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
   2. Remove backing bars or runoff tabs where exposed to view, back gouge, and grind steel smooth.

3.5 REPAIR

A. Touchup Painting:
   1. Immediately after erection, clean exposed areas where primer is damaged or missing, and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
      a. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.

3.6 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a special inspector to perform the following special inspections:
   1. Verify structural-steel materials and inspect steel frame joint details.
   2. Verify weld materials and inspect welds.
   3. Verify connection materials and inspect high-strength bolted connections.

B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
   1. Bolted Connections: Inspect bolted connections in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts."

2. Welded Connections: Visually inspect field welds in accordance with AWS D1.1.
    a. In addition to visual inspection, test and inspect field welds in accordance with AWS D1.1 and the following inspection procedures, at testing agency's option:
        1) Liquid Penetrant Inspection: ASTM E165.
        2) Magnetic Particle Inspection: ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
        3) Ultrasonic Inspection: ASTM E164.
        4) Radiographic Inspection: ASTM E94.

END OF SECTION

SECTION 05 31 00 - STEEL DECKING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Roof deck.
B. Related Requirements:
   1. Division 01 Specification Sections apply to Work of this Section.
   2. Section 05 12 00 "Structural Steel Framing" for shop- and field-welded shear connectors.
   3. Section 09 96 00 "High-Performance Coatings" for exterior painting requirements and Section 09 91 23 "Interior Painting" for interior painting requirements.

1.2 ACTION SUBMITTALS

A. Product Data: For the following:
   1. Roof deck.
B. Shop Drawings:
   1. Include layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

1.3 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.4 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.3, "Structural Welding Code - Sheet Steel."

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.
B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."
B. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2.2 ROOF DECK

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Canam Steel Corporation; Canam Group, Inc.
   2. New Millennium Building Systems, LLC.
   3. Nucor Corp.
B. Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 31, and with the following:
   1. Galvanized-Steel Sheet: ASTM A653, Structural Steel (SS), Grade 50, G60 zinc coating.
   2. Deck Profile: As indicated.
   3. Profile Depth: As indicated.
   4. Design Uncoated-Steel Thickness: As indicated.
   5. Span Condition: As indicated Triple span or more.
   6. Side Laps: Overlapped.

2.3 ACCESSORIES

A. Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.
B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.
C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.
D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.
E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi, not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.
F. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck unless otherwise indicated.
G. Flat Sump Plates: Single-piece steel sheet, 0.0747-inch thick, of same material and finish as deck. For drains, cut holes in the field.
H. Galvanizing Repair Paint: ASTM A780.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Install deck panels and accessories according to applicable Specifications and commentary in SDI Publication No. 31, manufacturer's written instructions, and requirements in this Section.
B. Install temporary shoring before placing deck panels if required to meet deflection limitations.
C. Locate deck bundles to prevent overloading of supporting members.
D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.
E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.
F. Cut and neatly fit deck panels and accessories around openings and other Work projecting through or adjacent to deck.
G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other Work.
H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding Work.

3.3 INSTALLATION OF ROOF DECK

A. Fasten roof-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter that is not less than 1-1/2 inches long, and as follows:
    1. Weld Diameter: 5/8-inch, nominal.
    2. Weld Spacing: Weld edge and interior ribs of deck units with a minimum of 2 welds per deck unit at each support. Space welds as indicated.
B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of 1/2 of the span or 18 inches, and as follows:
    1. Mechanically fasten with self-drilling, No. 10 diameter or larger, carbon-steel screws.
C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:
    1. End Joints: Lapped 2 inches minimum.

D. Roof Sump Pans and Sump Plates: Install over openings provided in roof deck and mechanically fasten flanges to top of deck. Space mechanical fasteners not more than 12 inches apart with at least 1 fastener at each corner.
   1. Install reinforcing channels or zees in ribs to span between supports and mechanically fasten.

E. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. mechanically fasten to substrate to provide a complete deck installation.
   1. Weld cover plates at changes in direction of roof-deck panels unless otherwise indicated.

F. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive according to manufacturer's written instructions to ensure complete closure.

3.4 REPAIR

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A780 and manufacturer's written instructions.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
B. Field welds will be subject to inspection.
C. Prepare test and inspection reports.

END OF SECTION

SECTION 05 40 00 - COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Load-bearing wall framing.
2. Exterior non-load-bearing wall framing.
3. Floor joist framing.
4. Ceiling joist framing.
5. Soffit framing.

B. Related Requirements:

1. Division 01 Specification Sections apply to Work of this Section.
2. Section 05 50 00 "Metal Fabrications" for miscellaneous steel shapes, masonry shelf angles, and connections used with cold-formed metal framing.
3. Section 09 22 16 "Non-Structural Metal Framing" for standard, interior non-load-bearing, metal-stud framing, with height limitations and ceiling-suspension assemblies.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project Site.

1.3 ACTION SUBMITTALS

A. Product Data: For the following:

1. Cold-formed steel framing materials.
2. Load-bearing wall framing.
3. Exterior non-load-bearing wall framing.
4. Interior non-load-bearing wall framing.
5. Vertical deflection clips.
6. Single deflection track.
7. Double deflection track.
8. Drift clips.
9. Floor joist framing.
10. Ceiling joist framing.
11. Soffit framing.
12. Post-installed anchors.
13. Power-actuated anchors.

B. Shop Drawings:
   1. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
   2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.

C. Delegated-Design Submittal: For cold-formed steel framing.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Welding certificates.

C. Product Certificates: For each type of code-compliance certification for studs and tracks.

D. Product Test Reports: For each listed product, for tests performed by a qualified testing agency.
   1. Steel sheet.
   2. Expansion anchors.
   3. Power-actuated anchors.
   4. Mechanical fasteners.
   5. Vertical deflection clips.
   6. Horizontal drift deflection clips
   7. Miscellaneous structural clips and accessories.

E. Research Reports:
   1. For nonstandard cold-formed steel framing post-installed anchors and power-actuated fasteners, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM E329 for testing indicated.

B. Product Tests: Mill certificates or data from a qualified independent testing agency indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.

C. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of the Steel Stud Manufacturers Association.

D. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code - Steel."
2. AWS D1.3, "Structural Welding Code - Sheet Steel."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. AllSteel & Gypsum Products, Inc.
   2. CEMCO; California Expanded Metal Products Co.
   3. ClarkDietrich.
   4. Consolidated Fabricators Corp.; Building Products Division.
   5. MRI Steel Framing, LLC.

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design cold-formed steel framing.

B. Structural Performance: Provide cold-formed steel framing capable of withstanding design loads within limits and under conditions indicated.
   1. Design Loads: As indicated on Drawings.
   2. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:
      a. Exterior Load-Bearing Wall Framing: Horizontal deflection of 1/720 of the wall height.
      b. Exterior Non-Load-Bearing Framing: Horizontal deflection of 1/600 of the wall height.
      c. Interior Non-Load-Bearing Framing: Horizontal deflection of 1/240 of the wall height under a horizontal load of 5 lbf/sq. ft.
      d. Floor Joist Framing: Vertical deflection of 1/360 for live loads and l/240 for total loads of the span.
      e. Ceiling Joist Framing: Vertical deflection of 1/360 of the span for live loads and 1/240 for total loads of the span.
   3. Design framing systems to provide for movement of framing members located outside the insulated building envelope without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 degrees F.
   4. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:
      a. Upward and downward movement of 1 inch.
   5. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.

C. Cold-Formed Steel Framing Standards: Unless more stringent requirements are indicated, framing shall comply with AISI S100, AISI S200, and the following:

1. Floor and Roof Systems: AISI S210.
2. Wall Studs: AISI S211.
3. Headers: AISI S212.
4. Lateral Design: AISI S213.

D. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency acceptable to authorities having jurisdiction.

2.3 COLD-FORMED STEEL FRAMING MATERIALS

A. Steel Sheet: ASTM A1003, Structural Grade, Type H, metallic coated, of grade and coating designation as follows:
   1. Grade: As required by structural performance.
   2. Coating: G60, A60, AZ50, or GF30.

B. Steel Sheet for Vertical Deflection Clips: ASTM A653, structural steel, zinc coated, of grade and coating as follows:
   1. Grade: As required by structural performance.
   2. Coating: G60.

2.4 LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
   1. Minimum Base-Metal Thickness: 0.0428-inch.
   2. Flange Width: 1-5/8 inches.

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with straight flanges, and as follows:
   1. Minimum Base-Metal Thickness: Matching steel studs.
   2. Flange Width: 1-1/4 inches.

C. Steel Box or Back-to-Back Headers: Manufacturer's standard C-shapes used to form header beams, of web depths indicated, unpunched, with stiffened flanges, and as follows:
   1. Minimum Base-Metal Thickness: 0.0329-inch.
   2. Flange Width: 1-3/8 inches.

D. Steel Single- or Double-L Headers: Manufacturer's standard L-shapes used to form header beams, of web depths indicated, and as follows:
   1. Minimum Base-Metal Thickness: 0.0428-inch.
   2. Top Flange Width: 1-5/8 inches.

2.5 EXTERIOR NON-LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
   1. Minimum Base-Metal Thickness: 0.0428-inch.
   2. Flange Width: 1-5/8 inches.

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
   1. Minimum Base-Metal Thickness: Matching steel studs.
   2. Flange Width: 1-1/4 inches.

C. Vertical Deflection Clips: Manufacturer's standard bypass clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. AllSteel & Gypsum Products, Inc.
      b. ClarkDietrich.
      c. Simpson Strong-Tie Co., Inc.

D. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:
   1. Minimum Base-Metal Thickness: 0.0428-inch.
   2. Flange Width: 1-inch plus the design gap for 1-story structures and 1 inch plus twice the design gap for other applications.

E. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure through positive mechanical attachment to stud web and structure.

2.6 FLOOR JOIST FRAMING

A. Steel Joists: Manufacturer's standard C-shaped steel joists, of web depths indicated, punched with standard holes, with stiffened flanges, and as follows:
   1. Minimum Base-Metal Thickness: 0.0428-inch.
   2. Flange Width: 1-5/8 inches, minimum.

B. Steel Joist Track: Manufacturer's standard U-shaped steel joist track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
   1. Minimum Base-Metal Thickness: 0.0428-inch.
   2. Flange Width: 1-1/4 inches, minimum.

2.7 CEILING JOIST FRAMING

A. Steel Ceiling Joists: Manufacturer's standard C-shaped steel sections, of web depths indicated, punched with enlarged service holes, with stiffened flanges, and as follows:
   1. Minimum Base-Metal Thickness: 0.0329-inch.
   2. Flange Width: 1-5/8 inches, minimum.

2.8 SOFFIT FRAMING

A. Exterior Soffit Frame: Manufacturer's standard C-shaped steel sections, of web depths indicated, with stiffened flanges, and as follows:
   1. Minimum Base-Metal Thickness: 0.0428-inch.
   2. Flange Width: 1-5/8 inches, minimum.

2.9 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories from ASTM A1003, Structural Grade, Type H, metallic coated steel sheet, of same grade and coating designation used for framing members.

B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:
   1. Supplementary framing.
   2. Bracing, bridging, and solid blocking.
   3. Web stiffeners.
   4. Anchor clips.
   5. Foundation clips.
   6. Gusset plates.
   7. Stud kickers and knee braces.
   8. Joist hangers and end closures.
   9. Hole-reinforcing plates.
   10. Backer plates.

2.10 ANCHORS, CLIPS, AND FASTENERS

A. Steel Shapes and Clips: ASTM A36, zinc coated by hot-dip process according to ASTM A123.

B. Anchor Bolts: ASTM F1554, Grade 36, threaded carbon-steel hex-headed bolts, carbon-steel nuts, and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A153, Class C.

C. Post-Installed Anchors: Fastener systems with bolts of same basic metal as fastened metal, if visible, unless otherwise indicated; with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC308 as appropriate for the substrate.
   1. Uses: Securing cold-formed steel framing to structure.
   2. Type: Torque-controlled adhesive anchor.

3. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941, Class Fe/Zn 5, unless otherwise indicated.

4. Material for Exterior or Interior Locations and Where Stainless Steel Is Indicated: Alloy Group 2 stainless-steel bolts, ASTM F593, and nuts, ASTM F594.

D. Power-Actuated Anchors: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

E. Mechanical Fasteners: ASTM C1513, corrosion-resistant-coated, self-drilling, self-tapping, steel drill screws.
   1. Head Type: Low-profile head beneath sheathing; manufacturer's standard elsewhere.

F. Welding Electrodes: Comply with AWS standards.

2.11 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: ASTM A780.

B. Nonmetallic, Nonshrink Grout: Factory-packaged, nonmetallic, noncorrosive, nonstaining grout, complying with ASTM C1107, and with a fluid consistency and 30-minute working time.

C. Shims: Load-bearing, high-density, multimonomer, nonleaching plastic; or cold-formed steel of same grade and metallic coating as framing members supported by shims.

2.12 FABRICATION

A. Fabricate cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.
   1. Fabricate framing assemblies using jigs or templates.
   2. Cut framing members by sawing or shearing; do not torch cut.
   3. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.
      a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
      b. Locate mechanical fasteners and install according to Shop Drawings, with screws penetrating joined members by no fewer than 3 exposed screw threads.
   4. Fasten other materials to cold-formed steel framing by welding, bolting, pneumatic pin fastening, or screw fastening, according to Shop Drawings.

B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies by means that prevent damage or permanent distortion.

C. Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable variation of 1/8-inch in 10 feet and as follows:
   1. Spacing: Space individual framing members no more than plus or minus 1/8-inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
   2. Squareness: Fabricate each cold-formed steel framing assembly to a maximum out-of-square tolerance of 1/8-inch.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, conditions, and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.
B. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire-resistive materials below that required to obtain fire-resistance ratings indicated. Protect remaining fire-resistive materials from damage.

C. Install load-bearing shims or grout between the underside of load-bearing wall bottom track and the top of foundation wall or slab at locations with a gap larger than 1/4-inch to ensure a uniform bearing surface on supporting concrete or masonry construction.

D. Install sill sealer gasket at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

3.3 INSTALLATION, GENERAL

A. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.
B. Install cold-formed steel framing according to AISI S200, AISI S202, and manufacturer's written instructions unless more stringent requirements are indicated.

C. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.
   1. Cut framing members by sawing or shearing; do not torch cut.
   2. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.
      a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
      b. Locate mechanical fasteners, install according to Shop Drawings, and comply with requirements for spacing, edge distances, and screw penetration.

D. Install framing members in 1-piece lengths unless splice connections are indicated for track or tension members.

E. Install temporary bracing and supports to secure framing and support loads equal to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

F. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.

G. Install insulation, specified in Section 07 21 00 "Thermal Insulation," in framing-assembly members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.

H. Fasten hole-reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.

3.4 INSTALLATION OF LOAD-BEARING WALL FRAMING

A. Install continuous top and bottom tracks sized to match studs. Align tracks accurately and securely anchor at corners and ends, and at spacings as follows:
   1. Anchor Spacing: As shown on Shop Drawings.

B. Squarely seat studs against top and bottom tracks, with gap not exceeding 1/8-inch between the end of wall-framing member and the web of track.
   1. Space studs as follows:
      a. Stud Spacing: 16 inches.

C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar configurations.

D. Align studs vertically where floor framing interrupts wall-framing continuity. Where studs cannot be aligned, continuously reinforce track to transfer loads.

E. Align floor and roof framing over studs according to AISI S200, Section C1. Where framing cannot be aligned, continuously reinforce track to transfer loads.

F. Anchor studs abutting structural columns or walls, including masonry walls, to supporting structure.

G. Install headers over wall openings wider than stud spacing. Locate headers above openings. Fabricate headers of compound shapes indicated or required to transfer load to supporting studs, complete with clip-angle connectors, web stiffeners, or gusset plates.

1. Frame wall openings with not less than a double stud at each jamb of frame. Fasten jamb members together to uniformly distribute loads.
2. Install tracks and jack studs above and below wall openings. Anchor tracks to jamb studs with clip angles or by welding, and space jack studs same as full-height wall studs.

H. Install supplementary framing, blocking, and bracing in stud framing indicated to support fixtures, equipment, services, casework, heavy trim, furnishings, and similar work requiring attachment to framing.
1. If type of supplementary support is not indicated, comply with stud manufacturer's written recommendations and industry standards in each case, considering weight or load resulting from item supported.

I. Install horizontal bridging in stud system, spaced vertically as indicated on Drawings. Fasten at each stud intersection.
1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs with a minimum of 2 screws into each flange of the clip angle for framing members up to 6 inches deep.
2. Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges, and secure solid blocking to stud webs or flanges.
3. Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.

J. Install steel sheet diagonal bracing straps to both stud flanges; terminate at and fasten to reinforced top and bottom tracks. Fasten clip-angle connectors to multiple studs at ends of bracing and anchor to structure.

K. Install miscellaneous framing and connections, including supplementary framing, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.5 INSTALLATION OF EXTERIOR NONLOADBEARING WALL FRAMING

A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure.

B. Fasten both flanges of studs to top and bottom track unless otherwise indicated. Space studs as follows:
1. Stud Spacing: 16 inches.

C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.

D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
1. Install single deep-leg deflection tracks and anchor to building structure.
2. Install double deep-leg deflection tracks and anchor outer track to building structure.
3. Connect vertical deflection clips to bypassing studs and anchor to building structure.

4. Connect drift clips to cold-formed steel framing and anchor to building structure.

E. Install horizontal bridging in wall studs, spaced vertically in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection.
   1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.

F. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 12 inches of single deflection track. Install a combination of bridging and stud or stud-track solid blocking of width and thickness matching studs, secured to stud webs or flanges.
   1. Install solid blocking at centers indicated on Shop Drawings.

G. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.6 INSTALLATION OF JOIST FRAMING

A. Install perimeter joist track sized to match joists. Align and securely anchor or fasten track to supporting structure at corners, ends, and spacings indicated on Shop Drawings.

B. Install joists bearing on supporting frame, level, straight, and plumb; adjust to final position, brace, and reinforce. Fasten joists to both flanges of joist track.
   1. Install joists over supporting frame with a minimum end bearing of 1-1/2 inches.
   2. Reinforce ends and bearing points of joists with web stiffeners, end clips, joist hangers, steel clip angles, or steel-stud sections.

C. Space joists not more than 2 inches from abutting walls, and as follows:
   1. Joist Spacing: 16 inches.

D. Frame openings with built-up joist headers, consisting of joist and joist track or another combination of connected joists if indicated.

E. Install joist reinforcement at interior supports with single, short length of joist section located directly over interior support, with lapped joists of equal length to joist reinforcement.
   1. Install web stiffeners to transfer axial loads of walls above.

F. Install bridging at intervals indicated on Shop Drawings. Fasten bridging at each joist intersection as follows:
   1. Joist-Track Solid Bridging: Joist-track solid blocking of width and thickness indicated, secured to joist webs.
   2. Combination Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and joist-track solid blocking of width and thickness indicated. Fasten flat straps to bottom flange of joists and secure solid blocking to joist webs.

G. Secure joists to load-bearing interior walls to prevent lateral movement of bottom flange.

H. Install miscellaneous joist framing and connections, including web stiffeners, closure pieces, clip angles, continuous angles, hold-down angles, anchors, and fasteners, to provide a complete and stable joist-framing assembly.

3.7 INSTALLATION TOLERANCES

A. Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8-inch in 10 feet and as follows:
   1. Space individual framing members no more than plus or minus 1/8-inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.8 REPAIR

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A780 and manufacturer's written instructions.

3.9 FIELD QUALITY CONTROL

A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
B. Field and shop welds will be subject to testing and inspecting.
C. Testing agency will report test results promptly and in writing to Contractor and Architect.

D. Cold-formed steel framing will be considered defective if it does not pass tests and inspections.
E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.10 PROTECTION

A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed steel framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 05 44 00 - COLD-FORMED METAL TRUSSES

PART 1 - GENERAL

1.1 SUMMARY

A. Related Requirements:
1. Division 01 Specification Sections apply to Work of this Section.

1.2 ACTION SUBMITTALS

A. Shop Drawings:
1. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel trusses; fabrication; and fastening and anchorage details, including mechanical fasteners.
2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.

B. Delegated Design Submittal: For cold-formed steel trusses.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design cold-formed steel trusses.

B. Structural Performance: Provide cold-formed steel trusses capable of withstanding design loads within limits and under conditions indicated.
1. Design Loads: As indicated on Drawings.
2. Deflection Limits: Design trusses to withstand design loads without deflections greater than the following:
a. Roof Trusses: Vertical deflection of 1/240 of the span.
3. Design trusses to provide for movement of truss members located outside the insulated building envelope without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 degrees F.

C. Cold-Formed Steel Truss Standards: Unless more stringent requirements are indicated, trusses comply with the following:
1. Floor and Roof Systems: AISI S210.
2. Lateral Design: AISI S213.
3. Roof Trusses: AISI S214.

2.2 COLD-FORMED STEEL TRUSS MATERIALS

A. Steel Sheet: ASTM A1003, Structural Grade, Type H, metallic coated, of grade and coating designation as follows:
   1. Grade: As required by structural performance.
   2. Coating: G90 or equivalent.

2.3 TRUSS ACCESSORIES

A. Fabricate steel-truss accessories from steel sheet, ASTM A1003, Structural Grade, Type H, metallic coated steel sheet, of same grade and coating designation used for truss members.

2.4 ANCHORS, CLIPS, AND FASTENERS

A. Steel Shapes and Clips: ASTM A36, zinc coated by hot-dip process according to ASTM A123.
B. Mechanical Fasteners: ASTM C1513, corrosion-resistant-coated, self-drilling, self-tapping steel drill screws.
   1. Head Type: Low-profile head beneath sheathing; manufacturer's standard elsewhere.

2.5 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: ASTM A780 MIL-P-21035B or SSPC-Paint 20.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install bridge, and brace cold-formed steel trusses according to AISI S200, AISI S202, AISI S214, and manufacturer's written instructions unless more stringent requirements are indicated.
   1. Coordinate with wall framing to align webs of bottom chords and load-bearing studs or continuously reinforce track to transfer loads to structure.
   2. Install continuous bridging and permanently brace trusses as indicated on Shop Drawings and designed according to CFSEI's Technical Note 551e, "Design Guide: Permanent Bracing of Cold-Formed Steel Trusses."
B. Install cold-formed steel trusses and accessories true to line and location, and with connections securely fastened.
C. Install temporary bracing and supports to secure trusses and support loads equal to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to trusses are secured.
D. Truss Spacing: As indicated on Drawings.

3.2 ERECTION TOLERANCES

A. Install cold-formed steel trusses level, plumb, and true to line to a maximum allowable tolerance variation of 1/8-inch in 10 feet and as follows:
   1. Space individual trusses no more than plus or minus 1/8-inch from plan location. Cumulative error are not to exceed minimum fastening requirements of sheathing or other finishing materials.

3.3 REPAIR

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel trusses with galvanized repair paint according to ASTM A780 and manufacturer's written instructions.

3.4 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:

END OF SECTION

SECTION 05 50 00 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Steel framing and supports for operable partitions.
2. Metal framing and supports for overhead doors and grilles.
3. Metal framing and supports for countertops.
4. Steel framing and supports for equipment.
5. Elevator machine beams.
6. Steel shapes for supporting elevator door sills.
7. Slotted channel framing.
8. Shelf angles.
9. Metal ladders.
10. Elevator pit sump covers.
11. Miscellaneous steel trim including steel angle corner guards and steel edgings.
12. Metal bollards.
13. Abrasive metal nosings.

B. Products furnished, but not installed, under this Section include the following:

1. Loose steel lintels.
2. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.

C. Related Requirements:

1. Division 01 Specification Sections apply to Work of this Section.
2. Section 04 20 00 "Unit Masonry" for installing loose lintels, anchor bolts, and other items built into unit masonry.

1.2 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of metal fabrications that are anchored to or that receive other work. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project Site in time for installation.

1.3 ACTION SUBMITTALS

A. Product Data: For the following:
1. Nonslip aggregates and nonslip-aggregate surface finishes.
2. Shop primers.
3. Paint products.
4. Shrinkage-resisting grout.
5. Metal bollards.
6. Abrasive metal nosingsand treads.

B. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide Shop Drawings for the following:
1. Steel framing and supports for operable partitions.
2. Steel framing and supports for overhead doors.
3. Steel framing and supports for countertops.
4. Elevator machine beamsand hoist beams.
5. Steel shapes for supporting elevator door sills.
6. Shelf angles.
7. Metal ladders.
8. Metal bollards.
9. Loose steel lintels.
10. Abrasive metal nosings.

C. Delegated-Design Submittal: For ladders, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel in accordance with the following:
1. AWS D1.1, "Structural Welding Code - Steel."

1.5 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls, floor slabs, decks, and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design ladders.

B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.
   1. Temperature Change: 120 degrees F, ambient; 180 degrees F, material surfaces.

2.2 METALS

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

B. Steel Plates, Shapes, and Bars: ASTM A36.

C. Rolled-Steel Floor Plate: ASTM A786, rolled from plate complying with ASTM A36 or ASTM A283, Grade C or D.
D. Rolled-Stainless Steel Floor Plate: ASTM A793.
E. Abrasive-Surface Floor Plate: Steel plate with abrasive granules rolled into surface orwith abrasive material metallically bonded to steel.

F. Steel Tubing: ASTM A500, cold-formed steel tubing.
G. Steel Pipe: ASTM A53, Standard Weight (Schedule 40) unless otherwise indicated.

H. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.
   1. Size of Channels: 1-5/8 by 1-5/8 inches.

   2. Material: Galvanized steel, ASTM A653, commercial steel, Type B, with G90 coating; 0.079-inch nominal thickness.
I. Cast Iron: Either gray iron, ASTM A48, or malleable iron, ASTM A47, unless otherwise indicated.
J. Aluminum Plate and Sheet: ASTM B209, Alloy 6061-T6.
K. Aluminum Extrusions: ASTM B221, Alloy 6063-T6.

2.3 FASTENERS

A. General: Unless otherwise indicated, provide Type 304 stainless steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
   1. Provide stainless steel fasteners for fastening aluminum, stainless steel or nickel silver.
   2. Provide bronze fasteners for fastening bronze.
B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A; with hex nuts, ASTM A563; and, where indicated, flat washers.

C. High-Strength Bolts, Nuts, and Washers: ASTM F3125, Grade A325, Type 3, heavy-hex steel structural bolts; ASTM A563, Grade DH3, heavy-hex carbon-steel nuts; and where indicated, flat washers.

D. Stainless Steel Bolts and Nuts: Regular hexagon-head annealed stainless steel bolts, ASTM F593; with hex nuts, ASTM F594; and, where indicated, flat washers; Alloy Group 1.

E. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A563; and, where indicated, flat washers.
   1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.

F. Anchors, General: Capable of sustaining, without failure, a load equal to 6 times the load imposed when installed in unit masonry and 4 times the load imposed when installed in concrete, as determined by testing in accordance with ASTM E488, conducted by a qualified independent testing agency.

G. Cast-in-Place Anchors in Concrete: Either threaded or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A47 malleable iron or ASTM A27 cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F2329.

H. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.
   1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941, Class Fe/Zn 5, unless otherwise indicated.

   2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless steel bolts, ASTM F593, and nuts, ASTM F594.

I. Slotted-Channel Inserts: Cold-formed, hot-dip galvanized-steel box channels (struts) complying with MFMA-4, 1-5/8- by 7/8-inch by length indicated with anchor straps or studs not less than 3 inches long at not more than 8 inches o.c. Provide with temporary filler and tee-head bolts, complete with washers and nuts, all zinc-plated to comply with ASTM B633, Class Fe/Zn 5, as needed for fastening to inserts.

2.4 MISCELLANEOUS MATERIALS

A. Shop Primers: Provide primers that comply with Section 09 91 13 "Exterior Painting." and Section 09 91 23 "Interior Painting."

B. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

C. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187.

D. Shrinkage-Resistant Grout: Factory-packaged, nonmetallic, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

E. Concrete: Comply with requirements in Section 03 30 00 "Cast-in-Place Concrete" for normal-weight, air-entrained concrete with a minimum 28-day compressive strength of 3,000 psi.

2.5 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32-inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
D. Form exposed work with accurate angles and surfaces and straight edges.
E. Weld corners and seams continuously to comply with the following:
    1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
    2. Obtain fusion without undercut or overlap.
    3. Remove welding flux immediately.
    4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.
G. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
J. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8-inch by 1-1/2 inches, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

2.6 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.
    1. Fabricate units from slotted channel framing where indicated.

C. Fabricate supports for operable partitions from continuous steel beams of sizes recommended by partition manufacturer with attached bearing plates, anchors, and braces as recommended by partition manufacturer. Drill or punch bottom flanges of beams to receive partition track hanger rods; locate holes where indicated on operable partition Shop Drawings.

D. Metal Framing and Supports for Countertops: Basis of Design Product: RAKKS Type "EH" by Rangine Corporation.
   1. Type: Support brackets fabricated by welding miter cut extruded aluminum sections, grinding and deburring sharp edges and welds, drilling holes for field attachment, and factory finishing.
   2. Material: Fabricate components from extruded aluminum sections complying with ASTM B221, 6063-T5 alloy and temper.
   3. Factory applied finishes: Exposed aluminum surfaces shall be free of scratches and other serious blemishes and be factory finished with clear anodized coating complying with AAMA 607.1 - MM10C22A31.
   4. Surface mounted counter brackets: L-shaped bracket fabricated from aluminum T sections designed for supporting counter, shelf, work surface as manufactured by Rangine Corporation. Horizontal leg within 3 inches of front edge with 18-inch vertical legs.

E. Galvanize miscellaneous framing and supports where indicated.

2.7 SHELF ANGLES

A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch bolts, spaced not more than 6 inches from ends and 24 inches o.c., unless otherwise indicated.
   1. Provide mitered and welded units at corners.
   2. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately 2 inches larger than expansion or control joint.

B. Galvanize shelf angles located in exterior walls.

2.8 METAL LADDERS

A. General:
   1. Comply with ANSI A14.3, except for elevator pit ladders.
   2. For elevator pit ladders, comply with ASME A17.1/CSA B44.

B. Steel Ladders:
   1. Space siderails 24 inches apart unless otherwise indicated.

   2. Siderails: Continuous, 1/2-inch by 2-1/2-inch steel flat bars, with eased edges.

   3. Rungs: 1-inch diameter, steel bars.
   4. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
   5. Provide nonslip surfaces on top of each rung, either by coating rung with aluminum-oxide granules set in epoxy-resin adhesive or by using a type of manufactured rung filled with aluminum-oxide grout.

6. Provide nonslip surfaces on top of each rung by coating with abrasive material metallically bonded to rung.

7. Provide platforms as indicated fabricated from welded or pressure-locked steel bar grating, supported by steel angles. Limit openings in gratings to no more than 1/2-inch in least dimension.

8. Support each ladder at top and bottom and not more than 60 inches o.c. with welded or bolted steel brackets.
9. Galvanized exterior ladders, including brackets.

2.9 ALTERNATING TREAD DEVICES

A. Alternating Tread Devices: Fabricate alternating tread devices of open-type construction with channel or plate stringers and pipe and tube railings unless otherwise indicated. Provide brackets and fittings for installation.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Lapeyre Stair Inc.
      b. Precision Ladders, LLC.
   2. Tread depth shall be not less than 5 inches exclusive of nosing or less than 8-1/2 inches including the nosing, tread width shall be not less than 7 inches, and riser height shall be not more than 9-1/2 inches.

   3. Tread depth shall be not less than 8-1/2 inches exclusive of nosing or less than 10-1/2 inches including the nosing, tread width shall be not less than 7 inches, and riser height shall be not more than 8 inches.
   4. Fabricate from aluminum and assemble by welding or with stainless steel fasteners.
   5. Comply with applicable railing requirements in Section 05 52 13 "Pipe and Tube Railings."
B. Prime exterior steel alternating tread devices, including treads, railings, brackets, and fasteners, with primer specified in Section 09 96 00 "High-Performance Coatings."

2.10 ELEVATOR PIT SUMP COVERS

A. Fabricate from welded or pressure-locked steel bar grating. Limit openings in gratings to no more than 3/4-inch in least dimension.
B. Provide steel angle supports unless otherwise indicated.

2.11 MISCELLANEOUS STEEL TRIM

A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.

B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.
   1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.
C. Galvanize miscellaneous steel trim.

2.12 METAL BOLLARDS

A. Fabricate metal bollards from Schedule 80 steel pipe.
   1. Cap bollards with 1/4-inch- thick, steel plate with domed top.

B. Prime steel bollards with zinc-rich primer.

2.13 ABRASIVE METAL NOSINGS

A. Cast-Metal Units: Cast iron, with an integral-abrasive, as-cast finish consisting of aluminum oxide, silicon carbide, or a combination of both. Fabricate units in lengths necessary to accurately fit openings or conditions.
   1. Manufacturers: Subject to compliance with requirements, provide products by 1 of the following:
      a. American Safety Tread Co., Inc.
      b. Balco, Inc.
      c. Wooster Products Inc.
   2. Nosings: Cross-hatched units, 4 inches wide with 1/4-inch lip, for casting into concrete.

2.14 LOOSE STEEL LINTELS

A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Fabricate in single lengths for each opening unless otherwise indicated. Weld adjoining members together to form a single unit where indicated.

B. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span, but not less than 8 inches unless otherwise indicated.
C. Galvanize and prime loose steel lintels located in exterior walls.

2.15 STEEL WELD PLATES AND ANGLES

A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than 2 integrally welded steel strap anchors for embedding in concrete.

2.16 GENERAL FINISH REQUIREMENTS

A. Finish metal fabrications after assembly.
B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.17 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153 for steel and iron hardware and with ASTM A123 for other steel and iron products.
   1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
B. Preparation for Shop Priming Galvanized Items: After galvanizing, thoroughly clean galvanized surfaces of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.
C. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.
   1. Shop prime with primers specified in Section 09 91 13 "Exterior Painting" and primers specified in Section 09 91 23 "Interior Painting" unless primers specified in Section 09 96 00 "High-Performance Coatings" are indicated.
D. Preparation for Shop Priming: Prepare surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
   1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
   2. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
   3. Other Steel Items: SSPC-SP 3, "Power Tool Cleaning."
E. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
C. Field Welding: Comply with the following requirements:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction.

Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

F. Corrosion Protection: Coat concealed surfaces of aluminum that come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:
   1. Cast Aluminum: Heavy coat of bituminous paint.
   2. Extruded Aluminum: Two coats of clear lacquer.

3.2 INSTALLATION OF MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

B. Anchor supports for overhead doors securely to, and rigidly brace from, building structure.

3.3 INSTALLATION OF METAL BOLLARDS

A. Anchor bollards in place with concrete footings. Center and align bollards in holes 3 inches above bottom of excavation. Place concrete and vibrate or tamp for consolidation. Support and brace bollards in position until concrete has cured.

3.4 INSTALLATION OF NOSINGS

A. Center nosings on tread widths unless otherwise indicated.

B. For nosings embedded in concrete steps or curbs, align nosings flush with riser faces and level with tread surfaces.

C. Seal thresholds exposed to exterior with elastomeric sealant complying with Section 07 92 00 "Joint Sealants" to provide a watertight installation.

3.5 REPAIRS

A. Touchup Painting:
   1. Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
      a. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.
   2. Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 09 91 13 "Exterior Painting" an Section 09 91 23 "Interior Painting."

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780.

END OF SECTION

SECTION 05 52 13 – PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes steel pipe and tube railings.
B. Related Requirements:
   1. Division 01 Specification Sections apply to Work of this Section.
   2. Section 09 91 13 "Exterior Painting."

1.2 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
B. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project Site in time for installation.
C. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

1.3 ACTION SUBMITTALS

A. Shop Drawings: Include plans, elevations, sections, details, and attachments to other Work.

1.4 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:
   1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

1.6 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design railings, including attachment to building construction.
B. Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
   1. Handrails and Top Rails of Guards:
      a. Uniform load of 50 lbf/ ft. applied in any direction.
      b. Concentrated load of 200 lbf applied in any direction.
      c. Uniform and concentrated loads need not be assumed to act concurrently.
   2. Infill of Guards:
      a. Concentrated load of 50 lbf applied horizontally on an area of 1 square foot.
      b. Infill load and other loads need not be assumed to act concurrently.

2.2 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.
B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.
   1. Provide type of bracket with predrilled hole for exposed bolt anchorage and that provides 1-1/2-inch clearance from inside face of handrail to finished wall surface.

2.3 STEEL AND IRON

A. Pipe: ASTM A53, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.
   1. Provide galvanized finish for exterior installations and where indicated.
B. Plates, Shapes, and Bars: ASTM A36.
C. Cast Iron: Either gray iron, ASTM A48, or malleable iron, ASTM A47, unless otherwise indicated.

2.4 FASTENERS

A. General: Provide the following:
   1. Ungalvanized-Steel Railings: Plated steel fasteners complying with ASTM B633 or ASTM F1941, Class Fe/Zn 5 for zinc coating.
   2. Hot-Dip Galvanized Railings: Type 304 stainless-steel or hot-dip zinc-coated steel fasteners complying with ASTM A153 or ASTM F2329 for zinc coating.
   3. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.

B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.
C. Fasteners for Interconnecting Railing Components:
   1. Provide concealed fasteners for interconnecting railing components and for attaching them to other Work, unless otherwise indicated.
   2. Provide concealed fasteners for interconnecting railing components and for attaching them to other Work, unless exposed fasteners are unavoidable or are the standard fastening method for railings indicated.
   3. Provide Phillips, square or hex socket flat-head machine screws for exposed fasteners unless otherwise indicated.
D. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors capable of sustaining, without failure, a load equal to 6 times the load imposed when installed in unit masonry and 4 times the load imposed when installed in concrete, as determined by testing according to ASTM E488, conducted by a qualified independent testing agency.
   1. Material for Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B633 or ASTM F1941, Class Fe/Zn 5, unless otherwise indicated.
   2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 2 stainless-steel bolts, ASTM F593, and nuts, ASTM F594.

2.5 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
B. Etching Cleaner for Galvanized Metal: Complying with MPI#25.
C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
D. Shop Primers: Provide primers that comply with Section 09 91 13 "Exterior Painting" and Section 09 91 23 "Interior Painting."
E. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
   1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
F. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.
G. Intermediate Coats and Topcoats: Provide products that comply with Section 09 91 13 "Exterior Painting" and Section 09 91 23 "Interior Painting."
H. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.
I. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project Site to create pourable anchoring, patching, and grouting compound.
   1. Water-Resistant Product: At exterior locations provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior use.

2.6 FABRICATION

A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.
B. Shop assemble railings to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.
C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32-inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
D. Form Work true to line and level with accurate angles and surfaces.
E. Fabricate connections that are exposed to weather in a manner that excludes water. Provide weep holes where water may accumulate.
F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.
G. Connections: Fabricate railings with welded connections unless otherwise indicated.
H. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
    1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
    2. Obtain fusion without undercut or overlap.
    3. Remove flux immediately.
    4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.
I. Form Changes in Direction as Follows:
    1. By bending or by inserting prefabricated elbow fittings.
J. For changes in direction made by bending, use jigs to produce uniform curvature for each repetitive configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
K. Close exposed ends of railing members with prefabricated end fittings.
L. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4-inch or less.
M. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other Work unless otherwise indicated.
    1. At brackets and fittings fastened to plaster or gypsum board partitions, provide crush-resistant fillers or other means to transfer loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.

N. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.

2.7 STEEL AND IRON FINISHES

A. For nongalvanized-steel railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves; however, galvanize anchors to be embedded in exterior concrete or masonry.
B. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 3, "Power Tool Cleaning."
C. Primer Application: Apply shop primer to prepared surfaces of railings unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Shop, Field, and Maintenance Painting of Steel," for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.
    1. Shop prime uncoated railings with universal shop primer.
    2. Do not apply primer to galvanized surfaces.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine plaster and gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements are clearly marked for Installer. Locate reinforcements and mark locations if not already done.

3.2 INSTALLATION, GENERAL

A. Fit exposed connections together to form tight, hairline joints.
B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
    1. Do not weld, cut, or abrade surfaces of railing components that are coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
    2. Set posts plumb within a tolerance of 1/16-inch in 3 feet.
    3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4-inch in 12 feet.
C. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.
    1. Coat, with a heavy coat of bituminous paint, concealed surfaces of aluminum that are in contact with grout, concrete, masonry, wood, or dissimilar metals.
D. Adjust railings before anchoring to ensure matching alignment at abutting joints.
E. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.3 RAILING CONNECTIONS

A. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article whether welding is performed in the shop or in the field.
B. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending 2 inches beyond joint on either side, fasten internal sleeve securely to one side, and locate joint within 6 inches of post.

3.4 ANCHORING POSTS

A. Form or core-drill holes not less than 5 inches deep and 3/4-inch larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with non-shrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions.
B. Cover anchorage joint with flange of same metal as post, attached to post with set screws.

3.5 ATTACHING RAILINGS

A. Anchor railing ends at walls with round flanges anchored to wall construction and welded to railing ends.
B. Anchor railing ends to metal surfaces with flanges bolted to metal surfaces and welded to railing ends.
C. Attach railings to wall with wall brackets. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.
D. Secure wall brackets and railing end flanges to building construction as follows:
    1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
    2. For hollow masonry anchorage, use toggle bolts.
    3. For wood stud partitions, use hanger or lag bolts set into studs or wood backing between studs. Coordinate with carpentry work to locate backing members.
    4. For steel-framed partitions, use hanger or lag bolts set into wood backing between studs. Coordinate with stud installation to locate backing members.
    5. For steel-framed partitions, use self-tapping screws fastened to steel framing or to concealed steel reinforcements.
    6. For steel-framed partitions, use toggle bolts installed through flanges of steel framing or through concealed steel reinforcements.

3.6 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 requirements for touching up shop-painted surfaces.
    1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

3.7 PROTECTION

A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

END OF SECTION

SECTION 06 10 00 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Wood blocking, cants, and nailers.
2. Wood furring and grounds.

3. Plywood backing panels.

B. Related Requirements:
1. Division 01 Specification Sections apply to the Work of this Section.
2. Section 06 16 00 "Sheathing" for sheathing, subflooring, and underlayment.

1.2 DEFINITIONS

A. Boards or Strips: Lumber of less than 2 inches nominal size in least dimension.

B. Dimension Lumber: Lumber of 2 inches nominal size or greater but less than 5 inches nominal size in least dimension.

C. Exposed Framing: Framing not concealed by other construction.

D. OSB: Oriented strand board.

E. Timber: Lumber of 5 inches nominal size or greater in least dimension.

F. Lumber grading agencies, and abbreviations used to reference them, include the following:
1. NeLMA: Northeastern Lumber Manufacturers' Association.
2. NLGA: National Lumber Grades Authority.
3. SPIB: The Southern Pine Inspection Bureau.
4. WCLIB: West Coast Lumber Inspection Bureau.
5. WWPA: Western Wood Products Association.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
1. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
2. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D5664.

1.4 INFORMATIONAL SUBMITTALS

A. Material Certificates:
   1. For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.

B. Reports: For the following, from ICC-ES:
   1. Fire-retardant-treated wood.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Stack wood products flat with spacers beneath and between each bundle to provide air circulation. Protect wood products from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 PRESERVATIVE TREATMENT

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground.
   1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.

   2. After treatment, redry to 19 percent maximum moisture content.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

D. Application: Treat items indicated on Drawings, and the following:
   1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
   2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
   3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
   4. Wood framing members that are less than 18 inches above the ground in crawlspaces or unexcavated areas.
   5. Wood floor plates that are installed over concrete slabs-on-grade.

2.2 FIRE-RETARDANT TREATMENT

A. General: Where fire-retardant-treated materials are indicated, materials shall comply with requirements in this article, that are acceptable to authorities having

jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.
   1. Treatment shall not promote corrosion of metal fasteners.

   2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D2898. Use for exterior locations and where indicated.
   3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D3201 at 92 percent relative humidity. Use where exterior type is not indicated.

C. Kiln-dry lumber after treatment to maximum moisture content of 19 percent. Kiln-dry plywood after treatment to maximum moisture content of 15 percent.

D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.

E. For exposed items indicated to receive a stained or natural finish, chemical formulations shall not bleed through, contain colorants, or otherwise adversely affect finishes.

F. Application: Treat items indicated on Drawings, and the following:
   1. Framing for raised platforms.
   2. Framing for stages.
   3. Concealed blocking.
   4. Plywood backing panels.

2.3 MISCELLANEOUS LUMBER

A. Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
   1. Blocking.
   2. Nailers.
   3. Rooftop equipment bases and support curbs.
   4. Cants.

B. Concealed Boards: 15 percent maximum moisture content and any of the following species and grades:

C. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.

D. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.
E. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.4 PLYWOOD BACKING PANELS

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

2.5 FASTENERS

A. General: Fasteners shall be of size and type indicated and shall comply with requirements specified in this article for material and manufacture. Provide nails or screws, in sufficient length, to penetrate not less than 1-1/2 inches into wood substrate.
   1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A153 or ASTM F2329.

B. Nails, Brads, and Staples: ASTM F1667.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.
B. Set work to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry accurately to other construction. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.
C. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant-treated plywood backing panels with classification marking of testing agency exposed to view.

D. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:
   1. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than 96 inches o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.
   2. Fire block concealed spaces of wood-framed walls and partitions at each floor level, at ceiling line of top story, and at not more than 96 inches o.c. Where fire blocking is not inherent in framing system used, provide closely fitted solid wood blocks of same width as framing members and 2-inch nominal thickness.

3. Fire block concealed spaces between floor sleepers with same material as sleepers to limit concealed spaces to not more than 100 sq. ft. and to solidly fill space below partitions.

4. Fire block concealed spaces behind combustible cornices and exterior trim at not more than 20 feet o.c.

E. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

F. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
1. Use inorganic boron for items that are continuously protected from liquid water.
2. Use copper naphthenate for items not continuously protected from liquid water.

G. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

H. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code (IBC).

2. ICC-ES evaluation report for fastener.

I. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

J. For exposed work, arrange fasteners in straight rows parallel with edges of members, with fasteners evenly spaced, and with adjacent rows staggered.
1. Use finishing nails unless otherwise indicated. Countersink nail heads and fill holes with wood filler.

3.2 INSTALLATION OF WOOD BLOCKING AND NAILERS

A. Install where indicated and where required for screeding or attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

3.3 INSTALLATION OF WOOD FURRING

A. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.

3.4 PROTECTION

A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

B. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet enough that moisture content exceeds that specified, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION

SECTION 06 16 00 - SHEATHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Wall sheathing.
   2. Parapet sheathing.
   3. Sheathing joint and penetration treatment.

B. Related Requirements:
   1. Division 01 Specification Sections apply to Work of this Section.
   2. Section 06 10 00 "Rough Carpentry" for plywood backing panels.
   3. Section 07 27 26 "Fluid Applied Membrane Air Barriers" for water-resistive barrier applied over wall sheathing.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
   1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Indicate type of preservative used and net amount of preservative retained.
   2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Include physical properties of treated materials.
   3. For fire-retardant treatments, include physical properties of treated plywood both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D5516.
   4. For products receiving waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project Site.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance Ratings: As tested according to ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

B. Air-Barrier and Water-Resistant Glass-Mat Gypsum Sheathing Performance: Air-barrier and water-resistant glass-mat gypsum sheathing assembly, and seals with adjacent construction, shall be capable of performing as a continuous air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air-barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations, tie-ins to installed waterproofing, tie-ins to other installed air barriers, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.

2.2 WOOD PANEL PRODUCTS

A. Thickness: As needed to comply with requirements specified, but not less than thickness indicated.
B. Factory mark panels to indicate compliance with applicable standard.

2.3 FIRE-RETARDANT-TREATED PLYWOOD

A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
B. Fire-Retardant-Treated Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.
    1. Use treatment that does not promote corrosion of metal fasteners.

    2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated plywood by pressure process after being subjected to accelerated weathering according to ASTM D2898. Use for exterior locations and where indicated.
    3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D3201 at 92 percent relative humidity. Use where exterior type is not indicated.

4. Design Value Adjustment Factors: Treated lumber plywood shall be tested according to ASTM D5516 and design value adjustment factors shall be calculated according to ASTM D6305. Span ratings after treatment shall be not less than span ratings specified. For roof sheathing and where high-temperature fire-retardant treatment is indicated, span ratings for temperatures up to 170 degrees F shall be not less than span ratings specified.

C. Kiln-dry material after treatment to a maximum moisture content of 15 percent. Do not use material that is warped or does not comply with requirements for untreated material.

D. Identify fire-retardant-treated plywood with appropriate classification marking of qualified testing agency.

E. Application: Treat all plywood unless otherwise indicated.
1. Roof sheathing.
2. Subflooring and underlayment for raised platforms.

2.4 WALL SHEATHING

A. Glass-Mat Gypsum Sheathing: ASTM C1177.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. CertainTeed Corporation.
b. Georgia-Pacific Gypsum LLC.
c. National Gypsum Company.
d. USG Corporation.
2. Type and Thickness: Type X, 5/8-inch thick.

3. Size: 48 by 96 inches for vertical installation.

2.5 PARAPET SHEATHING

A. Plywood Sheathing: Exterior sheathing.
1. Span Rating: Not less than 16/0.
2. Nominal Thickness: Not less than 3/4-inch.

2.6 SUBFLOORING AND UNDERLAYMENT

A. Plywood Combination Subfloor-Underlayment: DOC PS 1, Exposure 1, Structural I, Underlayment single-floor panels.
1. Span Rating: Not less than 16.

2. Nominal Thickness: Not less than 3/4-inch.

3. Edge Detail: Square.

2.7 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

1. For parapet and wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A153.

B. Nails, Brads, and Staples: ASTM F1667.

C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

D. Screws for Fastening Sheathing to Wood Framing: ASTM C1002.

E. Screws for Fastening Wood Structural Panels to Cold-Formed Metal Framing: ASTM C954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.

F. Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing to be attached.

1. For steel framing less than 0.0329-inch thick, use screws that comply with ASTM C1002.

2. For steel framing from 0.033-inch to 0.112-inch thick, use screws that comply with ASTM C954.

G. Screws for Fastening Composite Nail Base Insulated Roof Sheathing to Metal Roof Deck: Steel drill screws, in type and length recommended by sheathing manufacturer for thickness of sheathing to be attached, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B117. Provide washers or plates if recommended by sheathing manufacturer.

2.8 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

A. Sealant for Glass-Mat Gypsum Sheathing: Silicone emulsion sealant complying with ASTM C834, compatible with sheathing tape and sheathing and recommended by tape and sheathing manufacturers for use with glass-fiber sheathing tape and for covering exposed fasteners.

1. Sheathing Tape: Self-adhering glass-fiber tape, minimum 2 inches wide, 10 by 10 or 10 by 20 threads/inch, of type recommended by sheathing and tape manufacturers for use with silicone emulsion sealant in sealing joints in glass-mat gypsum sheathing and with a history of successful in-service use.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than 3 support members.

B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.

C. Securely attach to substrate by fastening as indicated, complying with the following:

1. Table 2304.9.1, "Fastening Schedule," in the ICC's International Building Code.

2. ICC-ES evaluation report for fastener.

D. Coordinate wall and parapet sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.
E. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.
F. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.2 GYPSUM SHEATHING INSTALLATION

A. Comply with GA-253 and with manufacturer's written instructions.
   1. Fasten gypsum sheathing to cold-formed metal framing with screws.
   2. Install panels with a 3/8-inch gap where non-load-bearing construction abuts structural elements.
   3. Install panels with a 1/4-inch gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.
B. Apply fasteners so heads bear tightly against face of sheathing, but do not cut into facing.

C. Horizontal Installation: Install sheathing with V-grooved edge down and tongue edge up. Interlock tongue with groove to bring long edges in contact with edges of adjacent panels without forcing. Abut ends over centers of studs, and stagger end joints of adjacent panels not less than 1 stud spacing. Attach at perimeter and within field of panel to each stud.
   1. Space fasteners approximately 8 inches o.c. and set back a minimum of 3/8-inch from edges and ends of panels.
D. Vertical Installation: Install vertical edges centered over studs. Abut ends and edges with those of adjacent panels. Attach at perimeter and within field of panel to each stud.
   1. Space fasteners approximately 8 inches o.c. and set back a minimum of 3/8-inch from edges and ends of panels.

E. Seal sheathing joints according to sheathing manufacturer's written instructions.
   1. Apply elastomeric sealant to joints and fasteners and trowel flat. Apply sufficient amount of sealant to completely cover joints and fasteners after troweling. Seal other penetrations and openings.
   2. Apply glass-fiber sheathing tape to glass-mat gypsum sheathing joints and apply and trowel sealant to embed entire face of tape in sealant. Apply sealant to exposed fasteners with a trowel so fasteners are completely covered. Seal other penetrations and openings.

3.3 CEMENTITIOUS BACKER UNIT INSTALLATION

A. Install panels and treat joints according to ANSI A108.11 and manufacturer's written instructions for type of application indicated.

END OF SECTION

SECTION 06 41 16 - PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Plastic-laminate-clad architectural cabinets.
   2. Wood furring, blocking, shims, and hanging strips for installing plastic-laminate-clad architectural cabinets that are not concealed within other construction.

B. Related Requirements:
   1. Texas Facilities Commission - 2015 Uniform General Conditions.
   2. Texas Facilities Commission - Preconstruction Guidelines.
   3. Division 01 Specification Sections apply to Work of this Section.
   4. Section 06 10 00 "Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing cabinets that are concealed within other construction before cabinet installation.

1.2 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to support loads imposed by installed and fully loaded cabinets.

B. Hardware Coordination: Distribute copies of Section 08 71 00.10 "Door Hardware Schedule" to manufacturer of architectural cabinets; coordinate Shop Drawings and fabrication with hardware requirements.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.

B. Shop Drawings:
   1. Include Plans, elevations, Sections, and attachment details.
   2. Show large-scale details.
   3. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
   4. Show locations and sizes of cutouts and holes for items installed in plastic-laminate architectural cabinets.

C. Samples for Verification: For the following:
   1. Plastic Laminates: 8 by 10 inches, for each type, color, pattern, and surface finish required.
      a. Provide 1 sample applied to core material with specified edge material applied to 1 edge.

2. Thermoset Decorative Panels: 8 by 10 inches, for each color, pattern, and surface finish.
   a. Provide edge banding on 1 edge.
3. Corner Pieces:
   a. Cabinet-front frame joints between stiles and rails and at exposed end pieces, 18 inches high by 18 inches wide by 6 inches deep.
   b. Miter joints for standing trim.
4. Exposed Cabinet Hardware and Accessories: 1 full-size unit for each type and finish.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer and installer.

1.5 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.
B. Installer Qualifications: Manufacturer of products.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver cabinets until painting and similar finish operations that might damage architectural cabinets have been completed in installation areas. Store cabinets in installation areas or in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install cabinets until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels planned for building occupants during the remainder of the construction period.
B. Environmental Limitations: Do not deliver or install cabinets until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 degrees F and relative humidity between 43 and 70 percent during the remainder of the construction period.
C. Field Measurements: Where cabinets are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
   1. Locate concealed framing, blocking, and reinforcements that support cabinets by field measurements before being enclosed/concealed by construction, and indicate measurements on Shop Drawings.
D. Established Dimensions: Where cabinets are indicated to fit to other construction, establish dimensions for areas where cabinets are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS

A. Quality Standard: Unless otherwise indicated, comply with the Architectural Woodwork Standards for grades of cabinets indicated for construction, finishes, installation, and other requirements.
   1. The Contract Documents contain requirements that are more stringent than the referenced quality standard. Comply with requirements of Contract Documents in addition to those of the referenced quality standard.

B. Architectural Woodwork Standards Grade: Custom.

C. Type of Construction: Frameless.

D. Door and Drawer-Front Style: Flush overlay.

E. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or if not indicated, as required by quality standard.
   1. Manufacturers: Basis of Design and subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. As indicated on Interior Material Legend in Drawings.

F. Laminate Cladding for Exposed Surfaces:
   1. Horizontal Surfaces: Grade HGS.
   2. Postformed Surfaces: Grade HGP.
   3. Vertical Surfaces: Grade VGS.
   4. Edges: PVC edge banding, 0.12-inch-thick, matching laminate in color, pattern, and finish.
   5. Pattern Direction: Vertically for doors and fixed panels, horizontally for drawer fronts.

G. Materials for Semiexposed Surfaces:
   1. Surfaces Other Than Drawer Bodies: Thermoset decorative panels.
      a. Edges of Plastic-Laminate Shelves: PVC edge banding, 0.12-inch-thick, matching laminate in color, pattern, and finish.
      b. Edges of Thermoset Decorative Panel Shelves: PVC or polyester edge banding.
      c. For semiexposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, NEMA LD 3, Grade VGS.
   2. Drawer Sides and Backs: Thermoset decorative panels with PVC or polyester edge banding.
   3. Drawer Bottoms: Thermoset decorative panels.

H. Drawer Construction: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.
   1. Join subfronts, backs, and sides with glued rabbeted joints supplemented by mechanical fasteners or glued dovetail joints.

I. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:

1. As selected by Architect from laminate manufacturer's full range in the following categories:
    a. Solid colors, matte finish.
    b. Solid colors with core same color as surface, matte finish.
    c. Wood grains, matte finish.
    d. Patterns, matte finish.

2.2 WOOD MATERIALS

A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.
    1. Wood Moisture Content: 5 to 10 percent.
B. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.
C. Composite Wood Products: Products shall be made without urea formaldehyde.
    1. Thermoset Decorative Panels: Particleboard or MDF finished with thermally fused, melamine-impregnated decorative paper and complying with requirements of NEMA LD 3, Grade VGL, for Test Methods 3.3, 3.4, 3.6, 3.8, and 3.10.

2.3 CABINET HARDWARE AND ACCESSORIES

A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets except for items specified in Section 08 71 00 "Door Hardware."
    1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
        a. Accuride International.
        b. Blum, Julius & Co., Inc.
        c. CompX International, Inc.
        d. Hettich America L.P.
        e. Knape & Vogt Manufacturing Company.
B. Butt Hinges: 2-3/4-inch, 5-knuckle steel hinges made from 0.095-inch-thick metal, and as follows:
    1. Semiconcealed Hinges for Flush Doors: BHMA A156.9, B01361.
C. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 135 degrees of opening, self-closing.
D. Back-Mounted Pulls: BHMA A156.9, B02011.
E. Wire Pulls: Back mounted, solid, 5 inches long, 2-1/2 inches deep, and 5/16-inch in diameter.
F. Catches: Ball friction catches, BHMA A156.9, B03013.
G. Adjustable Shelf Standards and Supports: BHMA A156.9, B04102; with shelf brackets, B04112.
H. Drawer Slides: BHMA A156.9.
    1. Grade 1HD-100 and Grade 1HD-200: Side mounted; full-overtravel-extension type; zinc-plated-steel ball-bearing slides.

2. For drawers not more than 3 inches high and not more than 24 inches wide, provide Grade 2.
3. For drawers more than 3 inches high, but not more than 6 inches high and not more than 24 inches wide, provide Grade 1.
4. For drawers more than 6 inches high or more than 24 inches wide, provide Grade 1HD-100.
5. For computer keyboard shelves, provide Grade 1.
6. For trash bins not more than 20 inches high and 16 inches wide, provide Grade 1HD-100.

I. Door Locks: BHMA A156.11, E07121.
J. Drawer Locks: BHMA A156.11, E07041.
K. Door and Drawer Silencers: BHMA A156.16, L03011.
L. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

2.4 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln-dried to less than 15 percent moisture content.
B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.
C. Adhesives: Do not use adhesives that contain urea formaldehyde.
D. Adhesive for Bonding Plastic Laminate:
   1. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.

2.5 FABRICATION

A. Fabricate architectural cabinets to dimensions, profiles, and details indicated.
B. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
   1. Notify Architect 7 days in advance of the dates and times architectural cabinet fabrication will be complete.
   2. Trial fit assemblies at manufacturer's shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements before disassembling for shipment.
C. Shop-cut openings to maximum extent possible to receive hardware, appliances, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installation, condition cabinets to humidity conditions in installation areas for not less than 72 hours.

3.2 INSTALLATION

A. Architectural Woodwork Standards Grade: Install cabinets to comply with quality standard grade of item to be installed.
B. Assemble cabinets and complete fabrication at Project site to extent that it was not completed in the shop.
C. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with wafer-head cabinet installation screws.
D. Install cabinets level, plumb, and true in line to a tolerance of 1/8-inch in 96 inches using concealed shims.
    1. Scribe and cut cabinets to fit adjoining Work, refinish cut surfaces, and repair damaged finish at cuts.
    2. Install cabinets without distortion so doors and drawers fit openings and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
    3. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches o.c. with No. 10 wafer-head screws sized for not less than 1-1/2-inch penetration into wood framing, blocking, or hanging strips.

3.3 ADJUSTING AND CLEANING

A. Repair damaged and defective cabinets, where possible, to eliminate functional and visual defects. Where not possible to repair, replace architectural cabinets. Adjust joinery for uniform appearance.
B. Clean, lubricate, and adjust hardware.
C. Clean cabinets on exposed and semiexposed surfaces.

END OF SECTION

SECTION 07 19 00 - WATER REPELLENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes penetrating water-repellent treatments for the following vertical and horizontal surfaces:
   1. Cast-in-place concrete.
   2. Cast stone.
   3. Concrete unit masonry.

B. Related Requirements:
   1. Division 01 Specification Sections apply to Work of this Section.
   2. Section 04 20 00 "Unit Masonry" for integral water-repellent admixture for unit masonry assemblies.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each type and color of water repellent and substrate indicated, 12 by 12 inches in size, with specified water-repellent treatment applied to half of each Sample.

1.3 QUALITY ASSURANCE

A. Mockups: Prepare mockups of each required water repellent on each type of substrate required to demonstrate aesthetic effects, and to set quality standards for materials and execution.
   1. Locate mockups on masonry sample panels.
   2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

1.4 FIELD CONDITIONS

A. Limitations: Proceed with application only when the following existing and forecasted weather and substrate conditions permit water repellents to be applied according to manufacturers' written instructions and warranty requirements:
   1. Concrete surfaces and mortar have cured for not less than 28 days.
   2. Building has been closed in for not less than 30 days before treating wall assemblies.
   3. Ambient temperature is above 40 degrees F and below 100 degrees F and will remain so for 24 hours.
   4. Substrate is not frozen and substrate-surface temperature is above 40 degrees F and below 100 degrees F.
   5. Rain or snow is not predicted within 24 hours.
   6. Not less than 7 days have passed since surfaces were last wet.
   7. Windy conditions do not exist that might cause water repellent to be blown onto vegetation or surfaces not intended to be treated.

1.5 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer and Applicator agree(s) to repair or replace materials that fail to maintain water repellency specified in "Performance Requirements" Article within specified warranty period.
   1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Performance: Water repellents must meet the following performance requirements as determined by testing on manufacturer's standard substrates representing those indicated for this Project.

B. Water Absorption: Minimum 80 percent reduction of water absorption after 24 hours for treated compared to untreated specimens when tested according to the following:
   1. Cast-in-Place Concrete: ASTM C642.
   2. Cast Stone: ASTM C1195.
   3. Concrete Masonry Units: ASTM C140.

C. Water-Vapor Transmission: Comply with 1 or both of the following:
   1. Maximum 10 percent reduction water-vapor transmission of treated compared to untreated specimens, according to ASTM E96.

D. Water Penetration and Leakage through Masonry: Minimum 90 percent reduction in leakage rate of treated compared to untreated specimens, according to ASTM E514.

E. Durability: Maximum 5 percent loss of water-repellent performance after 2500 hours of weathering according to ASTM G154 compared to water-repellent-treated specimens before weathering.

F. Chloride-Ion Intrusion in Concrete: NCHRP Report 244, Series II tests.
   1. Reduction of Water Absorption: 80 percent.
   2. Reduction in Chloride Content: 80 percent.

2.2 PENETRATING WATER REPELLENTS

A. Penetrating Low-VOC Silane Water Repellent: Clear, containing 20 percent or more active content of modified silane; with alcohol, mineral spirits, water, or other proprietary solvent carrier; and with 400 g/L or less of VOCs.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Pecora Corporation.
      b. PROSOCO, Inc.
      c. W.R. Meadows, Inc.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with applicator present, for compliance with requirements and conditions affecting performance of the Work.
   1. Verify that surfaces are clean and dry according to water-repellent manufacturer's requirements. Check moisture content in 3 representative locations by method recommended by manufacturer.
   2. Verify that there is no efflorescence or other removable residues that would be trapped beneath the application of water repellent.
   3. Verify that required repairs are complete, cured, and dry before applying water repellent.

B. Test pH level according to water-repellent manufacturer's written instructions to ensure chemical bond to silica-containing or siliceous minerals.

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

3.2 PREPARATION

A. New Construction and Repairs: Allow concrete and other cementitious materials to age before application of water repellent, according to repellent manufacturer's written instructions.

B. Cleaning: Before application of water repellent, clean substrate of substances that could impair penetration or performance of product according to water-repellent manufacturer's written instructions.

C. Protect adjoining work, including mortar and sealant bond surfaces, from spillage or blow-over of water repellent. Cover adjoining and nearby surfaces of aluminum and glass if there is the possibility of water repellent being deposited on surfaces. Cover live vegetation.

D. Coordination with Mortar Joints: Do not apply water repellent until pointing mortar for joints adjacent to surfaces receiving water-repellent treatment has been installed and cured.

E. Coordination with Sealant Joints: Do not apply water repellent until sealants for joints adjacent to surfaces receiving water-repellent treatment have been installed and cured.
   1. Water-repellent work may precede sealant application only if sealant adhesion and compatibility have been tested and verified using substrate, water repellent, and sealant materials identical to those required.

3.3 APPLICATION

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect the substrate before application of water repellent and to instruct Applicator on the product and application method to be used.

B. Apply coating of water repellent on surfaces to be treated using 15 psi- pressure spray with a fan-type spray nozzle to the point of saturation. Apply coating in dual passes of uniform, overlapping strokes. Remove excess material; do not allow material to puddle beyond saturation. Comply with manufacturer's written instructions for application procedure unless otherwise indicated.
   1. Cast Stone: At Contractor's option, first application of water repellent may be completed before installing units. Mask mortar and sealant bond surfaces to prevent water repellent from migrating onto joint surfaces. Remove masking after repellent has cured.

C. Apply a second saturation coating, repeating first application. Comply with manufacturer's written instructions for limitations on drying time between coats and after rainstorm wetting of surfaces between coats. Consult manufacturer's technical representative if written instructions are not applicable to Project conditions.

3.4 CLEANING

A. Immediately clean water repellent from adjoining surfaces and surfaces soiled or damaged by water-repellent application as work progresses. Correct damage to Work of other trades caused by water-repellent application, as approved by Architect.

B. Comply with manufacturer's written cleaning instructions.

END OF SECTION

SECTION 07 21 00 - THERMAL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Extruded polystyrene foam-plastic board insulation.
2. Glass-fiber blanket insulation.
3. Mineral-wool blanket insulation.

B. Related Requirements:
1. Division 01 Specifications Section apply to Work of this Section.
2. Section 06 16 00 "Sheathing" for foam-plastic board sheathing installed directly over steel framing.

1.2 ACTION SUBMITTALS

A. Product Data: For the following:
1. Extruded polystyrene foam-plastic board insulation.

1.3 INFORMATIONAL SUBMITTALS

A. Installer's Certification: Listing type, manufacturer, and R-value of insulation installed in each element of the building thermal envelope.

B. Product Test Reports: For each product, for tests performed by a qualified testing agency.

C. Research Reports: For foam-plastic insulation, from ICC-ES.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

B. Protect foam-plastic board insulation as follows:
1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project Site until just before installation time.
3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 - PRODUCTS

2.1 EXTRUDED POLYSTYRENE FOAM-PLASTIC BOARD INSULATION

A. Extruded Polystyrene Board Insulation, Type IV: ASTM C578, Type IV, 25-psi minimum compressive strength; unfaced.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. DiversiFoam Products.
   b. Dow Chemical Company (The).
   c. Kingspan Insulation Limited.
   d. Owens Corning.
2. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
3. Smoke-Developed Index: Not more than 450 when tested in accordance with ASTM E84.

4. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
5. Vertical dimension of each board to correspond to vertical spacing of masonry anchors. Form tight fitting butt joints at adjoining boards. Pressing boards over masonry anchors is not acceptable.

2.2 SOUND ATTENUATION BLANKET

A. Same as "glass fiber blanket insulation," full depth of stud or cavity, with STC 50, per ASTM C423.

2.3 GLASS-FIBER BLANKET INSULATION

A. Glass-Fiber Blanket Insulation, Unfaced: ASTM C665, Type I; passing ASTM E136 for combustion characteristics.

1. Manufacturers: Subject to compliance with requirements, provide products by 1 of the following:
   a. CertainTeed Corporation.
   b. Johns Manville; a Berkshire Hathaway company.
   c. Knauf Insulation.
   d. Owens Corning.
2. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
3. Smoke-Developed Index: Not more than 50 when tested in accordance with ASTM E84.

4. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

2.4 MINERAL-WOOL BLANKET INSULATION

A. Mineral-Wool Blanket Insulation, Unfaced: ASTM C665, Type I (blankets without membrane facing); consisting of fibers; passing ASTM E136 for combustion characteristics.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Johns Manville; a Berkshire Hathaway company.
      b. Rockwool International.
      c. Thermafiber, Inc.; an Owens Corning company.
   2. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
   3. Smoke-Developed Index: Not more than 50 when tested in accordance with ASTM E84.

2.5 ACCESSORIES

A. Insulation for Miscellaneous Voids:
   1. Spray Polyurethane Foam Insulation: ASTM C1029, Type II, closed cell, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E84.

B. Adhesive for Bonding Insulation: Product compatible with insulation and air and water barrier materials, and with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean substrates of substances that are harmful to insulation, including removing projections capable of puncturing insulation or vapor retarders, or that interfere with insulation attachment.

3.2 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and applications.
B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

C. Install insulation with manufacturer's R-value label exposed after insulation is installed.
D. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
E. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

3.3 INSTALLATION OF CAVITY-WALL INSULATION

A. Foam-Plastic Board Insulation: Install pads of adhesive spaced approximately 24 inches o.c. both ways on inside face and as recommended by manufacturer.
   1. Fit courses of insulation between wall ties and other obstructions, with edges butted tightly in both directions, and with faces flush.
   2. Press units firmly against inside substrates.

   3. Supplement adhesive attachment of insulation by securing boards with 2-piece wall ties designed for this purpose and specified in Section 04 20 00 "Unit Masonry."

3.4 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION

A. Blanket Insulation: Install in cavities formed by framing members according to the following requirements:
   1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than 1 length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
   2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
   3. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.

   4. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.

B. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:
   1. Glass-Fiber Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft.
   2. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.

3.5 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes.
B. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION

SECTION 07 27 26 - FLUID-APPLIED MEMBRANE AIR BARRIERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Vapor-permeable, fluid-applied air barriers.
B. Related Requirements:
   1. Division 01 Specification Sections apply to Work of this Section.
   2. Section 06 16 00 "Sheathing" for wall sheathings and wall sheathing joint-and-penetration treatments.

1.2 DEFINITIONS

A. Air-Barrier Material: A primary element that provides a continuous barrier to the movement of air.
B. Air-Barrier Accessory: A transitional component of the air barrier that provides continuity.
C. Air-Barrier Assembly: The collection of air-barrier materials and accessories applied to an opaque wall, including joints and junctions to abutting construction, to control air movement through the wall.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project Site.
   1. Review air-barrier requirements and installation, special details, mockups, air-leakage and bond testing, air-barrier protection, and work scheduling that covers air barriers.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include manufacturer's written instructions for evaluating, preparing, and treating each substrate; technical data; dry film thickness; and tested physical and performance properties of products.
B. Shop Drawings: For air-barrier assemblies.
   1. Show locations and extent of air-barrier materials, accessories, and assemblies specific to Project conditions.
   2. Include details for substrate joints and cracks, counterflashing strips, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
   3. Include details of interfaces with other materials that form part of air barrier.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For installer. Include list of ABAA-certified installers and supervisors employed by Installer, who work on Project.
B. Product Certificates: From air-barrier manufacturer, certifying compatibility of air barriers and accessory materials with Project materials that connect to or that come in contact with the barrier.
C. Product Test Reports: For each air-barrier assembly, for tests performed by a qualified testing agency.
D. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
B. Mockups: Build mockups to set quality standards for materials and execution.
    1. Build integrated mockups of exterior wall assembly, incorporating backup wall construction, external cladding, window, storefront, door frame and sill, insulation, ties and other penetrations, and flashing to demonstrate surface preparation, crack and joint treatment, application of air barriers, and sealing of gaps, terminations, and penetrations of air-barrier assembly.
        a. Include junction with roofing membrane, building corner condition, and foundation wall intersection. Refer to the Drawings for additional information on mockup configuration.
        b. If Primary Designer determines mockups do not comply with requirements, reconstruct mockups and apply air barrier until mockups are approved.
    2. Approval of mockup does not constitute approval of deviations from the Contract Documents contained in mockups unless Primary Designer specifically approves such deviations in writing.
    3. Subject to compliance with requirements, approved mockup SHALL NOT be a part of the completed Work.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Remove and replace liquid materials that cannot be applied within their stated shelf life.
B. Protect stored materials from direct sunlight.

1.8 MOCKUP

A. Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation. Contractor SHALL NOT order materials until the Mockup is approved by Owner.
    1. Build mockup of typical wall area as shown on Drawings.

2. Approval of mockup does not constitute approval of deviations from the Contract Documents contained in mockup unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockup SHALL NOT become part of the completed Work.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Apply air barrier within the range of ambient and substrate temperatures recommended in writing by air-barrier manufacturer.
1. Protect substrates from environmental conditions that affect air-barrier performance.
2. Do not apply air barrier to a damp or wet substrate or during snow, rain, fog, or mist.

PART 2 - PRODUCTS

2.1 MATERIALS
A. Source Limitations: Obtain primary air-barrier materials and air-barrier accessories from single source from single manufacturer.
B. VOC Content: 100 g/L or less.

2.2 PERFORMANCE REQUIREMENTS

A. Air-Barrier Performance: Air-barrier assembly and seals with adjacent construction shall be capable of performing as a continuous air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air-barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.
B. Air-Barrier Assembly Air Leakage: Maximum 0.04 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft., when tested according to ASTM E2357.

2.3 MEDIUM-BUILD AIR BARRIERS, VAPOR PERMEABLE
A. Medium-Build, Vapor-Permeable Air Barrier: Synthetic polymer material with an installed dry film thickness, according to manufacturer's written instructions, of 17 to 30 mils over smooth, void-free substrates.
1. Products: Subject to compliance with requirements, provide one of the following:
a. 3M Industrial Adhesives and Tapes Division; 3M Liquid Air Barrier 2085VP.
b. DuPont Building Innovations: E. I. du Pont de Nemours and Company; DuPont Tyvek Fluid Applied WB.

c. Rubber Polymer Corporation, Inc.; Rub-R-Wall Airtight VP.
d. Sto Corp; StoGuard AirSeal.
e. TK Products; TK-Airmax 2104 Vapor Permeable.
f. W.R. Meadows, Inc; Air-Shield LMP.

2. Physical and Performance Properties:
   a. Air Permeance: Maximum 0.004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. pressure difference; ASTM E2178.
   b. Vapor Permeance: Minimum 10 perms; ASTM E96, Desiccant Method, Procedure A.
   c. Ultimate Elongation: Minimum 250 percent; ASTM D412, Die C.
   d. Adhesion to Substrate: Minimum 16 lbf/sq. in. when tested according to ASTM D4541.
   e. UV Resistance: Can be exposed to sunlight for 180 days according to manufacturer's written instructions.

2.4 ACCESSORY MATERIALS

A. Requirement: Provide primers, transition strips, termination strips, joint reinforcing fabric and strips, joint sealants, counterflashing strips, flashing sheets and metal termination bars, termination mastic, substrate patching materials, adhesives, tapes, foam sealants, lap sealants, and other accessory materials that are recommended in writing by air-barrier manufacturer to produce a complete air-barrier assembly and that are compatible with primary air-barrier material and adjacent construction to which they may seal.

B. Primer: Liquid waterborne primer recommended for substrate by air-barrier material manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions with installer present, for compliance with requirements and other conditions affecting performance of the Work.
   1. Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.
   2. Verify that substrates have cured and aged for minimum time recommended in writing by air-barrier manufacturer.
   3. Verify that substrates are visibly dry and free of moisture.
   4. Verify that masonry joints are flush and completely filled with mortar.

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

3.2 SURFACE PREPARATION

A. Clean, prepare, treat, fill, and seal substrate and joints and cracks in substrate according to manufacturer's written instructions and details. Provide clean, dust-free, and dry substrate for air-barrier application.

B. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.

C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.
D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate-patching material.
E. Remove excess mortar from masonry ties, shelf angles, and other obstructions.
F. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.
G. Cover gaps in substrate plane and form a smooth transition from one substrate plane to another with stainless-steel sheet mechanically fastened to structural framing to provide continuous support for air barrier.
H. Bridge isolation joints, expansion joints and discontinuous wall-to-wall, deck-to-wall, and deck-to-deck joints with air-barrier accessory material that accommodates joint movement according to manufacturer's written instructions and details.

3.3 ACCESSORIES INSTALLATION

A. Install accessory materials according to air-barrier manufacturer's written instructions and details to form a seal with adjacent construction and ensure continuity of air and water barrier.
    1. Coordinate the installation of air barrier with installation of roofing membrane and base flashing to ensure continuity of air barrier with roofing membrane.
    2. Install transition strip on roofing membrane or base flashing so that a minimum of 3 inches of coverage is achieved over each substrate.
    3. Unless manufacturer recommends in writing against priming, apply primer to substrates at required rate and allow it to dry.
    4. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by air-barrier material on same day. Reprime areas exposed for more than 24 hours.
B. Connect and seal exterior wall air-barrier material continuously to roofing-membrane air barrier, concrete below-grade structures, floor-to-floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.
C. At end of each working day, seal top edge of strips and transition strips to substrate with termination mastic.
D. Apply joint sealants forming part of air-barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
E. Wall Openings: Prime concealed, perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply transition strip so that a minimum of 3 inches of coverage is achieved over each substrate. Maintain 3 inches of full contact over firm bearing to perimeter frames, with not less than 1-inch of full contact.
    1. Transition Strip: Roll firmly to enhance adhesion.
F. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, and doors, and miscellaneous penetrations of air-barrier material with foam sealant.
G. Seal strips and transition strips around masonry reinforcing or ties and penetrations with termination mastic.

H. Seal top of through-wall flashings to air barrier with an additional 6-inch wide, transition strip.
I. Seal exposed edges of strips at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.
J. Repair punctures, voids, and deficient lapped seams in strips and transition strips. Slit and flatten fishmouths and blisters. Patch with transition strips extending 6 inches beyond repaired areas in strip direction.

3.4 PRIMARY AIR-BARRIER MATERIAL INSTALLATION

A. Apply air-barrier material to form a seal with strips and transition strips and to achieve a continuous air barrier according to air-barrier manufacturer's written instructions and details. Apply air-barrier material within manufacturer's recommended application temperature ranges.
   1. Unless manufacturer recommends in writing against priming, apply primer to substrates at required rate and allow it to dry.
   2. Limit priming to areas that will be covered by air-barrier material on same day. Reprime areas exposed for more than 24 hours.
   3. Where multiple prime coats are needed to achieve required bond, allow adequate drying time between coats.
B. Medium-Build Air Barriers: Apply continuous unbroken air-barrier material to substrates according to the following thickness. Apply an increased thickness of air-barrier material in full contact around protrusions such as masonry ties.
   1. Vapor-Permeable, Medium-Build Air Barrier: Total dry film thickness as recommended in writing by manufacturer to comply with performance requirements, applied in one or more equal coats. Apply additional material as needed to achieve void- and pinhole-free surface, but do not exceed thickness on which required vapor permeability is based.
C. Do not cover air barrier until it has been tested and inspected by testing agency.
D. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air-barrier components.

3.5 FIELD QUALITY CONTROL

A. ABAA Quality Assurance Program: Perform examinations, preparation, installation, testing, and inspections under ABAA's Quality Assurance Program.
B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
C. Inspections: Air-barrier materials, accessories, and installation are subject to inspection for compliance with requirements. Inspections may include the following:
   1. Continuity of air-barrier system has been achieved throughout the building envelope with no gaps or holes.
   2. Air-barrier dry film thickness.
   3. Continuous structural support of air-barrier system has been provided.
   4. Masonry and concrete surfaces are smooth, clean, and free of cavities, protrusions, and mortar droppings.
   5. Site conditions for application temperature and dryness of substrates have been maintained.

6. Maximum exposure time of materials to UV deterioration has not been exceeded.
7. Surfaces have been primed, if applicable.
8. Laps in strips and transition strips have complied with minimum requirements and have been shingled in the correct direction (or mastic has been applied on exposed edges), with no fishmouths.
9. Termination mastic has been applied on cut edges.
10. Strips and transition strips have been firmly adhered to substrate.
11. Compatible materials have been used.
12. Transitions at changes in direction and structural support at gaps have been provided.
13. Connections between assemblies (air-barrier and sealants) have complied with requirements for cleanliness, surface preparation and priming, structural support, integrity, and continuity of seal.
14. All penetrations have been sealed.

D. Tests: As determined by testing agency from among the following tests:
1. Air-barrier dry film thickness.
2. Adhesion Testing: Air-barrier assemblies will be tested for required adhesion to substrate according to ASTM D4541 for each 600 sq. ft. of installed air barrier or part thereof.

E. Air barriers will be considered defective if they do not pass tests and inspections.
1. Apply additional air-barrier material, according to manufacturer's written instructions, where inspection results indicate insufficient thickness.
2. Remove and replace deficient air-barrier components for retesting as specified above.

F. Repair damage to air barriers caused by testing; follow manufacturer's written instructions.

G. Prepare test and inspection reports.

3.6 CLEANING AND PROTECTION

A. Protect air-barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.
1. Protect air barrier from exposure to UV light and harmful weather exposure as recommended in writing by manufacturer. If exposed to these conditions for longer than recommended, remove and replace air barrier or install additional, full-thickness, air-barrier application after repairing and preparing the overexposed materials according to air-barrier manufacturer's written instructions.
2. Protect air barrier from contact with incompatible materials and sealants not approved by air-barrier manufacturer.

B. Clean spills, stains, and soiling from construction that would be exposed in the completed work using cleaning agents and procedures recommended in writing by manufacturer of affected construction.

C. Remove masking materials after installation.

END OF SECTION

SECTION 07 42 43 - COMPOSITE WALL PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Exterior, panelized fiber cement cladding system and accessories to complete a drained and back-ventilated rainscreen.

B. Related Requirements:
1. Division 01 Specification Sections apply to Work of this Section.
2. Section 05 40 00 "Cold-Formed Metal Framing."
3. Section 06 10 00 "Rough Carpentry."
4. Section 06 16 00 "Sheathing."
5. Section 07 21 00 "Thermal Insulation."
6. Section 07 27 26 "Fluid-Applied Membrane Air Barriers."
7. Section 07 62 00 "Sheet Metal Accessories."
8. Section 07 92 00 "Joint Sealants."

1.2 REFERENCES

A. American Architectural Manufacturers Association (AAMA):
1. AAMA 509-14 - Voluntary Test and Classification Method of Drained and Back Ventilated Rain Screen Wall Cladding Systems.

B. ASTM International (ASTM):
1. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
2. ASTM C1185 - Standard Test Methods for Sampling and Testing Non-Asbestos Fiber Cement.
3. ASTM C1186 - Standard Specification for Flat Fiber-Cement Sheets.
4. ASTM E84 - Standard Test for Surface Burning Characteristics of Building Materials.
5. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
6. ASTM E228 - Standard Test Method for Linear Thermal Expansion of Solid Materials with a Vitreous Silica Dilatometer.
7. ASTM E330 - Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
8. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.

C. Florida Building Code - Test Protocol HVHZ:
1. Testing Application Standard (TAS) 202, 203 - HVHZ Test Procedures.

D. National Fire Protection Association (NFPA):
   1. NFPA 285 - Fire Test Method for Exterior Wall Assemblies Containing Combustible Material.
   2. NFPA 268 - Ignition Resistance of Exterior Wall Assemblies.
E. Standards Council of Canada & Underwriters Laboratories Canada (ULC):
   1. CAN/ULC S-102 - Standard Method of Test for Surface Burning Characteristics.
   2. CAN/ULC S-134 - Standard Method of Fire Test of Exterior Wall Assembly.

1.3 ACTION SUBMITTALS

A. Submit under provisions of Section 01 33 00 "Submittal Procedures."
B. Product Data: Submit manufacturer's product description, storage and handling requirements, and installation instructions.
C. Product Test Reports and Code Compliance: Documents demonstrating product compliance with local building code, such as test reports or Evaluation Reports from qualified, independent testing agencies.
D. Manufacturer's Details: Submit drawings (.dwg, .rvt, and/or .pdf formats), including plans, sections, showing installation details that demonstrate product dimensions, edge/termination conditions/treatments, compression and control joints, corners, openings, and penetrations.
E. Samples: Samples for verification of each product type.
   1. 12-inch long by actual width sample of siding.

1.4 INFORMATION SUBMITTALS

A. Product Certificates: For each type of composite wall panel.
B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for composite wall panels.
C. Research/Evaluation Reports: For each type of composite wall panels.
D. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITALS

A. Maintenance Data:
B. For each type of product, including related accessories, to include in maintenance manuals.

1.6 MINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Furnish full lengths of composite wall panel siding and accessories, in a quantity equal to 2 percent of amount installed.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications:
   1. All fiber cement panels specified in this Section must be supplied by a manufacturer with a minimum of 10 years of experience in fabricating and supplying fiber cement cladding systems.
      a. Products covered under this Section are to be manufactured in an ISO 9001 certified facility.
   2. Provide technical and design support as needed regarding installation requirements and warranty compliance provisions.
B. Installer Qualifications: All products listed in this Section are to be installed by a single installer trained by manufacturer or representative.
C. Pre-Installation Meetings: Prior to beginning installation, conduct conference to verify and discuss substrate conditions, manufacturer's installation instructions and warranty requirements, and Project requirements.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Panels must be stored flat and kept dry under cover before installation. A waterproof cover over panels and accessories should always be used prior to installation. Do not stack pallets more than 2 high. Refer to the information included on each pallet.
B. If panels are exposed to water or water vapor prior to installation, allow to completely dry before installing. Failure to do so may result in panel shrinkage at ship lap joints, and such action may void warranty.
C. Panels must be carried on edge. Do not carry or lift panels flat. Improper handling may cause cracking or panel damage.
D. Direct contact between the panels and the ground should always be avoided. It is necessary to keep panels clean during installation process.

1.9 MOCKUP

A. Build mockup to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
   1. Build mockup of typical wall area as shown on Drawings.
   2. Approval of mockup does not constitute approval of deviations from the Contract Documents contained in mockup unless Architect specifically approves such deviations in writing.

1.10 WARRANTY

A. Provide manufacturer's 15-year warranty against manufactured defects in fiber cement panels.
B. Provide manufacturer's 15-year warranty against manufactured defects in panel finish.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain products, including related accessories, from a single source from single manufacturer.

2.2 COMPOSITE WALL PANELS

A. General: ASTM C1186, Type A, Grade II, composite wall panels, non-combustible when tested to ASTM E136; with a flame spread index of 25 or less when tested according to ASTM E84.
B. Basis of Design Product: JameHardie.
   1. EXT. B: Hardie Panel Siding.
   2. Panel Style:
      a. Select Cedarmill.
      b. Factory sealed on 6 sides.
      c. Colors:
         1) Custom Color.
   3. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00 "Product Requirements."
   4. Labeling: Provide composite wall panel that is tested and labeled according to ASTM C1186 by a qualified testing agency acceptable to authorities having jurisdiction.

2.3 ACCESSORIES

A. Siding Accessories, General: Provide starter tracks, edge trim, inside and outside caps, and other accessories as shown on the Drawings and as recommended by the manufacturer for building configuration.
   1. Provide accessories matching color and texture of adjacent siding unless otherwise indicated.
   2. Decorative Accessories: Provide the following decorative accessories as indicated:
      a. Sealant Backers: Single flange and double flange.
      b. Manufactured Mitered Outside Corners with 3-1/2-inch returns for each panel profile, size, and color.
      c. Aluminum Trim Options: H-mold, J-mold, compression joint, and inside corner. H-Mold trim may not be used for expansion joints.
      d. Essential Flashing System: Starter and Overhang.
      e. Door and window casings.
B. Flashing: Provide flashing complying with 07 62 00 "Sheet Metal Flashing and Trim" at window and door heads and where indicated.
   1. Finish for Flashing: Siliconized polyester coating.

C. Fasteners: For fastening to wood, use ribbed bugle heads screws of sufficient length to penetrate a minimum of 1-inch into substrate.
D. For fastening to metal, use ribbed bugle heads screws of sufficient length to penetrate a minimum of 1/4-inch, or a minimum of 3 screw threads into substrate.
E. For fastening composite wall panels, use stainless steel fasteners.

2.4 MATERIALS

A. Composite wall panels manufactured from a pressed, stamped, and autoclaved mix of Portland cement, fly ash, silica, recycled rejects, and wood fiber bundles.
B. Panel surface pre-finished and machine applied.
C. Profiled along all four edges, such that both horizontal and vertical joints between the installed panels are ship-lapped.
D. Factory-applied sealant gasket added to top and right panel edges; all joints contain a factory sealant.

2.5 PERFORMANCE REQUIREMENTS:

A. Composite Wall Panels must comply with ASTM C1186, Type A, Grade II requirements:
    1. Wet Flexural Strength:
        a. Result: 1,418 psi.
        b. Lower Limit: 1,015 psi.
    2. Water Tightness: No water droplets observed on any specimen.
    3. Freeze-Thaw: No damage or defects observed.
    4. Warm Water: No evidence of cracking, delamination, swelling, or other defects observed.
    5. Heat-Rain: No crazing, cracking, or other deleterious effects, surface or joint changes observed in any specimen.
B. Mean Coefficient of Linear Thermal Expansion (ASTM E228): Maximum 1.0*10^-5 in./in. F.
C. Surface Burning (CAN-ULC S102/ASTM E84): Flame Spread: 0, Smoke Developed: 0.
D. Wind Load (ASTM E330): Contact manufacturer for ultimate test pressure data corresponding to framing type, dimensions, fastener type, and attachment clips. Project engineer(s) must determine Zone 4 and 5 design pressures based on Project specifics.
    1. Minimum Lateral Deflection: L/120.
E. Water Penetration (ASTM E331): No water leakage observed into wall cavity.
F. Steady-State Heat Flux and Thermal Transmission Properties Test (ASTM C518): 16 millimeters thick panel thermal resistance R Value of 0.47.
G. Fire Resistant (ASTM E119): The wall assembly must successfully endure 60-minute fire exposure without developing excessive unexposed surface temperature or allowing flaming on the unexposed side of the assembly.
H. Ignition Resistance (NFPA 268): No sustained flaming of panels, or assembly when subjected to a minimum radiant heat flux of 12.5 kW/m2 plus or minus 5 percent in the presence of a pilot ignition source for a 20-minute period.

I. Fire Propagation (NFPA 285): Wall assembly of Hardie Panel Siding , Ultimate Clips and Starter Track, Tyvek Commercial Wrap, 1/2-inch Densglass Gold Sheathing, 16-inch o.c., 18-gauge steel studs, mineral wool in-cavity insulation, and interior 5/8-inch Type X gypsum met the acceptance criteria of NFPA 285.

J. Drained and Back Ventilated Rainscreen (AAMA 509-14): System classifications: W1, V1.

2.6 INSTALLATION COMPONENTS

A. Ultimate Clip System:
   1. Starter Track:
      a. Horizontal Panel Installations: FA 700 - 3,030 mm (L) galvalume coated steel.
   2. Panel Clips: JEL 778 "Ultimate Clip II" (10 mm rainscreen for 16 mm AWP) - Zinc-Aluminum-Magnesium alloy coated steel.
      a. Joint Tab Attachments (Included): Used at all panel-to-panel vertical joints.
   3. Corner Clips: JE 777C (10 mm rainscreen for 5/8-inch AWP Manufactured Corners) - Zinc-Aluminum-Magnesium alloy coated steel.
   4. Single Flange Sealant Backer: FHK 1015 R (10 mm) - 6.5-foot fluorine coated galvalume.
   5. Double Flange Sealant Backer: FH 1015 R (10 mm) - 10-foot fluorine coated galvalume.
   6. Corrugated Spacer: FS 1005 (5 mm), FS 1010 (10 mm) - 4 feet.

B. Essential Flashing System:
   1. Starter: Main segments (3,030 mm), inside corners, outside corners.
   2. Overhang: Main segments (3,030 mm), inside corners, outside corners, joint clips.

C. Fasteners: Stainless Steel fasteners. Do not use aluminum fasteners, staples, or fasteners that are not rated or designed for intended use. See manufacturer's instructions for appropriate fasteners for construction method used.

D. Flashing: Flash all areas specified in manufacturer's instructions.

E. Sealant: Sealant shall comply with ASTM C920, Class 35.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions:
   1. Allowable cold-formed metal framing spacing 16 inches o.c. maximum.
   2. Metal flashing to be provided around all doors, windows, wall bottoms, material transitions, and penetrations.

B. Examine site to ensure substrate conditions are within alignment tolerances for proper installation.

C. Do not begin installation until unacceptable conditions have been corrected.

D. Do not install panels or components that appear to be damaged or defective. Do not install wet panels.

E. Clean finished surfaces according to manufacturer's written instructions and maintain a clean condition during construction.

3.2 TOLERANCE

A. Wall surface plane must be plumb and level within plus or minus 1/4-inch in 20 feet in any direction.
   1. One layer of Hardie Panel Sidingl5mm (~3/16-inch) Spacer may be used as shim.

3.3 INSTALLATION

A. General: Install products in accordance with the latest installation guidelines of manufacturer and all applicable building codes and other laws, rules, regulations and ordinances. Review all manufacturer installation, maintenance instructions, and other applicable documents before installation.
   1. Panel Layout: Staggered.
   2. Consult with your local dealer or Hardie Panel Siding installer before installing any Hardie Panel Siding product on a building higher than 45 feet or 3 stories, or for conditions not matching prescribed standard installation guide requirements and methods. Special installation conditions may be required via a Technical Review and Special Applications Form (SAF) process.
   3. Vertical Control/Expansion Joints are required within 2 to 10 feet of outside corners finished with metal trim and approximately every 30 feet thereafter.
   4. Horizontal/Compression Joints are required for multi-story installations of AWP. Locate joints at floor lines. Joints are flashed minimum 1/2-inch breaks. Do not caulk. Refer to installation guide(s).

B. Panel Cutting:
   1. Always cut fiber cement panels outside or in a well-ventilated area. Do not cut the products in an enclosed area.
   2. Always wear safety glasses and NIOSH/OSHA approved respirator whenever cutting, drilling, sawing, sanding or abrading the products. Refer to manufacturer SDS for more information.
   3. Use a dust-reducing circular saw with a diamond-tipped or carbide-tipped blade.
      a. Recommended Circular Saw: Makita 7-1/4-inch Circular Saw with Dust Collector (#5057KB).
      b. Recommended Blade: Tenryu Board-Pro Plus PCD Blade (#BP-18505).
      c. Shears (electric or pneumatic) or jig saw can be used for complicated cuttings, such as service openings, curves, radii, and scrollwork.
   4. Silica Dust Warning: Fiber cement products may contain some amounts of crystalline silica, a naturally occurring, potentially hazardous mineral when airborne in dust form. Consult product SDS or visit https://www.osha.gov/dsg/topics/silicacrystalline/.

3.4 CLEANING AND MAINTENANCE

A. Review manufacturer guidelines for detailed care instructions.

END OF SECTION

SECTION 07 62 00 - SHEET METAL AND MISCELLANEOUS ACCESSORIES

PART 1 - GENERAL

CONTRACTOR TO PROVIDE A FULL ROOF SYSTEM AS APPROVED ON THE TEXAS DEPARTMENT OF INSURANCE APPROVED SYSTEMS. CONTRACTOR IS TO PROVIDE A STATE OF TEXAS CURRENT LICENSED WINDSTORM ENGINEER TO PROVIDE SITE VISITS AS WELL AS PROVIDE THE WPI-8 WINDSTORM CERTIFICATE AS ISSUED BY TDI. MECHANICALLY ALL ROOF TOP EQUIPMENT SHALL BE HURRICANE STRAPPED AS REQUIRED BY TDI.

1.1 SUMMARY

A. Section Includes:
   1. Refer to roof plans for areas to be included in the scope of work.
B. Related Requirements:
   1. Division 01 Specification Sections apply to the Work of this Section.

1.2 DEFINITIONS

ACM	Asbestos Containing Materials
ANSI	American National Standards Institute
ASCE	American Society of Civil Engineers
ASTM	American Society for Testing and Materials
CTEM	Coal-Tar Elastomeric Membrane
EPA	Environmental Protection Agency
EPS	Expanded Polystyrene
EVT	Equiviscous Temperatures
FM	Factory Mutual
IBC	International Building Code
KEE	Ketone Ethylene Ester
NDL	No Dollar Limit
NESHAP	National Emissions Standards for Hazardous Air Pollutants
NRCA	National Roofing Contractors Association
OSHA	Occupational Safety & Health Administration
SBS	Styrene-Butadiene-Styrene
SDI	Steel Deck Institute
SMACNA	Sheet Metal and Air Conditioning Contractors National Association
SPRI	Single Ply Roofing Industry
UL	Underwriters Laboratories, Inc.

1.3 REFERENCES (INCLUDING LATEST REVISIONS)

A. Comply with governing local, state, and federal regulations, safety standards, and codes.
B. Testing Laboratory Services: Test results shall meet or exceed established standards.

C. Underwriters Laboratories, Inc. (Roofing Covering): Class A fire hazard classification.
D. American Society for Testing and Materials (ASTM).
E. The National Roofing Contractors Association (NRCA) - Roofing and Waterproofing Manual.
F. Sheet Metal and Air Conditioning Contractors National Association (SMACNA) - Architectural Sheet Metal Manual.
G. American Society of Civil Engineers – ASCE 7.

1.4 INSTALLER QUALIFICATIONS

A. Roofing installer must be:
   1. Currently prequalified with Owner in accordance with Owner's prequalification requirements.
   2. Currently in good standing with the manufacturer.
   3. Installer must be an experienced single firm specializing in the type of roofing repair and/or removal and replacement work required, employing only experienced workers for the class of work in which they are employed, having at least 5 years successful experience on projects similar in size and scope and acceptable as applicators by Project Manager/Architect.
   4. Contractor must have successfully completed previous projects warranted by the manufacturer.
B. It shall remain each Bidder's responsibility to determine his current status with the manufacturer's certification plan.

1.5 MANUFACTURER QUALIFICATIONS

A. A qualified manufacturer is 1 that is UL listed and has FM approvals for a membrane roofing system similar to that used for this Project for a minimum of fifteen years.

1.6 CONTRACT DOCUMENT QUALITY ASSURANCE

A. In the case of an inconsistency between the Drawings and Specifications or within either document not clarified by addendum, the better quality or greater quantity of Work shall be provided in accordance with the Project Manager's/Architect's interpretation.

1.7 SUBMITTALS

A. Product Data:
   1. Submit Shop Drawings, product data and mockups of all sheet metal.

1.8 QUALITY ASSURANCE

A. Comply with governing local, state, and federal regulations, safety standards, and codes. Provide products of acceptable manufacturers in satisfactory use in similar service for 5 years. Use experienced installers. Deliver, handle and store materials in accordance with manufacturer's instructions.
B. Reference Standards: Applicable portions of ASCE, SMACNA, ASTM, NAAMM and ES-1 publications.

1.9 PRE-INSTALLATION CONFERENCE

A. Convene a preinstallation conference 2 weeks prior to commencing the Work.
B. Require attendance of parties directly affecting the Work of this Section.
C. Review condition of roof deck and installation, installation procedures and coordination with related Work.

1.10 WARRANTIES

A. Manufacturer's Product Warranty: Submit roof system’s manufacturer's warranty signed by the manufacturer's authorized official, guaranteeing to correct failures in product which may occur during the warranty period, without reducing or otherwise limiting any other rights to correction which Architect may have under the contract documents. Failure is defined to include product failure which leads to interruption of a watertight installation. Correction may include repair or replacement of failed product. This is to be a part of the roof system warranty, not a stand alone warranty.
B. Contractor's Warranty Period: For roofing flashing and sheet metal, provide a written warranty which shall warrant work to be free of leaks and defects in materials and workmanship for 2 years, starting from date of Substantial Completion.
C. Defects of the sheet metal occurring during the warranty period shall be promptly corrected by Contractor, and defects of the roofing shall be promptly corrected by the manufacturer at no additional cost to Owner. Upon notification from Owner or Owner's representative that evidence of a defect exists, the responsible party shall immediately inform Owner's representative of the date on which corrective work will be scheduled and shall notify Owner's representative when the corrective work has been completed.

PART 2 - PRODUCTS

2.1 SHEET METAL MATERIAL

A. Hot-dipped Galvanized Steel for use as counter flashings (where not visible from the ground), and expansion joints: Minimum 24-gauge, G-90, hot-dipped galvanized metal, commercial quality, ASTM A653.
B. Hot-dipped Galvanized Steel for use as continuous clips: Minimum 22-gauge, G-90, hot-dipped galvanized metal, commercial quality, ASTM A653.
C. Prefinished Galvanized Sheet Steel (where visible from the ground): Shall be 24-gauge flat stock, prefinished with Kynar finish meeting ASTM A446, 45-1/2 inches to 48 inches width by 120 inches in length for use as new metal edge gravel guard, cover plates, downspouts, gutters, coping and miscellaneous metal.
D. Prefinished Aluminum: Shall be that most suitable for the purpose.
E. All prefinished metal color shall be as selected by Architect from manufacturer's full range of colors, including metallics.

2.2 FASTENERS

A. Fasteners shall be same metal as flashing/sheet metal, or other non-corrosive metal as recommended by sheet manufacturer for the specific application. Match finish of exposed heads with material being fastened.
B. Fasteners and fastening plates or bars shall be listed in the FM Global Approval Guide.
C. Fastener for Brick: Shall be 1/4-inch by 2 inches, zinc with plated steel or stainless steel nail, 1 piece unit, flat head.
D. Screws: One-piece, high domed bonneted self-taping sheet metal type with neoprene washer, as appropriate.
E. Pop Rivets: Full stainless-steel Series 42 or 44, as appropriate.
F. Continuous Clip: Concealed hold-down clip type; of same materials as coping, gravel guard, sized to suit application. Use a continuous clip, minimum 22-gauge G-90 galvanized.

2.3 RELATED MATERIAL

A. Plastic Cement: FS SS-C-153, cutback asphalt type.
B. Solder: QQ-S-571 composition best suited for purpose; use high tin content, minimum 60/40, for stainless steel and monel alloy.
C. Sealant (for Sheet Metal): One-component polyurethane, conforming to requirements of FS TT-S-230C, non-staining and non-bleeding.
D. Miscellaneous Materials:
    1. Splash Blocks: Concrete, 3,000 psi, 28 days. Provide and install with protection pads at all downspouts. Dimensions shall be a minimum 18 inches wide by 36 inches long.
    2. Metal Accessories: Provide and install sheet metal clips, straps, anchoring devices, and similar accessory units as required for installation of Work, matching or compatible with material being installed, non-corrosive, size, and gauge required for performance.

PART 3 - EXECUTION

3.1 INSPECTION

A. Verify roof openings, curbs, pipes, sleeves, ducts or vents through roof are solidly set, cant strips and reglets in place, substrates are smooth and clean and nailing strips located.
B. Verify membrane termination and base flashings are in place, sealed and secure, prior to metal installation.
C. Beginning of installation means acceptance of conditions.
D. Compatibility: Provide materials that are recommended by manufacturers to be fully compatible with indicated substrates or provide separation materials as required to eliminate contact between incompatible materials.

3.2 PREPARATION

A. Field measure site conditions prior to fabricating Work. Provide all Shop Drawings and mock-ups 1 month prior to installation to Owner/Project Consultant for approval.
B. Install starter and edge strips and cleats before starting installation.

3.3 FABRICATION – GENERAL (ALL FABRICATION SHALL BE BY UDERWRITERS LABORATORY ES-1 CERTIFIED SHOP AND ALL COMPONENST SHALL BE ES-1 STAMPED)

A. Comply with details shown, and with applicable requirements of SMACNA "Architectural Sheet Metal Manual" and ES-1 or 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's instructions and recommendations. Form exposed sheet metal work without excessive oil-canning, buckling, and tool marks, true to line and levels as indicated, with exposed edges folded back to form hems.
B. Form materials with straight lines, sharp angles and smooth curves.
C. Fold back edges on concealed side of exposed edge to form hem, 1/4-inch minimum.
D. Weld or solder joints on parts that are to be permanently and rigidly assembled.
E. Limit single-piece lengths to 10 feet.
F. Fabricate corner pieces with 18-inch extensions, mitered and sealed by forming as 1 piece.
G. Where installing flashing directly to masonry or dissimilar materials, back-paint with bituminous paint.
H. All sheet metal shall be sealed and watertight.
I. Metal work should be secured so as to prevent damage from buckling or wind. Where clips are shown, fabricate as detailed.
J. All metal to receive bitumen or adhesive shall be first primed with asphalt primer.
K. All prefinished metal shall be sanded and/or abraded prior to receiving primer.
L. Separations: Provide for separation of metal from non-compatible metal or corrosive substrates by coating concealed surfaces at locations of contact, with bituminous coating or other permanent separation as recommended by manufacturer/fabricator.
M. Bed flanges of work in a thick coat of bituminous roofing cement where required for waterproof performance.
N. All metal shall have an ES-1 Certified sticker.

3.4 INSTALLATION SHALL BE UNDERWIRTER LABORATORY ES-1 CERTIFIED AND STAMPED.

A. General: All sheet metal termination to vertical wall shall have a through-wall with receiver installed on masonry walls or prefabricated "Z" bar flashing pre-installed to fluid applied wall finished prior to installation of sheet metal termination. This applies to edge metal, base flashing closures and all vertical surface intersections. Refer to NRCA, SMACNA, and metal manufacturer's guidelines.

B. Gravel Guard/Fascia:
   1. Shall be installed with expansion joints, 10 feet on center, 1/4-inch expansion leeway, with a cover plate.
   2. Form sections identical to profiles as shown or approved similar, to match existing building.
   3. Fabricate corner pieces with minimum 18-inch, maximum 48-inch extensions, formed and sealed with rivets and sealant, as 1 piece.
   4. Hem exposed edges 1/2-inch minimum.
   5. Back-paint flashing in contact with masonry or dissimilar materials with bituminous paint. Surface sand before applying primers.
   6. Integrate flashing in a manner consistent with detailing.
   7. Provide and install continuous clip, minimum 22 gauge.
   8. Apply sealant at horizontal juncture of gravel guard metal to exterior vertical wall.
   9. Shall be fabricated in accordance with published details.
   10. Install bead of sealant at metal edge juncture at exterior wall surface.

C. Expansion Joint Field and at Wall:
   1. Shall be as outlined by details and be in full compliance with these specifications.
   2. Lock seams and end joints.
   3. Fabricate corner pieces with minimum 18-inch, maximum 48-inch extensions, formed and sealed with rivets and sealant, as 1 piece.
   4. Hem exposed edges 1/4-inch minimum.
   5. Back-paint flashing in contact with masonry or dissimilar materials with bituminous paint. Surface sand before applying primers.
   6. Integrate flashing in a manner consistent with detailing.
   7. Provide and install continuous clip, minimum 22-gauge or 1-gauge thicker than flashing.
   8. Shall be fabricated in accordance with published details.

D. Counterflashing:
   1. Provide and install new 2-piece sheet metal counterflashing as required for a permanent watertight installation.
   2. Saw cut brick mortar joint to receive friction fit reglet and removable counterflashing as detailed in SMACNA 7th Edition Figure 4-4D.

E. Pitch Pans - Galvanized:
   1. Install pitch pans of 24-gauge galvanized steel according to NRCA standards, minimum of 6 by 6 inches.
   2. Pitch pans shall be fabricated to a minimum of 4 inches above the finished roof membrane. Seams of pitch pans shall be soldered.
   3. Mastic shall be applied under pitch pan flange a minimum of 1/2-pound per linear foot.
   4. All metal flanges shall be primed with asphalt primer prior to flashing installation. Inside of pitch pan shall be cleaned and primed as required by pitch pan sealant manufacturer.
   5. All projections enclosed in pitch pans shall be cleaned in any manner suitable and coated with a rust inhibitive coating as approved by Owner/Project Consultant. Coating shall be allowed to dry prior to pitch pan fill.

6. Base of pitch pans shall be filled around penetration with M-1 sealant. Sprinkle mod bit granules over sealant 1/4-inch deep.
7. Top finish fill shall be coal-tar urethane, with minimum fill to top of the pitch pan sides.

F. Bonnets/Hoods:
1. Fabricate and install above all pitch pans, where necessary, or reinstall as applicable, metal bonnets over all pitch pans, NO EXCEPTIONS.
2. Bonnets/Hoods shall be manufactured with metal compatible with metal to which bonnet is to be attached.
3. On beams and other steel, weld in place bonnets fabricated from 1/4-inch steel plate.
4. Draw band bonnets fabricated from 22-gauge galvanized steel may be used on circular projections.

3.5 FINISH

A. Back-paint concealed metal surfaces with bituminous paint where expected to be in contact with cementitious materials or dissimilar metals. Exposed surfaces to be provided with a factory applied fluorocarbon Kynar finish meeting ASTM A446 and AAMA specification 605.2 for high performance coating.

END OF SECTION

SECTION 07 62 13 - GUTTERS AND DOWNSPOUTS

PART 1 - GENERAL

1.1 AREAS COVERED

A. Refer to roof plans for areas to be included in the scope of Work.

1.2 SUMMARY

A. Section Includes:
   1. Precoated galvanized steel gutters, downspouts, scuppers, brackets, spacers, fasteners, stiffeners and caps.
   2. Precast concrete splash blocks.

B. Related requirements:
   1. Division 01 Specification Sections apply to Work of this Section.

1.3 REFERENCES

A. American Society for Testing and Materials:
   1. ASTM A48 – Grey Iron Castings.
   2. ASTM A167 – Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip.
   3. ASTM A361 – Sheet Steel, Zinc-Coated (Galvanized) by Hot-Dip Process for Roofing and Siding.
   4. ASTM A446 – Steel Sheet, Zinc Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality.
   5. ASTM B32 – Solder Metal.
   6. ASTM B209 – Aluminum and Aluminum Alloy Sheet and Plate.

B. Federal Specifications: FS TT-C-494 – Coating Compound, Bituminous, Solvent Type, Acid Resistant.

C. SMACNA – Architectural Sheet Metal Manual.

D. ASCE - American Society of Civil Engineers: ASCE 7.

E. Comply with governing local, state, and federal regulations, safety standards, and codes.

1.4 INSTALLER QUALIFICATIONS

A. Installer must be:
   1. Currently prequalified with the Owner in accordance with Owner's prequalification requirements.
   2. Currently in good standing with the manufacturer.

3. Installer must be an experienced single firm specializing in the type of roofing related repair and/or removal and replacement work required, employing only experienced workers for the class of work in which they are employed, having at least 5 years' successful experience on projects similar in size and scope and acceptable as applicators by the Project Manager/Architect.
4. Contractor must have successfully completed previous projects warranted by the manufacturer.

B. It shall remain each Bidder's responsibility to determine his current status with the manufacturer's certification plan.

1.5 MANUFACTURER QUALIFICATIONS

A. A qualified manufacturer is 1 that is UL listed and has FM approvals for a membrane roofing system similar to that used for this Project for a minimum of fifteen years.

1.6 SUBMITTALS

A. Refer to Specification Section 01 33 00 for submittal requirements
B. Shop Drawings: Provide manufacturer's approved details of all perimeter conditions, projection conditions, and any additional special job conditions which require details other than indicated in the Drawings.
C. Shop Drawings: Showing layout, profiles, jointing methods, fastening details, locations, and installation details.
D. Samples: Submit 6-inch long samples of factory-fabricated products illustrating component design, finish, color and configuration.

1.7 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in manufacturer's original, unopened containers and rolls with all labels intact and legible including labels indicating appropriate warnings, storage conditions, lot numbers, and usage instructions. Materials damaged in shipping or storage shall not be used.
B. Manufacturer's packaging and/or roll plastic is not acceptable for exterior storage. Tarpaulin with grommets shall be minimum acceptable for exterior coverings. All materials stored as above shall be a minimum of 4 inches off the substrate, and the tarpaulin tied off with rope.
C. Deliver materials requiring fire resistance classification to the job with labels attached and packaged as required by labeling service.
D. Deliver materials in sufficient quantity to allow continuity of Work.
E. Handle and store material and equipment in such a manner as to avoid damage. Liquid products shall be delivered sealed, in original containers.
F. Select and operate material handling equipment so as not to damage existing construction or applied roofing.
G. Protect materials against damage by construction traffic.
H. The proper storage of materials is the sole responsibility of Contractor and any Damaged materials shall be discarded, removed from the Project Site, and replaced prior to application.

I. No storage of materials shall be permitted on roof areas other than those materials that are to be installed the same day. Any exception must be in written form.
J. Stack preformed and prefinished material to prevent twisting, bending or abrasion, and to provide ventilation. Slope to drain.
K. Prevent contact with materials during storage which may cause discoloration, staining or damage.

1.8 SITE CONDITIONS

A. Job Condition Requirements:
1. Coordinate the Work of Contractor with the Work to be performed by other trades, to ensure proper sequencing of the entire Work. Contractor is to schedule his Work so that adequate time is allowed for other trades to perform their Work.
2. Apply metal in dry weather.
3. Proceed with roofing work only when weather conditions are in compliance with manufacturer's recommended limitations, and when conditions will permit the Work to proceed in accordance with Specifications.
4. Schedule the Work so the building will be left watertight at the end of each day.
5. Load placed on the roof at any point shall not exceed the safe load for which the roof is designed.
6. All surfaces to receive new metal shall be smooth, dry, and free from dirt, debris, and foreign material before any of this Work is installed. Competent operators shall be in attendance at all times equipment is in use. Materials shall be stored neatly in areas designated by the Project Manager/Architect.
7. Contractor is to take all necessary precautions to prevent damage to the existing roof. All damage to the existing roof that could result in roof leaks is to be repaired on a daily basis by the roofing Contractor.
8. Contractor shall follow local, state, and federal regulations, safety standards, and codes for the removal, handling, and disposal of asbestos containing materials, if present. When a conflict exists, follow the stricter document.
Due caution should be exercised so as not to alter the structural integrity of the deck. When cutting through any deck, care should be taken so as not to damage the deck or any part of the deck, such as post tension cables, etc.

B. Protection of Work and Property:
1. Work: Contractor shall maintain adequate protection of all Work from damage and shall protect the Owner's and adjacent property from injury or loss arising from this contract. Contractor shall provide and maintain at all times any OSHA required danger signs, guards, and/or obstructions necessary to protect the public and workers from any dangers inherent with or created by the Work in progress. All federal, state, and city rules and requirements pertaining to safety and all EPA standards, OSHA standards, NESHAP regulations pertaining to asbestos as required shall be fulfilled by Contractor as part of his proposal.

2. Property: Protect existing planting and landscaping as necessary or required to provide and maintain clearance and access to the Work of this contract. Examples of 2 categories or degrees of protection are generally as follows:
    a. Removal, protection, preservation, or replacement and replanting of plant materials;
    b. Protection of plant materials in place, and replacement of any damage resulting from Contractor's operations.
3. Finished roof areas shall be protected from damage by Contractor during construction.
4. Twenty-Four Hour Call: Contractor shall have personnel on call 24 hours per day, 7 days per week for emergencies during the course of a job. Owner/Project Manager/Architect is to have the 24-hour numbers for the contact. Contractor must be able to respond to any emergency call and have personnel on-site within 2 hours after contact. Numbers available to Owner/Project Manager/Architect are to be mobile, home and office numbers for:
    a. Job Foreman.
    b. Job Superintendent.
    c. Owner or Company Officer.

C. Damage to Work of Others: Contractor shall repair, refinish, and make good any damage to the building or landscaping resulting from any of his operation. This shall include, but is not limited to, any damage to plaster, tile work, wall covering, paint, ceilings, floors, or any other finished Work. Damage done to the building, equipment, or grounds must be repaired at the successful Contractor's expense holding the Owner harmless from any other claims for property damage and/or personal injury.

D. Measurements: It will be Contractor's responsibility to obtain and/or verify any necessary dimensions by visiting the job site, and Contractor shall be responsible for the correctness of same. Any Drawings supplied are for reference only.

E. Use of Premises:
1. Contractor is advised that Owner will occupy the building at all times, and Contractor must provide all safeguards required to protect personnel and to keep noise levels as low as reasonably possible for each operation.
2. Contractor shall:
    a. Coordinate Work in such a manner as to not interfere with the normal operation of the building.
    b. Assume full responsibility for protection and safekeeping of products stored on premises.
    c. Agree to hold Owner harmless in any and all liability of every nature and description which may be suffered through bodily injuries, including death of any persons by reason of negligence of Contractor, agents, employees, or subcontractors.

F. Cleaning and Disposal of Materials:
1. Contractor shall keep the job clean and free from all loose materials and foreign matter. Contractor shall take necessary precautions to keep outside walls clean and shall allow no roofing materials to remain on the outside walls.

2. All waste materials, rubbish, etc., shall be removed from Owner's premises as accumulated. Rubbish shall be carefully handled to reduce the spread of dust. A suitable scrap chute or hoist must be used to lower any debris. At completion, all Work areas shall be left broom clean and all contractor's equipment and materials removed from the site.
3. Debris shall be deposited at an approved disposal site.

1.9 SEQUENCING AND SCHEDULING

A. Coordinate Work with roofing work for correct sequencing of items which makes up entire weatherproof, rain drainage and sheet metal system.
B. Coordinate Work with downspout discharge pipe inlet.
C. Coordinate gutter and downspout system with installation of field fabricated flashing and sheet metal under Section 07 50 00 "Membrane Roofing," Section 07 62 00 "Sheet Metal Accessories," and 07 72 00 "Roof Accessories." Work of this Section shall bring gutters and downspouts to point of connection with roofing system, with necessary accommodations for connections.

1.10 PERFORMANCE REQUIREMENTS

A. Metal Gutters and Downspouts System: Shall prevent water migration through seams and connections or building interior through the metal edge system and base flashing.

1.11 QUALITY ASSURANCE

A. Installer Qualifications: Five years documented experience installing sheet metal systems.
B. Regulatory Requirements: Comply with applicable code for size and method for rain water discharge. Comply with SMACNA Manual for sizing components for rainfall intensity determined by storm occurrence of 1 in 5 years.
C. Gutters/Downspouts and all accessories shall be designed and provided by metal roofing manufacturer providing the standing seam metal roof panels.
D. Factory Technical Representative: Roofing Contractor is to arrange and schedule the manufacturer’s technical representative to be on-site the first day of the installation of manufacturer’s roofing system. The manufacturer's technical representative shall inspect the work of Contractor at least 1 time each week during the installation of the roofing system. The manufacturer's technical representative shall perform with Owner's representative and the roofing contractor a final inspection of the roofing system. At the completion of the final inspection, provide to the roofing contractor a list of punch list items (if any) to be correct before technical acceptance of the roofing project and prior to issuance of manufacturer's 20-Year Full System Warranty. Field reports shall be provided after each inspection within 5 days of site visit.

1.12 REGULATORY REQUIREMENTS

A. Conform to all applicable local codes for metal assembly.
B. Provide certification of inspection confirming approval of design and installation by authority having jurisdiction.

1.13 PRE-INSTALLATION CONFERENCE

A. Convene a preinstallation conference 2 weeks prior to commencing the Work.
B. Require attendance of parties directly affecting the Work of this Section.
C. Review condition of roof deck and installation, installation procedures, and coordination with related Work.

1.14 WARRANTIES

A. Manufacturer's Product Warranty: Submit manufacturer's standard limited product /OR/ ten year labor and material warranty signed by the manufacturer's authorized official, guaranteeing to correct failures in product which may occur during the warranty period, without reducing or otherwise limiting any other rights to correction which Owner/Project Consultant may have under the contract documents. Failure is defined to include product failure which leads to interruption of a watertight installation. Correction may include repair or replacement of failed product.
B. Contractor's Warranty Period: For roofing flashing and sheet metal, provide a written warranty which shall warrant work to be free of leaks and defects in materials and workmanship for 2 years, starting from date of Substantial Completion.
C. Defects of the sheet metal occurring during the warranty period shall be promptly corrected by Contractor, and defects of the roofing shall be promptly corrected by the manufacturer at no additional cost to Owner. Upon notification from Owner or Owner's representative that evidence of a defect exists, the responsible party shall immediately inform Owner's representative of the date on which corrective work will be scheduled and shall notify Owner's representative when the corrective work has been completed.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Pre-Coated Galvanized Steel: ASTM A446, Grade A, G 90 zinc coating, 24-gauge core steel, shop pre-coated.
B. Fasteners: Galvanized steel screws, bolts or nuts, as applicable.
C. Stiffener Angles and Supports: Formed steel, type to match gutters, 18-gauge and clad with prefinished metal cover.
D. Solder: ASTM B32, 50-50 percent tin/lead solder with rosin flux for use with steel.
E. Neutralized: Five percent to ten percent washing soda solution.
F. Protective Back Paint for Galvanizing: Zinc chromate or galvanized iron type.
G. Bituminous Coating: FS TT-G-494, or MIL-C-18480, or SSPC-12, cold-applied bituminous mastic, compound, for 15 mil dry film thickness coating.

H. Wire Screen: One-half inch mesh, stainless steel.
I. Splash Pads or Blocks: Precast concrete type; minimum 3,000 psi at 28 days, with minimum 5 percent air entrainment.
J. Prefinished steel downspout boots: Steel powder coated boots, color to match the downspout.

2.2 FABRICATION

A. Gutters: SMACNA style profile as detail by Architect; same gauge as panel, 24-gauge minimum.
B. Downspouts: SMACNA profile as detailed by Architect; same gauge as panel, 24-gauge minimum.
C. Fabricate gutters and downspouts true to design and dimensions, straight and without deformation. Finish Work free from blemishes, abrasions, tool marks, burrs and other defects which may affect strength or performance. Form corners to smallest radius possible without causing grain separation or otherwise impairing Work. Allow for expansion and contraction.
D. Completely weld joints in gutter sections to provide watertight units. Form expansion joints between gutter sections as shown. Weld stiffener angles to gutters 4 feet on center.
E. Weld angles to underside of gutters at downspout locations to form frame, weld downspout tube to angles.
F. Form gutters in 8-foot or 10-foot long welded sections, lap joints 1-1/2-inch. Provide loose-locked expansion joints midway between outlet tubes and where gutter ends adjoin walls. Fit joints with cover strips in manner to provide watertight connections.
G. Provide outlet tubes with flanges riveted and soldered to form gutters. Extend tubes 3 inches into downspouts. Set gutters to slope to downspouts minimum 1/8-inch for each foot.
H. Form downspouts in 8-foot to 10-foot lengths. Telescope end joints 1-1/2-inch and lock longitudinal joints. Fasten downspouts to walls with 3-inch wide straps. Space straps not more than 8 feet apart. Provide shoulder of solder on each side of downspout above each strap. Fasten straps to walls with screws in lead sleeves. Form downspouts of length to discharge water 3 feet to 0 inches from building slab.
I. Lock and solder, or weld without flux all seams. Close tops of downspout heads with 18-gauge removable strainer type with wire screen.
J. Hem exposed edges of metal.

2.3 FINISHES

A. Gutter and Downspouts: 70 to 75 percent fluorocarbon resin equivalent to Kynar 500/Hylar 5000; Colors as selected from manufacturer full range of colors including premium colors as selected by Project Manager / Architect.
B. Back paint concealed metal surfaces with protective backing paint to minimum dry thickness of 15 mils.
C. Apply bitumen protective backing paint on surfaces in contact with dissimilar materials.

PART 3 - EXECUTION

3.1 REFERENCE

A. In the instance of a conflict between these specifications and those of the manufacturer and/or current NRCA, Underwriters Laboratory and IBC guidelines, the more stringent specifications (better quality or greater quantity of work) shall take precedence.
B. The manufacturer's Technical Specifications and current SMACNA, Underwriters Laboratory and IBC guidelines shall be considered a part of this specification and shall be referred to for general application procedures and recommendations.
C. Application of materials shall be in strict accordance with the manufacturer's recommendations and current NRCA, SMACNA, Underwriters Laboratory and IBC guidelines, except where more stringent requirements (better quality or greater quantity of work) are shown or specified.
D. General Installation:
    1. Comply with governing local, state, and federal regulations, safety standards, and codes.
    2. Protect adjacent areas with tarpaulin or other durable materials.
    3. Use cleaning materials or primers necessary to render an acceptable surface/substrate.
    4. All surfaces/substrates shall be clean and dry prior to application of materials.
    5. All surfaces that are to receive the self-adhered membranes shall be primed with a fast-drying asphaltic primer.

3.2 EXAMINATION

A. Verify that surfaces and site conditions are ready to receive the Work of this Section.
B. Verify that deck is secure, that it is clean and smooth, free of depressions, waves, abrupt elevation change, protrusions, or projections and properly sloped to drains.
C. Verify that deck surfaces are dry and free of frost, dew or other moisture.

3.3 INSTALLATION

A. Install gutters, downspouts and accessories in accordance with SMACNA Architectural Sheet Metal Manual.
B. Joint lengths with seams watertight. Flash and seal gutters to downspouts and accessories.
C. Slope gutters to drain. Confirm slopes with Project Manager / Architect for aesthetics.
D. Set splash blocks under downspouts where they occur on the roof surface and at grade.
E. Install gutter, downspout, and accessories.
    1. Join lengths with seams pop riveted and sealed watertight. Flash and seal collector head to downspouts and accessories.
    2. Seal all metal joints watertight for full metal surface contact.
    3. Collector Head: SMACNA style profile; submit detail for approval.
    4. Downspouts: Rectangular profile. Seal all joints, 6 by 6 inches minimum or as shown on published details.

5. Support Brackets, Joint Fasteners: Profiled to suit gutters and downspouts.
6. Anchorage Devices: SMACNA requirements. Type recommended by fabricator.
7. Collector Head Supports – Kynar.
8. Downspout Support Straps – Kynar.

F. Install 18-gauge clad with prefinished metal cover or powder coated metal supports under gutter and fastened to exterior fascia at 30 inches o.c. max staggered between the upper gutter straps at 30 inches o.c. in alternating sequence.

G. Install steel downspout boots on the ends of the downspout where they empty down on existing grade as where shown on the Drawings.

3.4 FIELD QUALITY CONTROL

A. Flood test gutters and downspouts upon completion. Repair any leaks.

3.5 FINISH

A. Back-paint concealed metal surfaces with bituminous paint where expected to be in contact with cementitious materials or dissimilar metals. Exposed surfaces to be provided with a factory applied fluorocarbon Kynar finish meeting ASTM A446 and AAMA specification 605.2 for high performance coating.

END OF SECTION

SECTION 07 72 00 - ROOF ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Equipment supports
   2. Roof hatches
   3. Wall Mounted Access Ladders
   4. Roof supports
   5. Preformed flashings
B. Related Requirements:
   1. Division 01 Specification Sections apply to the Work of this Section.

1.2 SUBMITTALS

A. Shop Drawings: Provide manufacturer's approved details of all pertinent conditions, projection conditions, and any additional special job conditions which require details other than indicated in the Drawings.
B. Refer to Specification Section 01 33 00 "Submittal Procedures" for submittal requirements.
C. Product Data: For each type of roof accessory indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
D. Coordination Drawings: Roof plans, drawn to scale, and coordinating penetrations and roof-mounted items. Show the following:
   1. Size and location of roof accessories specified in this Section.
   2. Method of attaching roof accessories to roof or building structure.
   3. Other roof-mounted items including mechanical and electrical equipment, ductwork, piping, and conduit.

1.3 QUALITY ASSURANCE

A. Sheet Metal Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" details for fabrication of units, including flanges and cap flashing to coordinate with type of roofing indicated.
B. Factory Technical Representative: Roofing Contractor is to arrange and schedule the manufacturer’s technical representative to be on-site the first day of the installation of manufacturer’s roofing system. The manufacturer's technical representative shall inspect the work of the contractor at least 1 time each week during the installation of the roofing system. The manufacturer's technical representative shall perform with Owner's representative and the roofing Contractor a final inspection of the roofing system. At the completion of the final inspection, provide to the roofing contractor a list of punch list items (if any) to be corrected before technical acceptance of the roofing project and prior to issuance of manufacturer's 20-Year Full System Warranty. Field reports shall be provided after each inspection within 5 days of site visit.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Pack, handle, and ship roof accessories properly labeled in heavy-duty packaging to prevent damage.

1.5 PROJECT CONDITIONS

A. Field Measurements: Verify required openings for each type of roof accessory by field measurements before fabrication and indicate measurements on Shop Drawings.

1.6 COORDINATION

A. Coordinate layout and installation of roof accessories with (roofing membrane and base flashing and) interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.
   1. With Architect's approval, adjust location of roof accessories that would interrupt roof drainage routes and/or roof expansion joints.

1.7 WARRANTY

A. The product manufacturer shall provide a 1-year full system material warranty necessary to cover replacement of all components of the system against defects in manufacturing. The warranty will not include Acts of God, vandalism, neglect, metal finish or improper spacing of equipment, which would be a result of improper application.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers listed in other Part 2 Articles.
B. Manufacturers: Subject to compliance with requirements, provide products by 1 of the manufacturers listed in other Part 2 Articles.

2.2 METAL MATERIALS

A. Galvanized Steel Sheet: ASTM A653, G90 (Z275) coated.
B. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A792, AZ50 (AZM150) coated.
C. Prepainted, Metallic-Coated Steel Sheet: Steel sheet metallic coated by hot-dip process and prepainted by coil-coating process to comply with ASTM A755.
   1. Galvanized Steel Sheet: ASTM A653, G90 (Z275) coated.
   2. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A792, Class AZ50 (Class AZM150) coated.

3. Exposed Finishes: High-Performance Organic Finish (2-Coat Fluoropolymer): Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturer's written instructions.
    a. Fluoropolymer 2-Coat System: Manufacturer's standard 2-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with physical properties and coating performance requirements in (AAMA 2604) (AAMA 2605), except as modified below:
        1) Humidity Resistance: 1,000 hours.
        2) Salt-Spray Resistance: 1,000 hours.

D. Aluminum Sheet: ASTM B209, alloy and temper recommended by manufacturer for type of use and mill finish.
E. Aluminum Extrusions and Tubes: ASTM B221, alloy and temper recommended by manufacturer for type of use, mill finished.
F. Stainless-Steel Shapes or Sheet: ASTM A240 or ASTM A666, Type 304 or Type 316, No. 2D finish.
G. Steel Shapes: ASTM A36, hot-dip galvanized to comply with ASTM A123, unless otherwise indicated.
H. Steel Tube: ASTM A500, round tube, baked-enamel finished.
I. Galvanized Steel Tube: ASTM A500, round tube, hot-dip galvanized to comply with ASTM A123.
J. Galvanized Steel Pipe: ASTM A53.

2.3 MISCELLANEOUS MATERIALS

A. Polycarbonate Glazing: Thermoformable, monolithic polycarbonate sheets manufactured by extrusion process, burglar-resistance rated per UL 972 with an average impact strength of 12 to 16 ft-lbf/in. of width when tested according to ASTM D256, Method A (Izod).
B. Cellulosic-FiberBoard Insulation: ASTM C208, Type II, Grade 1, 1-inch-thick.
C. Polyisocyanurate Board Insulation: ASTM C1289, 1-inch-thick.
D. Wood Nailers: Softwood lumber, pressure treated with waterborne preservatives for aboveground use, complying with AWPA C2; not less than 1-1/2 inches thick.
E. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.
F. Polyethylene Sheet: 6-mil thick, polyethylene sheet complying with ASTM D4397.
G. Felt: ASTM D226, Type II (No. 30), asphalt-saturated organic felt, nonperforated.
    1. Slip Sheet: Rosin-sized paper, minimum 3 pounds per 100 square feet.
H. Fasteners: Same metal as metals being fastened, or nonmagnetic stainless steel or other noncorrosive metal as recommended by roof accessory manufacturer. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners.
I. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, or PVC; or flat design of foam rubber, sponge neoprene, or cork.
J. Elastomeric Sealant: ASTM C920, polyurethane sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

K. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant, polyisobutylene plasticized, and heavy bodied for hooked-type expansion joints with limited movement.
L. Roofing Cement: ASTM D4586, nonasbestos, fibrated asphalt cement designed for trowel application or other adhesive compatible with roofing system.

2.4 ROOF HATCHES

A. Roof Hatches: Fabricate roof hatches with insulated double-wall lids and insulated double-wall curb frame with integral deck mounting flange and lid frame counterflashing. Fabricate with welded or mechanically fastened and sealed corner joints. Provide continuous weathertight perimeter gasketing and equip with corrosion-resistant or hot-dip galvanized hardware.
   1. Manufacturers:
      a. Babcock-Davis; a Cierra Products Inc. Company.
      b. JL Industries.
      c. Nystrom.
   2. Loads: Fabricate roof hatches to withstand 40 pounds per square foot external and 20 pounds per square foot internal loads.
   3. Type and Size: Single-leaf lid, thermally-broken, 36 feet by 60 inches.
   4. Curb and Lid Material: Aluminum sheet, 0.090-inch-thick.
      a. Finish: Baked enamel.
   5. Insulation: 3-Inch Polyisocyanurate, equal to R-20.3, in curb and cover.
   6. Interior Lid Liner: Manufacturer's standard metal liner of same material and finish as outer metal lid.
   7. Exterior Curb Liner: Manufacturer's standard metal liner of same material and finish as metal curb.
   8. On ribbed or fluted metal roofs, form flange at perimeter bottom to conform to roof profile.
   9. Fabricate units to minimum height of 14 inches, unless otherwise indicated.
   10. Sloping Roofs: Where slope or roof deck exceeds 1:48, fabricate hatch curbs with height tapered to match slope to level tops of units.
   11. Hardware: Galvanized steel spring latch with turn handles, butt- or pintle-type hinge system, and padlock hasps inside and outside.
      a. Provide 2-point latch on covers larger than 84 inches.
   12. Ladder Safety Post: Manufacturer's standard ladder safety post. Post to lock in place on full extension. Provide release mechanism to return post to closed position.
      a. Test Load:
      b. Height: 42 Inches above finished roof deck.
      c. Material and Finish: Aluminum, mill finished.
      d. Diameter: Pipe with 1-5/8-inch OD tube.
   13. Hatch Lid to have and R value of R20.

14. Safety Railing System: Manufacturer's standard aluminum construction, nonpenetrating safety railing system with self-closing and latching gate. Corrosion resistant construction. System shall meet or exceed OSHA fall protection regulations (29 CFR 1910.29). Color: Safety Yellow.

2.5 WALL MOUNTED ACCESS LADDERS

A. Fixed Ladder Design, as manufactured by O'Keefe's, Inc., or approved equal.
   1. Ladder safety devices or fall-arrest systems are required on ladders over 24 feet.
   2. Ladder safety devices or fall-arrest systems are required on all ladders in high or hazardous areas.
   3. Landing platforms are required at 50 feet above the bottom of the ladder.
   4. Rail and harness fall arrest system as alternate to landing platforms shall be a permissible manufacturer's option.
      a. Fixed ladder bottom bracket.
      b. Bottom floor supported bracket.
      c. Bottom wall supported bracket.
      d. Bracket as drawn.

B. Fixed Access Ladder:
   1. Tubular Rail Low Parapet Access Ladder with Platform and Return.
      a. Model 503, as manufactured by O'Keeffe's Inc.

C. Materials:
   1. Aluminum Sheet: Alloy 5005-H34 to comply with ASTM B209.
   2. Aluminum Extrusions: Alloy 6063-T6 to comply with ASTM B221.

D. Finishes:
   1. Mill finish. As extruded.
   2. Clear Anodic Finish: AA-M10C22A41 Mechanical finish as fabricated. Architectural Class I, clear coating 0.018 millimeters or thicker.
   3. Paint. Urethane over chemically pretreated substrate.
      a. Fire Red (RAL 2002).
      b. Alert Orange (RAL 2003).
      c. Warning Blue (RAL 5005).
      d. Caution Yellow (RAL 1018).
      e. Safety Green (RAL 6001).
      f. As scheduled on Drawings.
   4. Furnish touchup kit for each type and color of paint finish provided.

E. Fabrication:
   1. Rungs: Not less than 1-1/4 inches in section and 18-3/8 inches long, formed from tubular aluminum extrusions. Squared and deeply serrated on all sides.
      a. Rungs shall withstand a 1,500 pound load without deformation or failure.
   2. Channel Side Rails: Not less than 1/8-inch wall thickness by 3 inches wide.
   3. Heavy Duty Tubular Side Rails: Assembled from 2 interlocking aluminum extrusions no less than 1/8-inch wall thickness by 3 inches wide. Construction shall be self-locking stainless steel fasteners, full penetration TIG welds and clean, smooth and burr-free surfaces.
   4. Ship Ladders: Not less than 1-1/4 inches high, 4-1/8 inches deep and 2 feet wide; tread spacing shall be 1 foot on center. Handrails shall be aluminum pipe, not less than 1-1/2 inches in diameter with hemispheric end caps.

5. Walk-Through Rail and Roof Rail Extension: Not less than 3 feet 6 inches above the landing and shall be fitted with deeply serrated, square, tubular grab rails.
6. Landing Platform: 1-1/2 inches or greater diameter, tubular aluminum guardrails and decks of serrated aluminum treads.
7. Security Doors: Formed 1/8-inch-thick aluminum sheet. Security panels shall extend on both sides, perpendicular to the door face, to within 2 inches of the wall. Security door shall be furnished with continuous aluminum piano hinge and heavy duty forged steel locking hasps.
8. Ship Ladder Seismic Bottom Support: Manufacturer's standard; 2 isolation bearings per stringer.
9. Ladder Safety Post: Retractable hand hold and tie off.
10. Rail and Harness Fall Arrest System: Supplied where specified as alternate to safety cage and landing platforms, in accordance with OSHA regulation 1910.28; permanently mounted to ladder rungs and complete with necessary components.

2.6 ROOF PIPE SUPPORTS

A. To support conduit or pipe sized up to 8 inches when height adjustment is needed use Model # SS1000A Adjustable Pipe Support. 17-inch circular base with 12-gague framing channel, 18 inches long, attached to 17-inch circular base using 1/2-inch threaded rods, 12 inches long, with washers and nuts. Height of channel can be adjusted along the length of the 1/2-inch threaded rods. Strut clamps are suggested to hold piping or conduit in place.
   1. Manufacturers:
      a. Advanced Support Products, Inc.

B. To support water or gas piping up to 8 inches or when a roller support with height adjustment is needed use Model # SS1000RA Pipe Support with Adjustable Roller. 17-inch circular base with SBR heavy duty rubber roller assembly attached to 17-inch circular base using 1/2-inch threaded rods, 12 inches long, with washers and nuts. Height of roller assembly can be adjusted along the length of the 1/2-inch threaded rods.
   1. Manufacturers:
      a. Advanced Support Products, Inc.

C. To support multiple pipe runs, piping up to 12 inches when height adjustment or pipe suspension is needed use Model # SS4000P, SS6000P or SS8000P Adjustable Support Bridge. SS4000P Adjustable Support Bridge is made of four 17-inch circular bases and 12-gauge framing channel formed to make 1 "H" shaped support with crossbar. SS6000P Adjustable Support Bridge is made of six 17-inch circular bases and 12-gauge framing channel formed to make 2 "H" shaped supports with crossbar. SS8000P Adjustable Support Bridge is made of eight 17-inch circular bases and 12-gauge framing channel formed to make 3 "H" shaped supports with crossbar. Crossbar height is adjustable and offered in 18-inch, 24-inch, 36-inch, and 48-inch lengths. Use Adjustable Support Bridge with strut clamps or roller accessories or use optional hanger supports to suspend water or gas piping at various heights. Optional hanger supports attached to support frame using 1/2-inch threaded rods.

D. Hangers offer complete height adjustments along the length of 1/2-inch threaded rods.
   1. Manufacturers:
      a. Advanced Support Products, Inc.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with installer present, to verify actual locations, dimensions, and other conditions affecting performance of Work.
   1. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored and is ready to receive roof accessories.
   2. Verify dimensions of roof openings for roof accessories.
   3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install roof accessories according to manufacturer's written instructions. Anchor roof accessories securely in place and capable of resisting forces specified. Use fasteners, separators, sealants, and other miscellaneous items as required for completing roof accessory installation. Install roof accessories to resist exposure to weather without failing, rattling, leaking, and fastener disengagement.
B. Install roof accessories to fit substrates and to result in watertight performance.
C. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
   1. Coat concealed side of uncoated aluminum roof accessories with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
   2. Underlayment: Where installing exposed-to-view components of roof accessories directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet, or install a course of polyethylene underlayment.
   3. Bed flanges in thick coat of asphalt roofing cement where required by roof accessory manufacturers for waterproof performance.
D. Install roof accessories level, plumb, true to line and elevation, and without warping, jogs in alignment, excessive oil canning, buckling, or tool marks.

3.3 PIPE AND EQUIPMENT SUPPORT INSTALLATION:

A. Install support systems in accordance with manufacturer’s instructions and approved Shop Drawings.

B. Accurately locate and align pre-fabricated pipe supports in locations specified as per approved Shop Drawings or as required herein and by site conditions to limit pipe and/or conduit deflection to L/240, not to exceed 10 feet on center. No isolation pads are required under the 17-inch circular bases.
C. Should the roofing manufacturer require a separation sheet between the roof and the support system, place a separation sheet or protective pad conforming to the existing roof manufacturer's system under 17-inch circular bases. Do not adhere to the roof system or 17-inch circular bases.
D. If required, insert frame structures into 17-inch circular bases as indicated by manufacturer's instructions.
E. Adjust height of each strut or channel and hanger or roller to its required height and tighten with nut, but do not over-tighten. Check each support for equal weight disbursement. Correct if necessary.
F. Remove any unused materials and packaging from job site. All gas lines, piping, and conduit must be supported on specified stands or hangars.
G. Supports shall be attached to pipes with oversized strapping.
H. Designated pipe/equipment supports shall be removed and replaced with new.
I. Verify that roof surface is smooth and clean to extent needed to receive materials. Surface shall be cleaned by removing any loose gravel and any foreign matter.
J. Install support systems in accordance with manufacturer's instructions and approved Shop Drawings. Accurately locate and align pre-fabricated pipe supports in locations specified as per approved Shop Drawings. Pipe supports shall be placed not to exceed 10 feet on center and within 2 feet of all elevation changes, intersections, and corners.
K. Supports shall be set on a double layer of membrane, adhered to the roof surface using specified silyl-terminated polyester sealant, unless noted otherwise by support manufacturer.
L. Provide bond breaker between dissimilar metals.

3.4 ROOF HATCH INSTALLATION:

A. Check roof hatch for proper operation. Adjust operating mechanism as required. Clean and lubricate joints and hardware.
B. Attach safety railing system to roof hatch curb.
C. Attach ladder safety post according to manufacturer's written instructions.
D. Provide the required structural members necessary to install the hatch into the roof deck. Refer to structural drawings for further information.

3.5 INSTALLATION OF EXTERIOR ROOF ACCESS LADDER

A. Examination:
   1. Coordinate anchorages. Furnish setting drawings, templates, and anchorage structural loads for fastener resistance.
   2. Do not begin installation until supporting structure is complete and ladder installation will not interfere with supporting structure work.
   3. If supporting structure is the responsibility of another installer, notify Architect of unsatisfactory supporting work before proceeding.

B. Installation: Install in accordance with manufacturer's instructions and in proper relationship with adjacent construction.
C. Protection:
   1. Protect installed products until completion of Project.
   2. Touch-up, repair or replace damaged products before Substantial Completion.

3.6 TOUCH UP

A. Touch up factory-primed surfaces with compatible primer ready for field painting in accordance with Division 09 painting Sections.
B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780.

3.7 CLEANING

A. Clean exposed surfaces according to manufacturer's written instructions.

END OF SECTION

SECTION 07 84 13 - PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Penetration firestopping systems for the following applications:
a. Penetrations in fire-resistance-rated walls.
b. Penetrations in horizontal assemblies.

2. Fire and smoke assembly identification.

B. Related Requirements:
1. Division 01 Specification Sections apply to Work of this Section.
2. Section 07 84 43 "Joint Firestopping" for joints in or between fire-resistance-rated construction, at exterior curtainwall/floor intersections, and in smoke barriers.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Product Schedule: For each penetration firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing and inspecting agency.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For installer.
B. Product Test Reports: For each penetration firestopping system, for tests performed by a qualified testing agency.

1.4 PROJECT CONDITIONS

A. Environmental Limitations: Do not install penetration firestopping system when ambient or substrate temperatures are outside limits permitted by penetration firestopping system manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.
B. Install and cure penetration firestopping materials per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

1.5 COORDINATION

A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping systems can be installed according to specified firestopping system design.
B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping systems.

PART 2 - PRODUCTS

2.1 PENETRATION FIRESTOPPING SYSTEMS

A. Penetration Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. 3M Fire Protection Products.
   b. Hilti, Inc.
   c. Tremco, Inc.

B. Penetrations in Fire-Resistance-Rated Walls: Penetration firestopping systems with ratings determined per ASTM E814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.

F-Rating: Not less than the fire-resistance rating of constructions penetrated.

C. Penetrations in Horizontal Assemblies: Penetration firestopping systems with ratings determined per ASTM E814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.

1. F-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated.

2. T-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.

D. Manufactured Piping Penetration Firestopping System: Penetration firestopping systems with ratings determined per ASTM E814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. ProVent Systems, Inc.

2. F-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated.

3. T-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.

4. Sleeve: Molded-PVC plastic, of length to match slab thickness and with integral nailing flange on 1 end for installation in cast-in-place concrete slabs.

5. Stack Fitting: ASTM A48, gray-iron, hubless-pattern wye branch with neoprene O-ring at base and gray-iron plug in thermal-release harness. Include PVC protective cap for plug.

6. Special Coating: Corrosion resistant on interior of fittings.

E. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping system manufacturer and approved by qualified testing and inspecting agency for conditions indicated.

Permanent forming/damming/backing materials.
1. Substrate primers.
2. Collars.
3. Steel sleeves.

2.2 MIXING

A. Penetration Firestopping Materials: For those products requiring mixing before application, comply with penetration firestopping system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.
B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning: Before installing penetration firestopping systems, clean out openings immediately to comply with manufacturer's written instructions and with the following requirements:
1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of penetration firestopping materials.
2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping materials. Remove loose particles remaining from cleaning operation.
3. Remove laitance and form-release agents from concrete.

B. Prime substrates where recommended in writing by manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

3.3 INSTALLATION

A. General: Install penetration firestopping systems to comply with manufacturer's written installation instructions and published drawings for products and applications.
B. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings.
   1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not forming permanent components of firestopping.
C. Install fill materials by proven techniques to produce the following results:
   1. Fill voids and cavities formed by openings, forming materials, accessories and penetrating items to achieve required fire-resistance ratings.
   2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
   3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

A. Fire and Smoke Assembly Identification: Where assembly types are identified in Drawings, provide stenciled identification in accessible concealed spaces.
   1. Assembly Types Requiring Identification: Fire walls, fire barriers, fire partitions, smoke barriers, and smoke partitions.
   2. Accessible concealed spaces include below accessible floors, above ceilings, and attic spaces.

   3. Locate within 15 feet of partition ends and at intervals not exceeding 30 feet measured horizontally.
   4. Lettering not less than 3 inches in height with a minimum 3/8-inch stroke in a contrasting color.

   5. Wording: Include hour rating and assembly type followed by "protect all openings."

3.5 CLEANING AND PROTECTION

A. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping system manufacturers and that do not damage materials in which openings occur.
B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping systems are without damage or deterioration

at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping material and install new materials to produce systems complying with specified requirements.

3.6 PENETRATION FIRESTOPPING SYSTEM SCHEDULE

A. Where UL-classified systems are indicated, they refer to system numbers in UL's "Fire Resistance Directory" under product Category XHEZ.

B. Where Intertek Group-listed systems are indicated, they refer to design numbers in Intertek Group's "Directory of Listed Building Products" under "Firestop Systems."

C. Where FM Approval-approved systems are indicated, they refer to design numbers listed in FM Approval's "Approval Guide" under "Wall and Floor Penetration Fire Stops."

END OF SECTION

SECTION 07 84 43 - JOINT FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Joints in or between fire-resistance-rated constructions.
2. Joints at exterior curtainwall/floor intersections.
3. Joints in smoke barriers.

B. Related Requirements:
1. Division 01 Specification Sections apply to Work of this Section.
2. Section 07 84 13 "Penetration Firestopping" for penetrations in fire-resistance-rated walls, horizontal assemblies, and smoke barriers and for wall identification.
3. Section 09 22 16 "Non-Structural Metal Framing" for firestop tracks for metal-framed partition heads.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project Site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Product Schedule: For each joint firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing agency.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For installer.

B. Product Test Reports: For each joint firestopping system, for tests performed by a qualified testing agency.

1.5 CLOSEOUT SUBMITTALS

A. Installer Certificates: From installer indicating that joint firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A firm that has been approved by FM Global according to FM Global 4991, "Approval of Firestop Contractors," or been evaluated by UL and found to comply with UL's "Qualified Firestop Contractor Program Requirements."

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not install joint firestopping systems when ambient or substrate temperatures are outside limits permitted by joint firestopping system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.
B. Install and cure joint firestopping systems per manufacturer's written instructions using natural means of ventilation or, where this is inadequate, forced-air circulation.

1.8 COORDINATION

A. Coordinate construction of joints to ensure that joint firestopping systems can be installed according to specified firestopping system design.
B. Coordinate sizing of joints to accommodate joint firestopping systems.

PART 2 - PRODUCTS

2.1 JOINT FIRESTOPPING SYSTEMS

A. Joint Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of assemblies in or between which joint firestopping systems are installed. Joint firestopping systems shall accommodate building movements without impairing their ability to resist the passage of fire and hot gases.
B. Joints in or between Fire-Resistance-Rated Construction: Provide joint firestopping systems with ratings determined per ASTM E1966 or UL 2079.
    1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
        a. 3M Fire Protection Products.
        b. Hilti, Inc.
        c. Tremco, Inc.
C. Joints at Exterior Curtain-Wall/Floor Intersections: Provide joint firestopping systems with rating determined per ASTM E2307.
    1. Basis of Design Products: Subject to compliance with requirements, provide Thermafiber Inc., an Owens Corning company, Thermafiber CW-S-004. Other available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
        a. 3M Fire Protection Products.
        b. Hilti, Inc.
        c. Tremco, Inc.
    2. F-Rating: Equal to or exceeding the fire-resistance rating of the floor assembly.

D. Joints in Smoke Barriers: Provide fire-resistive joint systems with ratings determined per UL 2079 based on testing at a positive pressure differential of 0.30-inch wg.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. 3M Fire Protection Products.
      b. Hilti, Inc.
      c. Thermafiber, Inc.; an Owens Corning company.
   2. L-Rating: Not exceeding 5.0 cfm/ft. of joint at both ambient and elevated temperatures.

E. Exposed Joint Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E84.

F. Accessories: Provide components of fire-resistive joint systems, including primers and forming materials, that are needed to install elastomeric fill materials and to maintain ratings required. Use only components specified by joint firestopping system manufacturer and approved by the qualified testing agency for conditions indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with installer present, for compliance with requirements for joint configurations, substrates, and other conditions affecting performance of the Work.

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

3.2 PREPARATION

A. Surface Cleaning: Before installing fire-resistive joint systems, clean joints immediately to comply with fire-resistive joint system manufacturer's written instructions and the following requirements:
   1. Remove from surfaces of joint substrates foreign materials that could interfere with adhesion of elastomeric fill materials or compromise fire-resistive rating.
   2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with elastomeric fill materials. Remove loose particles remaining from cleaning operation.
   3. Remove laitance and form-release agents from concrete.

B. Prime substrates where recommended in writing by joint firestopping system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

3.3 INSTALLATION

A. General: Install fire-resistive joint systems to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.
B. Install forming materials and other accessories of types required to support elastomeric fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
   1. After installing elastomeric fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of fire-resistive joint system.
C. Install elastomeric fill materials for fire-resistive joint systems by proven techniques to produce the following results:
   1. Elastomeric fill voids and cavities formed by joints and forming materials as required to achieve fire-resistance ratings indicated.
   2. Apply elastomeric fill materials so they contact and adhere to substrates formed by joints.
   3. For elastomeric fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

A. Joint Identification: Identify joint firestopping systems with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of joint edge so labels are visible to anyone seeking to remove or joint firestopping system. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:
   1. The words "Warning - Joint Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
   2. Contractor's name, address, and phone number.
   3. Designation of applicable testing agency.
   4. Date of installation.
   5. Manufacturer's name.
   6. Installer's name.

3.5 CLEANING AND PROTECTION

A. Clean off excess elastomeric fill materials adjacent to joints as the Work progresses by methods and with cleaning materials that are approved in writing by joint firestopping system manufacturers and that do not damage materials in which joints occur.
B. Provide final protection and maintain conditions during and after installation that ensure joint firestopping systems are without damage or deterioration at time of Substantial Completion. If damage or deterioration occurs despite such protection, cut out and remove damaged or deteriorated fire-resistive joint systems immediately and install new materials to produce fire-resistive joint systems complying with specified requirements.

3.6 JOINT FIRESTOPPING SYSTEM SCHEDULE

A. Where UL-classified systems are indicated, they refer to system numbers in UL's "Fire Resistance Directory" under product Category XHBN or Category XHDG.

B. Where Intertek Group-listed systems are indicated, they refer to design numbers in Intertek Group's "Directory of Listed Building Products" under product category Expansion/Seismic Joints or Firestop Systems.

END OF SECTION

SECTION 07 92 00 - JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Nonstaining silicone joint sealants.
   2. Urethane joint sealants.
   3. Mildew-resistant joint sealants.
   4. Butyl joint sealants.
   5. Latex joint sealants.

B. Related Requirements:
   1. Division 01 Specification Sections apply to Work of this Section.

1.2 ACTION SUBMITTALS

A. Product Data: For each joint-sealant product.

B. Samples for Verification: For each kind and color of joint sealant required, provide samples with joint sealants in 1/2-inch wide joints formed between two 6-inch long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

C. Joint-Sealant Schedule: Include the following information:
   1. Joint-sealant application, joint location, and designation.
   2. Joint-sealant manufacturer and product name.
   3. Joint-sealant formulation.
   4. Joint-sealant color.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data:
   1. For installer.
   2. For qualified testing agency.

B. Product Test Reports: For each kind of joint sealant, for tests performed by a qualified testing agency.

C. Preconstruction Laboratory Test Schedule: Include the following information for each joint sealant and substrate material to be tested:
   1. Joint-sealant location and designation.
   2. Manufacturer and product name.
   3. Type of substrate material.
   4. Proposed test.
   5. Number of samples required.

D. Preconstruction Laboratory Test Reports: From sealant manufacturer, indicating the following:
   1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
   2. Interpretation of test results and written recommendations for primers and substrate preparation are needed for adhesion.

E. Preconstruction Field-Adhesion-Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on testing specified in "Preconstruction Testing" Article.
F. Field-Adhesion-Test Reports: For each sealant application tested.
G. Sample Warranties: For special warranties.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.
B. Product Testing: Test joint sealants using a qualified testing agency.
   1. Testing Agency Qualifications: Qualified according to ASTM C1021 to conduct the testing indicated.
C. Mockups: Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section.

1.5 PRECONSTRUCTION TESTING

A. Preconstruction Laboratory Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.
   1. Adhesion Testing: Use ASTM C794 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
   2. Compatibility Testing: Use ASTM C1087 to determine sealant compatibility when in contact with glazing and gasket materials.
   3. Stain Testing: Use ASTM C1248 to determine stain potential of sealant when in contact with masonry substrates.
   4. Submit manufacturer's recommended number of pieces of each type of material, including joint substrates, joint-sealant backings, and miscellaneous materials.
   5. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
   6. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures, including use of specially formulated primers.
   7. Testing will not be required if joint-sealant manufacturers submit data that are based on previous testing, not older than 24 months, of sealant products for adhesion to, staining of, and compatibility with joint substrates and other materials matching those submitted.
B. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates as follows:
   1. Locate test joints where indicated on Project or, if not indicated, as directed by Architect.
   2. Conduct field tests for each kind of sealant and joint substrate.
   3. Notify Architect seven days in advance of dates and times when test joints will be erected.

4. Report whether sealant failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
5. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

1.6 FIELD CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:
   1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer.
   2. When joint substrates are wet.
   3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
   4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.7 WARRANTY

A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
   1. Warranty Period: Two years from date of Substantial Completion.
B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
   1. Warranty Period: Five years from date of Substantial Completion.
C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:
   1. Movement of the structure caused by stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
   2. Disintegration of joint substrates from causes exceeding design specifications.
   3. Mechanical damage caused by individuals, tools, or other outside agents.
   4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 JOINT SEALANTS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's standard range. Unless noted otherwise, do not paint sealants to achieve color.

2.2 NONSTAINING SILICONE JOINT SEALANTS

A. Nonstaining Joint Sealants: No staining of substrates when tested according to ASTM C1248.

B. Silicone, Nonstaining, M, NS, 50, NT: Nonstaining, multicomponent, non-sag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type M, Grade NS, Class 50, Use NT.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    a. Tremco Incorporated; Spectrem 4-TS.

2.3 URETHANE JOINT SEALANTS

A. Urethane, M, NS, 50, NT: Multicomponent, non-sag, plus 50 percent and minus 50 percent movement capability nontraffic-use, urethane joint sealant; ASTM C920, Type M, Grade NS, Class 50, Use NT.

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

2.4 MILDEW-RESISTANT JOINT SEALANTS

A. Mildew-Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.

B. Silicone, Mildew Resistant, Acid Curing, S, NS, 25, NT: Mildew-resistant, single-component, non-sag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    a. Dow Corning Corporation; 786-M White.
    b. GE Construction Sealants; Momentive Performance Materials Inc.; SCS1700 Sanitary.
    c. Sika Corporation U.S.; Sikasil-GP.
    d. Soudal USA; RTV GP.
    e. Tremco Incorporated; Tremsil 200.

2.5 BUTYL JOINT SEALANTS

A. Butyl-Rubber-Based Joint Sealants: ASTM C1311.
   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      a. Bostik, Inc.; Chem-Calk 300.
      b. Pecora Corporation; BC-158.

2.6 LATEX JOINT SEALANTS

A. Acrylic Latex: Acrylic latex or siliconized acrylic latex, ASTM C834, Type OP, Grade NF.
   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      a. BASF Construction Chemicals - Building Systems; Sonolac.
      b. Pecora Corporation; AC-20.
      c. Sherwin-Williams Company (The); 850A.
      d. Sika Corporation U.S.; Sikacryl-20 FC.
      e. Tremco Incorporated; Tremflex 834.

2.7 JOINT-SEALANT BACKING

A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. BASF Construction Chemicals - Building Systems.
      b. Construction Foam Products, a division of Nomaco, Inc.

B. Cylindrical Sealant Backings: ASTM C1330, any of the following types; as approved in writing by joint-sealant manufacturer for joint application indicated. Size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
   1. Type C (closed-cell material with a surface skin).
   2. Type O (open-cell material).
   3. Type B (bicellular material with a surface skin).

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.8 MISCELLANEOUS MATERIALS

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

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.
B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
   1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
   2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
      a. Concrete.
      b. Masonry.
      c. Unglazed surfaces of ceramic tile.
   3. Remove laitance and form-release agents from concrete.
   4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
      a. Metal.
      b. Glass.
      c. Porcelain enamel.
      d. Glazed surfaces of ceramic tile.
B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written

instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
   1. Do not leave gaps between ends of sealant backings.
   2. Do not stretch, twist, puncture, or tear sealant backings.
   3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
   1. Place sealants so they directly contact and fully wet joint substrates.
   2. Completely fill recesses in each joint configuration.
   3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F. Tooling of Non-sag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
   1. Remove excess sealant from surfaces adjacent to joints.
   2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
   3. Provide concave joint profile per Figure 8A in ASTM C1193 unless otherwise indicated.

3.4 FIELD QUALITY CONTROL

A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:
   1. Extent of Testing: Test completed and cured sealant joints as follows:
      a. Perform 10 tests for the first 1,000 feet of joint length for each kind of sealant and joint substrate.
      b. Perform 1 test for each 1,000 feet of joint length thereafter or 1 test per each floor per elevation.

2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C1193 or Method A, Tail Procedure, in ASTM C1521.
    a. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
3. Inspect tested joints and report on the following:
    a. Whether sealants filled joint cavities and are free of voids.
    b. Whether sealant dimensions and configurations comply with specified requirements.
    c. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion complies with sealant manufacturer's field-adhesion hand-pull test criteria.
4. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant material, sealant configuration, and sealant dimensions.
5. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.

B. Evaluation of Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.5 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.6 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original Work.

3.7 JOINT-SEALANT SCHEDULE

A. Joint-Sealant Application: Exterior joints in horizontal traffic surfaces.

1. Joint Locations:
    a. Tile control and expansion joints.
    b. Joints between different materials listed above.
    c. Other joints as indicated on Drawings.
2. Joint Sealant:
    a. Urethane, M, P, 50, T, NT.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

B. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces.
1. Joint Locations:
    a. Construction joints in cast-in-place concrete.
    b. Control and expansion joints in unit masonry.
    c. Joints between metal panels.
    d. Joints between different materials listed above.
    e. Perimeter joints between materials listed above and frames of doors, windows and louvers.
    f. Control and expansion joints in ceilings and other overhead surfaces.
    g. Other joints as indicated on Drawings.
2. Joint Sealant:
    a. Silicone, nonstaining, S, NS, 50, NT.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

C. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces.
1. Joint Locations:
    a. Control and expansion joints on exposed interior surfaces of exterior walls.
    b. Tile control and expansion joints.
    c. Vertical joints on exposed surfaces of unit masonry, concrete, walls, and partitions.
    d. Other joints as indicated on Drawings.
2. Joint Sealant:
    a. Urethane, S, NS, 25, NT.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

D. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces not subject to significant movement.
1. Joint Locations:
    a. Control joints on exposed interior surfaces of exterior walls.
    b. Perimeter joints between interior wall surfaces and frames of interior doors, windows, and elevator entrances.
    c. Other joints as indicated on Drawings.
2. Joint Sealant: Acrylic latex.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

E. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Locations:
    a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
    b. Tile control and expansion joints where indicated.
    c. Other joints as indicated on Drawings.
2. Joint Sealant:
    a. Silicone, mildew resistant, acid curing, S, NS, 25, NT.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

F. Joint-Sealant Application: Concealed mastics.
1. Joint Locations:
    a. Thresholds.
    b. Sill plates.
    c. Other joints as indicated on Drawings.
2. Joint Sealant: Butyl-rubber based.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

END OF SECTION

SECTION 08 11 13 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes hollow-metal work.
B. Related Requirements:
   1. Division 01 Specification Sections apply to Work of this Section.
   2. Section 08 71 00 "Door Hardware" for door hardware for hollow-metal doors.
   3. Section 08 17 43 "Fiberglass Doors" for exterior doors and frames.

1.2 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.

1.3 COORDINATION

A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project Site in time for installation.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, core descriptions, fire-resistance ratings, and finishes.
B. Shop Drawings: Include the following:
   1. Elevations of each door type.
   2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
   3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
   4. Locations of reinforcement and preparations for hardware.
   5. Details of each different wall opening condition.
   6. Details of anchorages, joints, field splices, and connections.
   7. Details of accessories.
   8. Details of moldings, removable stops, and glazing.
   9. Details of conduit and preparations for power, signal, and control systems.
C. Samples for Verification:
   1. For each type of exposed finish required, prepared on Samples of not less than 3 by 5 inches.
D. Schedule: Provide a schedule of hollow-metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final Door Hardware Schedule.
E. Product to be designed for use for all areas within Texas as defined by the Texas Department of Insurance.

1.5 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each type of hollow-metal door and frame assembly, for tests performed by a qualified testing agency.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow-metal work palletized, packaged, or crated to provide protection during transit and Project-Site storage. Do not use non-vented plastic.
   1. Provide additional protection to prevent damage to factory-finished units.
B. Store hollow-metal work vertically under cover at Project Site with head up. Place on minimum 4-inch high wood blocking. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Ceco Door; ASSA ABLOY.
   2. Curries Company; ASSA ABLOY.
   3. DKS Steel Door & Frame System, Inc.
   4. Republic Doors and Frames.
   5. Steelcraft; an Ingersoll-Rand company.
   6. Steward Steel Door & Frame Division.
   7. Pearland Industries.
B. Source Limitations: Obtain hollow-metal work from single source from single manufacturer.

2.2 REGULATORY REQUIREMENTS

A. Fire-Rated Assemblies: Complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings and temperature-rise limits indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.
B. Fire-Rated, Borrowed-Lite Assemblies: Complying with NFPA 80 and listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9.

2.3 INTERIOR DOORS AND FRAMES

A. Construct interior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Heavy-Duty Doors and Frames: SDI A250.8, Level 4. At interior locations. Exterior door frames to be grouted solid.
   1. Physical Performance: Level B according to SDI A250.4.
   2. Doors:
      a. Type: As indicated in the Door and Frame Schedule.
      b. Thickness: 1-3/4 inches.
      c. Face: Uncoated, cold-rolled steel sheet, minimum thickness of 0.042-inch.
      d. Edge Construction: Model 2, Seamless.
      e. Core: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core at manufacturer's discretion.
   3. Frames:
      a. Materials: Uncoated steel sheet, minimum thickness of 0.053-inch.
      b. Sidelite and Transom Frames: Fabricated from same thickness material as adjacent door frame.
      c. Construction: Face welded.
   4. Exposed Finish: Prime.

C. Extra-Heavy-Duty Doors and Frames: SDI A250.8, Level 3. At interior stile and rail door locations.
   1. Physical Performance: Level A according to SDI A250.4.
   2. Doors:
      a. Type: As indicated in the Door and Frame Schedule.
      b. Thickness: 1-3/4 inches.
      c. Face: Uncoated, cold-rolled steel sheet, minimum thickness of 0.053-inch.
      d. Edge Construction: Model 2, Seamless.
      e. Core: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core at manufacturer's discretion.
   3. Frames:
      a. Materials: Uncoated, steel sheet, minimum thickness of 0.053-inch.
      b. Sidelite and Transom Frames: Fabricated from same thickness material as adjacent door frame.
      c. Construction: Face welded.
   4. Exposed Finish: Prime.

2.4 EXTERIOR HOLLOW-METAL DOORS AND FRAMES

A. Construct exterior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Extra-Heavy-Duty Doors and Frames: SDI A250.8, Level 3. At exterior locations or doors with stile and rails.
   1. Physical Performance: Level A according to SDI A250.4.
   2. Doors:
      a. Type: As indicated in the Door and Frame Schedule.
      b. Thickness: 1-3/4 inches.

c. Face: Metallic-coated steel sheet, minimum thickness of 0.053-inch, with minimum A40 coating.
d. Edge Construction: Model 2, Seamless.
e. Core: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core at manufacturer's discretion. Provide doors fabricated with thermal-resistance value (R-value) of not less than 2.1 deg F by h by sq. ft./Btu when tested according to ASTM C1363.

3. Frames:
   a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053-inch, with minimum A40 coating.
   b. Construction: Face welded.
4. Exposed Finish: Prime.

2.5 BORROWED LITES

A. Hollow-metal frames of metallic-coated steel sheet, minimum thickness of 0.053-inch.
B. Construction: Face welded.

2.6 HOLLOW-METAL PANELS

A. Provide hollow-metal panels of same materials, construction, and finish as adjacent door assemblies.

2.7 FRAME ANCHORS

A. Jamb Anchors:
   1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042-inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177-inch-thick.
   2. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042-inch-thick.

2.8 MATERIALS

A. Hot-Rolled Steel Sheet: ASTM A1011, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
B. Frame Anchors: ASTM A879, Commercial Steel (CS), 04Z coating designation; mill phosphatized.
   1. For anchors built into exterior walls, steel sheet complying with ASTM A1008 or ASTM A1011, hot-dip galvanized according to ASTM A153, Class B.
C. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A153.
D. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.
E. Grout: ASTM C476, except with a maximum slump of 4 inches, as measured according to ASTM C143.

F. Mineral-Fiber Insulation: ASTM C665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E136 for combustion characteristics.
G. Glazing: Comply with requirements in Section 08 80 00 "Glazing."
H. Bituminous Coating: Cold-applied asphalt mastic, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.9 FABRICATION

A. Fabricate hollow-metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for metal thickness. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project Site, clearly identify work that cannot be permanently factory assembled before shipment.
B. Hollow-Metal Doors:
   1. Steel-Stiffened Door Cores: Provide minimum thickness 0.026-inch, steel vertical stiffeners of same material as face sheets extending full-door height, with vertical webs spaced not more than 6 inches apart. Spot weld to face sheets no more than 5 inches o.c. Fill spaces between stiffeners with glass- or mineral-fiber insulation.
   2. Fire Door Cores: As required to provide fire-protection ratings indicated.
   3. Vertical Edges for Single-Acting Doors: Provide beveled or square edges at manufacturer's discretion.
   4. Top Edge Closures: Close top edges of doors with flush closures of same material as face sheets.
   5. Bottom Edge Closures: Close bottom edges of doors with end closures or channels of same material as face sheets.
   6. Exterior Doors: Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
C. Hollow-Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
   1. Sidelite and Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
   2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
   3. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
   4. Floor Anchors: Weld anchors to bottoms of jambs with at least four spot welds per anchor; however, for slip-on drywall frames, provide anchor clips or countersunk holes at bottoms of jambs.

5. Jamb Anchors: Provide number and spacing of anchors as follows:
    a. Masonry Type: Locate anchors not more than 16 inches from top and bottom of frame. Space anchors not more than 32 inches o.c., to match coursing, and as follows:
        1) Two anchors per jamb up to 60 inches high.
        2) Three anchors per jamb from 60 to 90 inches high.
        3) Four anchors per jamb from 90 to 120 inches high.
        4) Four anchors per jamb plus one additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.
    b. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
        1) Three anchors per jamb up to 60 inches high.
        2) Four anchors per jamb from 60 to 90 inches high.
        3) Five anchors per jamb from 90 to 96 inches high.
        4) Five anchors per jamb plus one additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
    c. Compression Type: Not less than two anchors in each frame.
6. Head Anchors: Two anchors per head for frames more than 42 inches wide and mounted in metal-stud partitions.
7. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.
    a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
    b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.
8. Door Silencers: Drill stops to receive door silencers where specified in Section 08 71 00. Keep holes clear during construction.

D. Fabricate concealed stiffeners and edge channels from either cold- or hot-rolled steel sheet.

E. Hardware Preparation: Factory prepare hollow-metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.
1. Reinforce doors and frames to receive non-templated, mortised, and surface-mounted door hardware.
2. Comply with applicable requirements in SDI A250.6 and BHMA A156.115 for preparation of hollow-metal work for hardware.

F. Stops and Moldings: Provide stops and moldings around glazed lites and louvers where indicated. Form corners of stops and moldings with mitered hairline joints.
1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow-metal work.
2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
4. Provide loose stops and moldings on inside of hollow-metal work.
5. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.

2.10 STEEL FINISHES

A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.
   1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

2.11 ACCESSORIES

A. Louvers: Provide louvers for interior doors, where indicated, which comply with SDI 111C, with blades or baffles formed of 0.020-inch thick, cold-rolled steel sheet set into 0.032-inch thick steel frame.
   1. Sight-proof Louver: Stationary louvers constructed with inverted-V or inverted-Y blades.
B. Grout Guards: Formed from same material as frames, not less than 0.016-inch-thick.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.
C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Drill and tap doors and frames to receive non-templated, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

A. General: Install hollow-metal work plumb, rigid, properly aligned, and securely fastened in place. Comply with Drawings and manufacturer's written instructions.
B. Hollow-Metal Frames: Install hollow-metal frames for doors, transoms, sidelites, borrowed lites, and other openings, of size and profile indicated. Comply with SDI A250.11 or NAAMM-HMMA 840 as required by standards specified.
   1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
      a. At fire-rated openings, install frames according to NFPA 80.

b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
c. Install frames with removable stops located on secure side of opening.
d. Install door silencers in frames before grouting.
e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
f. Check plumb, square, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.

2. Metal-Stud Partitions: Solidly pack mineral-fiber insulation inside frames.
3. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
4. Concrete Walls: Solidly fill space between frames and concrete with mineral-fiber insulation.
5. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
6. Installation Tolerances: Adjust hollow-metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
   a. Squareness: Plus or minus 1/16-inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
   b. Alignment: Plus or minus 1/16-inch, measured at jambs on a horizontal line parallel to plane of wall.
   c. Twist: Plus or minus 1/16-inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
   d. Plumbness: Plus or minus 1/16-inch, measured at jambs at floor.

C. Hollow-Metal Doors: Fit hollow-metal doors accurately in frames, within clearances specified below. Shim as necessary.
1. Non-Fire-Rated Steel Doors:
   a. Between Door and Frame Jambs and Head: 1/8-inch plus or minus 1/32-inch.
   b. Between Edges of Pairs of Doors: 1/8-inch to 1/4-inch plus or minus 1/32-inch.
   c. At Bottom of Door: 3/4-inch plus or minus 1/32-inch.
   d. Between Door Face and Stop: 1/16-inch to 1/8-inch plus or minus 1/32-inch.
2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.

D. Glazing: Comply with installation requirements in Section 08 80 00 "Glazing" and with hollow-metal manufacturer's written instructions.
1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

3.4 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave Work in complete and proper operating condition. Remove and replace defective Work, including hollow-metal work that is warped, bowed, or otherwise unacceptable.

B. Remove grout and other bonding material from hollow-metal Work immediately after installation.

C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

D. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

E. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION

SECTION 08 14 16 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Solid-core flush wood doors with plastic-laminate faces.

B. Related Requirements:
1. Division 01 Specification Sections apply to Work of this Section.

2. Section 08 80 00 "Glazing" for glass view panels in flush wood doors.
3. Section 09 91 23 "Interior Painting."

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product, including the following:
1. Door core materials and construction.
2. Door edge construction
3. Door face type and characteristics.
4. Door trim for openings.
5. Door frame construction.
6. Factory-machining criteria.
7. Factory-finishing specifications.

B. Sustainable Design Submittals:
1. Product Data: For adhesives, indicating that product contains no urea formaldehyde.

C. Shop Drawings: Indicate location, size, and hand of each door; elevation of each type of door; construction details not covered in Product Data; and the following:
1. Door schedule indicating door and frame location, type, size, fire protection rating, and swing.
2. Door elevations, dimension and locations of hardware, lite and louver cutouts, and glazing thicknesses.
3. Details of frame for each frame type, including dimensions and profile.
4. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
5. Dimensions and locations of blocking for hardware attachment.
6. Dimensions and locations of mortises and holes for hardware.
7. Clearances and undercuts.

D. Samples for Verification:
1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches, for each material and finish.
2. Plastic laminate, 6 inches square, for each color, texture, and pattern selected.

3. Corner sections of doors, approximately 8 by 10 inches, with door faces and edges representing actual materials to be used.
4. Frames for light openings, 6 inches long, for each material, type, and finish required.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Package doors individually in cardboard cartons and wrap bundles of doors in plastic sheeting.

C. Mark each door on top and bottom rail with opening number used on Shop Drawings.

1.4 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until building is enclosed and weathertight, wet work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 degrees F and relative humidity between 25 and 55 percent during remainder of construction period.

1.5 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace doors and frames that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to:
a. Delamination of veneer.
b. Warping (bow, cup, or twist) more than 1/4-inch in a 42- by 84-inch section.
c. Telegraphing of core construction in face veneers exceeding 0.01-inch in a 3-inch span.
2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors and frames.

3. Warranty Period for Solid-Core Interior Doors: Life of installation.

4. Warranty Period for Hollow-Core Interior Doors: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain flush wood doors from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Rated Wood Door and Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated on Drawings, based on testing at positive pressure in accordance with UL 10C or NFPA 252.

2.3 FLUSH WOOD DOORS, GENERAL

A. Quality Standard: In addition to requirements specified, comply with AWI/AWMAC/WI's "Architectural Woodwork Standards."
   1. Provide labels from AWI certification program indicating that doors comply with requirements of grades specified.

2.4 SOLID-CORE FLUSH WOOD DOORS WITH PLASTIC-LAMINATE FACES

A. Interior Doors:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. ASSA ABLOY.
      b. Mohawk Flush Doors, Inc.
      c. VT Industries Inc.
   2. Performance Grade:
      a. ANSI/WDMA I.S. 1A Extra Heavy Duty: Classrooms, public toilets, janitor's closets, assembly spaces, exits, and where indicated on Drawings.

   3. Plastic-Laminate Faces: High-pressure decorative laminates complying with NEMA LD 3, Grade HGS.

   4. Colors, Patterns, and Finishes: As indicated.

   5. Exposed Vertical and Top Edges: Plastic laminate that matches faces, applied before faces.
      a. Fire-Rated Single Doors: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed vertical edges.

      b. Fire-Rated Pairs of Doors: Provide fire-retardant stiles that are listed and labeled for applications indicated without formed-steel edges and astragals. Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.

      c. Mineral-Core Doors: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.
         1) Screw-Holding Capability: 550 lbf (2440 N) in accordance with WDMA T.M. 10.

6. Core for Non-Fire-Rated Doors:
   a. ANSI A208.1, Grade LD-1 particleboard.
      1) Blocking: Provide wood blocking in particleboard-core doors as follows:
         (a) 5-inch top-rail blocking, in doors indicated to have closers.
         (b) 5-inch bottom-rail blocking, in exterior doors and doors indicated to have kick, mop, or armor plates.
      2) Provide doors with glued-wood-stave or WDMA I.S. 10 structural-composite-lumber cores instead of particleboard cores for doors scheduled to receive exit devices in Section 08 71 00 "Door Hardware."
   b. Glued wood stave.
   c. WDMA I.S. 10 structural composite lumber.
      1) Screw Withdrawal, Door Face: 550 lbf.
      2) Screw Withdrawal, Vertical Door Edge: 550 lbf.
   d. Either glued wood stave or WDMA I.S. 10 structural composite lumber.
7. Core for Fire-Rated Doors: As required to achieve fire-protection rating indicated on Drawings.
   a. Blocking for Mineral-Core Doors: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated on Drawings as follows:
      1) 5-inch top-rail blocking.
      2) 5-inch bottom-rail blocking, in doors indicated to have protection plates.
      3) 5-inch midrail blocking, in doors indicated to have armor plates.
      4) 4-1/2- by 10-inch lock blocks, in doors indicated to have exit devices.

2.5 LIGHT FRAMES AND LOUVERS

A. Metal Frames for Light Openings in Fire-Rated Doors: Manufacturer's standard frame formed of 0.048-inch thick, cold-rolled steel sheet; with baked-enamel or powder-coated finish; and approved for use in doors of fire-protection rating indicated on Drawings.

B. Metal Louvers:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Activar Construction Products Group, Inc.
      b. ASSA ABLOY.
      c. McGill Architectural Products.
   2. Blade Type: Vision-proof, inverted V.

   3. Metal and Finish: Hot-dip galvanized steel, 0.040-inch thick, with baked-enamel or powder-coated finish.

2.6 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated.
   1. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
   2. Comply with NFPA 80 requirements for fire-rated doors.

B. Factory machine doors for hardware that is not surface applied.
   1. Locate hardware to comply with DHI-WDHS-3.
   2. Comply with final hardware schedules, door frame Shop Drawings, ANSI/BHMA-156.115-W, and hardware templates.
   3. Coordinate with hardware mortises in metal frames, to verify dimensions and alignment before factory machining.
   4. For doors scheduled to receive electrified locksets, provide factory-installed raceway and wiring to accommodate specified hardware.
   5. Metal Astragals: Factory machine astragals and formed-steel edges for hardware for pairs of fire-rated doors.

C. Transom and Side Panels:
   1. Fabricate matching panels with same construction, exposed surfaces, and finish as specified for associated doors.
   2. Finish bottom edges of transoms and top edges of rabbeted doors same as door stiles.
   3. Fabricate door and transom panels with full-width, solid-lumber, rabbeted, meeting rails.
   4. Provide factory-installed spring bolts for concealed attachment into jambs of metal door frames.

D. Openings: Factory cut and trim openings through doors.
   1. Light Openings: Trim openings with moldings of material and profile indicated.
   2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 08 80 00 "Glazing."
   3. Louvers: Factory install louvers in prepared openings.

2.7 FACTORY FINISHING

A. Comply with referenced quality standard for factory finishing.
   1. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
   2. Finish faces, all four edges, edges of cutouts, and mortises.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and installed door frames, with installer present, before hanging doors.
   1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
   2. Reject doors with defects.
B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Hardware: For installation, see Section 08 71 00 "Door Hardware."
B. Install doors and frames to comply with manufacturer's written instructions and referenced quality standard, and as indicated.
C. Install frames level, plumb, true, and straight.
   1. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8-inch in 96 inches.
   2. Anchor frames to anchors or blocking built in or directly attached to substrates.
      a. Secure with countersunk, concealed fasteners and blind nailing.
      b. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork.
         1) For factory-finished items, use filler matching finish of items being installed.
   3. Install fire-rated doors and frames in accordance with NFPA 80.

D. Job-Fitted Doors:
   1. Align and fit doors in frames with uniform clearances and bevels as indicated below.
      a. Do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors.
   2. Machine doors for hardware.
   3. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.
   4. Clearances:
      a. Provide 1/8-inch at heads, jambs, and between pairs of doors.
      b. Provide 1/8-inch from bottom of door to top of decorative floor finish or covering unless otherwise indicated on Drawings.
      c. Where threshold is shown or scheduled, provide 1/4-inch from bottom of door to top of threshold unless otherwise indicated.

      d. Comply with NFPA 80 for fire-rated doors.
   5. Bevel non-fire-rated doors 1/8-inch in 2 inches at lock and hinge edges.

   6. Bevel fire-rated doors 1/8-inch in 2 inches at lock edge; trim stiles and rails only to extent permitted by labeling agency.

E. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.
F. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project Site.

3.3 ADJUSTING
A. Operation: Rehang or replace doors that do not swing or operate freely.
B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION

SECTION 08 17 45 – FIBERGLASS DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes
   1. Fiberglass Reinforced Plastic (FRP) Doors.
   2. Fiberglass Reinforced Plastic (FRP) Frames.

B. Related Requirements:
   1. Division 01 Specification Sections apply to Work of this Section.
   2. Section 04 20 00 “Unit Masonry.”
   3. Section 08 71 00 “Door Hardware.”
   4. Section 08 80 00 “Glazing.”

1.2 QUALITY ASSURANCE

A. General Qualifications:
   1. Manufacturer Qualifications: A company that specializes in manufacturing FRP doors and frames with a minimum of 30 years’ experience.
   2. Quality Assurance: Obtain all FRP doors and FRP frames from a single manufacturer to ensure consistent quality.
   3. Quality Assurance: Hardware and accessories for all FRP doors and FRP frames shall exactly adhere to the Architect’s specification.
   4. Quality Assurance: Glass for windows in doors shall be furnished per the Architect’s instructions and specifications.

B. Regulatory Requirements:
   1. Fire-rated door, panel and frame construction conforms to products tested under ASTM E152, UL10C & NFPA 252.
   2. Install doors, panels and frames conforming to NFPA 80 for fire-rated class, ANSI A117.1 specifications for handicap accessibility, ADA requirements, ANSI A250.42011 cycle swing in excess of 1,000,000 cycles with no failure of any design features of the door.
   3. Flame Spread: All rated FRP component parts, including the finish, shall have a flame spread classification of 25 or less per ASTM E84 and shall be self-extinguishing per ASTM D635, unless operating conditions dictate otherwise.
   4. Resins and coatings to meet with USDA standards for incidental food contact, if applicable to this project.
   5. Products manufactured—if so specified—that have passed the Florida Building Code (FBC), including Miami-Dade High Velocity Hurricane Zone (HVHZ).

C. Warranty:
   1. To include 10 years free from defects in material and workmanship from date of shipment, and lifetime from corrosion from date of shipment, provided that the structural integrity of the doors and frames have not been violated or compromised.

1.3 SUBMITTALS

A. Submit shop drawings and product data under provisions of Section 01 30 00 “Submittal Procedures.”
B. Shop Drawings – Include the following:
   1. Elevation of each door type including door size, handing and finish.
   2. Cutout locations for lites and hardware.
   3. Internal reinforcement.
   4. Frame configuration, anchor types and spacing.
C. Product data including manufacturer’s literature, fabrication descriptions and installation instructions.
D. Construction and/or color samples as requested.

1.4 DELIVERY, STORAGE AND PROTECTION

A. Doors and frames will be individually packaged in cardboard cartons. Cartons will be clearly labeled with Project information and will include fasteners and installation instructions, if required. Only remove cartons upon arrival if cartons are wet or damaged.
B. Deliver and store doors and frames at the job site in such a manner as to prevent damage; out of weather and/or extreme temperatures. Doors shall be stored in a vertical position on blocking, clear of the floor and with blocking between the doors to permit air circulation between the doors.
C. All damaged or otherwise unsuitable doors and frames, when so ascertained, shall be immediately removed from job site.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Products manufactured by the following companies complying with these Specifications will be acceptable:
   1. CORRIM Company, Oshkosh, Wisconsin 54901. Phone: 920.231.2000 Fax: 920.231.2238. Website: www.corrim.com.
B. Substitutions may be considered provided the manufacturer can comply with the Specifications as written and the products are manufactured in the United States of America. Requests for substitutions must be submitted in writing no less than 10 business days prior to the bid date. Substitution requests shall include a physical sample and written documentation that the product meets the specific manufacturing methods as stated herein.

2.2 FRP DOORS

A. Door Fabrication:
   1. Total door thickness to be a nominal 1-3/4 inches thick.
   2. Lock stiles on non-rated and rated active leaves shall be factory beveled 1/8 in 2-inch.
   3. Provide doors with completely seamless construction on all 6 surfaces.

B. Face Sheets: FRP face sheets shall be manufactured using a corrosion resistant resin system with light stabilizing additives. The resin shall be reinforced with fiberglass, 50 percent average by weight for enhanced strength. Face sheets shall be a minimum of 0.125inch-thick fiberglass. Face sheets will be Architect's choice of smooth or pebble seamless finish.

C. Stiles and Rails: Stiles and rails shall be 1-1/2-inch square pultruded fiberglass tubes. Pultrusion is a fiberglass fabrication process that results in a much stronger, more durable product. Non-rated and 20-minute doors will have a full width horizontal 1-1/2-inch square pultruded fiberglass tube every 24 inches in height for internal reinforcement. A 1-1/2-inch square solid fiberglass block shall be used at all hardware reinforcements and corner intersections. A minimum of 1,000 pounds screw withdrawal force shall be required per screw. The bottom rail shall allow for 1-1/4 inches of height alterability without loss of the panel's integrity. Absolutely no metal or wood reinforcements, including #2 SPF (Spruce Pine Fir), will be allowed in any part of the stile and rail configuration.

D. Core Options:
   1. Polyurethane Foam Core: A 1-1/2-inch-thick rigid block of polyurethane shall be laminated to the interior of the panels. The "R" factor shall be 12. The polyurethane insulation shall be Class A and CFC free. Foam properties comply with ASTM E-84 and The International Building Code (IBC).
   2. Balsa Core: 1-1/2 inches thick Balsa core of end grain construction for enhanced strength, shall be laminated to the interior of the panels. The balsa shall have a density of 8.5 to 9.0 lbs/cu. ft. Compressive strength, perpendicular to the door panel surface shall be 1,400 psi.
   3. Honeycomb Core: Phenolic impregnated resin paper honeycomb.
   4. Mineral Core: for 30-minute to 90-minute fire rated FRP doors.

E. Hardware Preparations: Doors shall be reinforced and mortised for hardware with 1-1/2 inches by 1-1/2 inches of solid fiberglass to allow application of hinges and locks, in accordance with the hardware schedule, hardware manufacturer's instructions and templates.
   1. Reinforcement Blocking: Non-swelling polymer or firestop blocking will be used for all lockset, surface mounted hardware and thru-bolted hardware blocking.
   2. Pilot holes for full mortise butt hinges will be pre-drilled by factory.
   3. All hardware shall be attached / installed by using pilot hole and stainless-steel wood screws.

F. Door Accessories
   1. Glazing: Glazing support structures shall ensure that the glass area is weather sealed as not to permit moisture from entering the core of the door. This is to be accomplished by utilizing pultruded 1-1/2-inch square FRP tubes to fabricate the window opening. Glazing must allow for ready access for repair in the event of damage or replacement, without affecting the sealed integrity of the cutout in the door panel itself. Openings cut directly into the core material will not be allowed.
   2. Louvers: Louvers shall be fabricated with pultruded FRP material of an inverted "V" design and shall be subject to the same performance guarantee as the door panel. The louver opening will be fabricated in the same method as for glazing above.

3. Fasteners: Provide countersunk stainless-steel fasteners as required for glazing openings and louvers.
4. Transoms: All transom panels will be identical to the doors in construction, materials, thickness, color and reinforcement.
5. Astragals: Astragals for pairs of doors to be fabricated with FRP material of manufacturer's standard flat design.

2.3 FRP FRAMES

A. Fabrication: FRP frames shall be rigid, neat in appearance, free from defects and the finish shall match the doors. Fabricate FRP doors and frames as shown on Drawings and in accordance with best shop practices. Field measurements shall be taken as required for coordinating with adjoining work.
   1. Provide frames for doors, transoms, sidelites and borrowed lites, as required.
   2. All frames shall be 100 percent pultruded fiberglass with an average 50 percent glass content by weight which results in an industrial fiberglass frame as strong as a 14gauge hollow metal frame.
   3. Non-rated and 20-minute UL labeled: Standard 1-piece FRP profile with integral stop: 5-3/4-inch by 2-inch equal rabbet (optional: 4-inch header) (optional: modified depth with equal rabbet) (optional: modified depth with un-equal rabbet) (optional: single rabbet design).
   4. 30- to 90-minute UL labeled FRP Frames: Standard 1-piece FRP profile with integral stop: 5-3/4-inch by 2-inch equal rabbet. Frames that must be grouted solid with mortar in the field to achieve label are not acceptable.
   5. Head and jamb members shall be standard 45-degree miter, providing a neatly mitered corner connection, fabricated for Knocked Down (KD) field assembly. (optional: one piece frame, resin bonded and assembled at factory, available on nonrated frames only).

B. Reinforcements and Braces / Supports:
   1. Frames shall be reinforced and mortised for hardware in accordance with the hardware schedule, manufacturer's instructions and templates. Absolutely no metal reinforcements will be allowed in any part of the FRP frame configuration.
   2. Corner Reinforcement: 4 inches by 4 inches by 5-3/8 inches by 1/4-inch-thick pultruded fiberglass angle. Attached to head bar at factory using stainless steel screws.
   3. Mortise Hinge Reinforcement: 3 inches by 7 inches by 9/16-inch- (or 3/8-inch-) thick FRP material attached to frame by means of bonding and stainless-steel countersunk screws.
   4. Closer Reinforcement: 1-1/2 inches by 19 inches by 3/16-inch-thick FRP material attached to frame by means of bonding.
   5. Strike Reinforcement: 1-1/2 inches by 9 inches by 3/4-inch-thick FRP material attached to frame by means of bonding and stainless-steel countersunk screws.

6. Anchoring Systems: Furnish at least 3 anchors in each jamb of frames up to 90 inches high and 1 additional anchor for each 30 inches in height above 90 inches, in shapes, sizes and spacing shown or required for anchorage into adjoining wall construction.
    a. New Masonry: T-Strap or Wire Anchor (optional: stainless steel T-Strap).
    b. New Stud (before sheathing): New Stud Anchor.
    c. Butt Existing Wall: Existing Opening Anchor; Masonry, Steel or Wood (optional: concealed).
    d. Wrap Existing Wall: Compression Anchor.
    e. Consult factory for additional anchoring options.

2.4 FINISH

A. Polyurethane finish, high solids polyurethane topcoat that exhibits excellent chemical resistance, outstanding toughness, flexibility, abrasion resistance and excellent outside durability.
    1. Flat; smooth face sheet options.
    2. Semi-Gloss; all face sheet options.
    3. Gloss; all face sheet options.
B. Gelcoat Matte Finish, 25 mil (smooth face sheets only), from manufacture's full range of colors.
C. Prime; finish for field painting, all face sheet options.
    1. Acceptable top coatings:
        a. Enamel.
        b. Alkyd.
        c. Polyurethane.
        d. Latex.
        e. Epoxy.
D. Finish on door and frame units will match.

PART 3 - EXECUTION

3.1 INSPECTION

A. Installer shall examine the substrate and conditions under which fiberglass reinforced plastic work is to be installed and notify the General Contractor in writing of any conditions detrimental to the proper and timely completion of the work. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to the installer.

3.2 INSTALLATION

A. Doors and frames will be delivered in individual cartons with the identifying mark number listed on each carton.
B. Install FRP doors, frames and accessories in accordance with manufacturers printed instructions, final shop drawings, NFPA 80 standards at fire rated openings and / or HVHZ standards for FBC labeled openings.

C. Provide clearance for doors of 1/8-inch at jambs and heads; 1/4-inch clearance above threshold.
D. Fire labeled doors, frames and accessories must be installed by qualified, licensed installers adhering to the latest version of NFPA 80.

3.3 ADJUSTING

A. At substantial completion, adjust all operable components to ensure proper installation. Doors shall function smoothly and swing freely without binding. Doors shall remain open at any angle without being affected by gravitational influence.

3.4 CLEANING

A. Remove dirt and excess sealant from exposed surfaces. Follow the manufacturer's recommended cleaning techniques and procedures for cleaning all surfaces. Only use cleaning products that will not scratch or damage the surfaces and are recommended by the manufacturer.

PART 4 - MATERIAL PROPERTIES OF FIBER REINFORCED PLASTIC (FRP) PROFILES

4.1 DOOR PROPERTIES

A. ASTM D256: Notched Izod Impact.
B. ASTM D638: Tensile Strength Properties of Plastic.
C. ASTM D695: Compressive Strength.
D. ASTM D732: Shear Strength.
E. ASTM D790: Flexural Strength / Flexural Modulus.
F. ASTM D2583: Barcol Hardness.
G. ASTM E283: Air Infiltration Test.
H. ASTM E330: Static Load Test.
I. ASTM E331: Water Infiltration.
J. ASTM E1886: Impact by Missiles & Exposed to Cyclic Pressure Differentials.
K. ASTM E1996: Impact by Wind Borne Debris.
L. TAS 201: Large Missile Impact.
M. TAS 202: Static Load Test.
N. TAS 203: Cyclic Load Test.
O. SFBC 3603.2: Forced Entry.

4.2 FOAM CORE PROPERTIES

A. ASTM C203: Flexural Modulus.
B. ASTM C272: Water Absorption.
C. ASTM C273: Shear Strength.
D. ASTM C518: K-Factor / R-Factor.
E. ASTM D1621: Compressive Modulus.
F. ASTM D1622: Density.

G. ASTM D1623: Tensile Strength.
H. ASTM D2126: Dimensional Stability.
I. ASTM D2856: Closed Cell Content.
J. ASTM E84: Surface Burning Characteristics.
K. ASTM E96: Water Vapor Permeability.

4.3 BALSA CORE PROPERTIES

A. ASTM C271: Apparent Normal Density.
B. ASTM C273: Shear Strength.
C. ASTM C297: Tensile Strength.
D. ASTM C365: Compressive Strength.
E. ASTM D177: Thermal Conductivity.
F. BSS-7238: Smoke Density & Toxic Gas Generation.
G. CMVSS/FMVSS 302: Motor Vehicle Flammability Safety Test.
H. MIL-STD-907B: Fire Resistance Test.

4.4 ADHESIVE PROPERTIES: URETHANE ADHESIVE SYSTEM

A. ASTM D570: Water Absorption.
B. ASTM D638: Elongation Percent.
C. ASTM D638: Tensile Strength.
D. ASTM D638: Young’s Modulus.
E. ASTM D2240: Shore Hardness, D.
F. ASTM D3163: Bond Configuration Lap Shear.
G. ASTM E132: Poisson Ratio.

END OF SECTION

SECTION 08 31 13 - ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Access doors and frames.
   2. Fire-rated access doors and frames.
B. Related Requirements:
   1. Division 01 Specification Sections apply to Work of this Section.

   2. Section 07 72 00 "Roof Accessories" for roof hatches.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, fire ratings, material descriptions, dimensions of individual components and profiles, and finishes.
B. Samples: For each type of access door and frame and for each finish specified, complete assembly minimum 6 by 6 inches in size.
C. Product Schedule: For access doors and frames. Use same designations indicated on Drawings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Rated Access Doors and Frames: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection and temperature-rise limit ratings indicated, according to NFPA 252 or UL 10B.

2.2 ACCESS DOORS AND FRAMES

A. Recessed Access Doors with Concealed Flanges for seamless acoustical ceiling and wall system:
   1. Basis of Design Product: Subject to compliance with requirements, provide ACUDOR Products Inc., Model ACD-2064, or a comparable product by one of the following:
      a. Babcock-Davis.
      b. Larsens Manufacturing Company.
      c. Maxam Metal Products Limited.
   2. Description: Door face recessed 5/8-inch for gypsum board infill or recess needed for seamless acoustical ceiling and wall system; with concealed flange for gypsum board installation and concealed hinge.

3. Locations: Where indicated on the Drawings or as needed for access to equipment.
4. Door Size: As required for access to equipment.

5. Latch and Lock: Cam latch, key operated.

B. Exterior Flush Access Doors:
1. Manufacturers: Subject to compliance with requirements, provide products by 1 of the following:
   a. Activar Construction Products Group, Inc. - JL Industries.
   b. Babcock-Davis.
   c. Larsens Manufacturing Company.
   d. Maxam Metal Products Limited.
2. Description: Weatherproof assembly, with face of door fit flush with frame and with exposed frame. Include extruded door gaskets and minimum 2-inch-thick fiberglass insulation.

3. Optional Features: Piano hinges.
4. Locations: Where needed for access to equipment.
5. Door Size: AS required for access to equipment.

6. Metallic-Coated Steel Sheet for Door: Nominal 0.064-inch, 16-gauge, factory primed.
7. Frame Material: Same material, thickness, and finish as door.
8. Latch and Lock: Cam latch operated by handle, with keyed lock in handle.

2.3 FIRE-RATED ACCESS DOORS AND FRAMES
A. Fire-Rated, Flush Access Doors with Exposed Flanges:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Activar Construction Products Group, Inc. - JL Industries.
   b. ACUDOR Products, Inc.
   c. Babcock-Davis.
2. Description: Door face flush with frame, with a core of mineral-fiber insulation enclosed in sheet metal; with exposed flange, self-closing door, and concealed hinge.

3. Optional Features: Gasketing and piano hinges.
4. Locations: Wall and ceiling.
5. Door Size: As required for access.
6. Fire-Resistance Rating: Not less than that of adjacent construction.

7. Metallic-Coated Steel Sheet for Door: Nominal 0.040-inch, 20-gauge, factory primed.

2.4 MATERIALS
A. Steel Plates, Shapes, and Bars: ASTM A36.

B. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A879, with cold-rolled steel sheet substrate complying with ASTM A1008, Commercial Steel (CS), exposed.
C. Metallic-Coated Steel Sheet: ASTM A653, Commercial Steel (CS), Type B; with minimum G60 or A60 metallic coating.

2.5 FABRICATION

A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.
B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.
C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish mounting holes, attachment devices and fasteners of type required to secure access doors to types of supports indicated.
    1. For concealed flanges with drywall bead, provide edge trim for gypsum panels securely attached to perimeter of frames.
D. Recessed Access Doors: Form face of panel to provide recess for application of applied finish. Reinforce panel as required to prevent buckling. Provide access sleeves for each latch operator and install in holes cut through finish.

E. Latch and Lock Hardware:
    1. Quantity: Furnish number of latches and locks required to hold doors tightly closed.
    2. Keys: Furnish 2 keys per lock and key all locks alike.

2.6 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installing access doors and frames.

3.3 ADJUSTING

A. Adjust doors and hardware, after installation, for proper operation.

END OF SECTION

SECTION 08 41 13 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Aluminum-framed storefront systems.
2. Aluminum-framed entrance door systems.

B. Related Requirements:
1. Division 01 Specification Sections apply to Work of this Section.
2. Section 07 92 00 "Joint Sealants."
3. Section 08 71 00 "Door Hardware."
4. Section 08 80 00 "Glazing."

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project Site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For aluminum-framed entrances and storefronts. Include plans, elevations, sections, full-size details, and attachments to other Work.
1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
2. Include full-size isometric details of each type of vertical-to-horizontal intersection of aluminum-framed entrances and storefronts, showing the following:
a. Joinery, including concealed welds.
b. Anchorage.
c. Expansion provisions.
d. Glazing.
e. Flashing and drainage.
3. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.
4. Include point-to-point wiring diagrams showing the following:
a. Power requirements for each electrically operated door hardware.
b. Location and types of switches, signal device, conduit sizes, and number and size of wires.

C. Samples for Initial Selection: For units with factory-applied color finishes.

D. Fabrication Sample: Of each vertical-to-horizontal intersection of assemblies, made from 12-inch lengths of full-size components and showing details of the following:
   1. Joinery, including concealed welds.
   2. Anchorage.
   3. Expansion provisions.
   4. Glazing.
   5. Flashing and drainage.

E. Delegated-Design Submittal: For aluminum-framed entrances and storefronts including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data:
   1. For Installer.
B. Energy Performance Certificates: For aluminum-framed entrances and storefronts, accessories, and components, from manufacturer.
   1. Basis for Certification: NFRC-certified energy performance values for each aluminum-framed entrance and storefront.
C. Product Test Reports: For aluminum-framed entrances and storefronts, for tests performed by manufacturer and witnessed by a qualified testing agency.

D. Sample Warranties: For special warranties.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For aluminum-framed entrances and storefronts to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.
   1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.

1.7 MOCKUP

A. Build mockup to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation. Contractor SHALL NOT order materials until the Mockup is approved by Owner.
   1. Build mockup of typical wall area as shown on Drawings.

   2. Approval of mockup does not constitute approval of deviations from the Contract Documents contained in mockup unless Architect specifically approves such deviations in writing.

   3. Subject to compliance with requirements, approved mockup SHALL NOT become part of the completed Work.

1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of aluminum-framed entrances and storefronts that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures, including, but not limited to, excessive deflection.
      b. Noise or vibration created by wind and thermal and structural movements.

      c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
      d. Water penetration through fixed glazing and framing areas.
      e. Failure of operating components.
   2. Warranty Period: Ten years from date of Substantial Completion.

B. Special Finish Warranty, Anodized Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of anodized finishes within specified warranty period.
   1. Deterioration includes, but is not limited to, the following:
      a. Color fading more than 5 Delta E units when tested according to ASTM D2244.
      b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
      c. Cracking, peeling, or chipping.
   2. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design Product: Oldcastle Building Envelope FG-5750T Stormax Storefront System.
B. Manufacturers: Subject to compliance with requirements, provide specified product or comparable products by one of the following:
   1. Kawneer North America, an Arconic company.

2. Tubelite.
3. YKK AP America Inc.
4. Trulite Glass & Aluminum Solutions, LLC.
5. U.S. Aluminum; a brand of C.R. Laurence.

C. Product to be designed for use for all areas within Texas as defined by the Texas Department of Insurance.

D. Source Limitations: Unless noted otherwise in this Section, obtain all components of non-fire rated aluminum-framed entrance and storefront system, including framing spandrel panels and accessories, from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design aluminum-framed entrances and storefronts.

B. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed entrances and storefronts representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
   1. Aluminum-framed entrances and storefronts shall withstand movements of supporting structure, including, but not limited to, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
   2. Failure also includes the following:
      a. Thermal stresses transferring to building structure.
      b. Glass breakage.
      c. Noise or vibration created by wind and thermal and structural movements.
      d. Loosening or weakening of fasteners, attachments, and other components.
      e. Failure of operating units.

C. Structural Loads:
   1. Wind Loads: As indicated on Drawings.
   2. Other Design Loads: As indicated on Drawings.

D. Structural: Test according to ASTM E330 as follows:
   1. When tested at positive and negative wind-load design pressures, storefront assemblies, including entrance doors, do not evidence deflection exceeding specified limits.
   2. When tested at 150 percent of positive and negative wind-load design pressures, storefront assemblies, including entrance doors and anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
   3. Test Durations: As required by design wind velocity, but not less than 10 seconds.

E. Water Penetration under Static Pressure: Test according to ASTM E331 as follows:
   1. No evidence of water penetration through fixed glazing and framing areas, including entrance doors, when tested according to a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft.

F. Energy Performance: Certified and labeled by manufacturer for energy performance as follows:
   1. Thermal Transmittance (U-factor):
      a. Fixed Glazing and Framing Areas: U-factor for the system of not more than 0.45 Btu/sq. ft. by h by degrees F as determined according to NFRC 100.
      b. Entrance Doors: U-factor of not more than 0.77 Btu/sq. ft. by h by degrees F as determined according to NFRC 100.
   2. Solar Heat-Gain Coefficient (SHGC):
      a. Fixed Glazing and Framing Areas: SHGC for the system of not more than 0.35 as determined according to NFRC 200.
      b. Entrance Doors: SHGC of not more than 0.35 as determined according to NFRC 200.
   3. Air Leakage:
      a. Fixed Glazing and Framing Areas: Air leakage for the system of not more than 0.06 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft. when tested according to ASTM E283.

      b. Entrance Doors: Air leakage of not more than 1.0 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft.
   4. Condensation Resistance Factor (CRF):
      a. Fixed Glazing and Framing Areas: CRF for the system of not less than 55 as determined according to AAMA 1503.
      b. Entrance Doors: CRF of not less than 57 as determined according to AAMA 1503.

G. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes.
   1. Temperature Change: 120 degrees F, ambient; 180 degrees F, material surfaces.

2.3 STOREFRONT SYSTEMS
A. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.
   1. Exterior Framing Construction: Thermally broken.
   2. Interior Vestibule Framing Construction: Same as exterior framing.
   3. Glazing System: Retained mechanically with gaskets on four sides.
   4. Glazing Plane: Front.
   5. Finish: Clear anodic finish as specified in Aluminum Finishes Article below.

6. Fabrication Method: Field-fabricated stick system.
7. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
8. Steel Reinforcement: As required by manufacturer.

2.4 ENTRANCE DOOR SYSTEMS

A. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing or automatic operation.
   1. Door Construction: 1-3/4-inch overall thickness, with minimum 0.125-inch-thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated, and fillet welded or that incorporate concealed tie rods.
      a. Thermal Construction: High-performance plastic connectors separate aluminum members exposed to the exterior from members exposed to the interior.
   2. Door Design: Wide stile; 5-inch nominal width.
   3. Glazing Stops and Gaskets: Beveled, snap-on, extruded-aluminum stops and preformed gaskets.
      a. Provide nonremovable glazing stops on outside of door.
   4. Finish: Match adjacent storefront framing finish.

2.5 ENTRANCE DOOR HARDWARE

A. General:
   1. Cylinders: As specified in Section 08 71 00 "Door Hardware."

B. Hardware sets for aluminum doors located in Section 08 71 00.10 "Door Hardware Schedule."

2.6 GLAZING

A. Glazing: Comply with Section 08 80 00 "Glazing."

B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.

C. Glazing Sealants: As recommended by manufacturer.

2.7 MATERIALS

A. Sheet and Plate: ASTM B209.
B. Extruded Bars, Rods, Profiles, and Tubes: ASTM B221.
C. Extruded Structural Pipe and Tubes: ASTM B429.
D. Structural Profiles: ASTM B308.

E. Steel Reinforcement:
   1. Structural Shapes, Plates, and Bars: ASTM A36.
   2. Cold-Rolled Sheet and Strip: ASTM A1008.
   3. Hot-Rolled Sheet and Strip: ASTM A1011.

F. Steel Reinforcement Primer: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after

surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM, and prepare surfaces according to applicable SSPC standard.

2.8 ACCESSORIES

A. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
   1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
   2. Reinforce members as required to receive fastener threads.
   3. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system.

B. Anchors: Three-way adjustable anchors with minimum adjustment of 1-inch that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.
   1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A123 or ASTM A153 requirements.

C. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.

D. Bituminous Paint: Cold-applied asphalt-mastic paint containing no asbestos, formulated for 30-mil thickness per coat.

E. Rigid PVC Filler.

2.9 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. Fabricate components that, when assembled, have the following characteristics:
   1. Profiles that are sharp, straight, and free of defects or deformations.
   2. Accurately fitted joints with ends coped or mitered.
   3. Physical and thermal isolation of glazing from framing members.
   4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
   5. Provisions for field replacement of glazing from interior for vision glass and exterior for spandrel glazing or metal panels.
   6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

C. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.

D. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.
   1. At interior and exterior doors, provide compression weather stripping at fixed stops.

E. Entrance Doors: Reinforce doors as required for installing entrance door hardware.
   1. At pairs of exterior doors, provide sliding-type weather stripping retained in adjustable strip and mortised into door edge.
   2. At exterior doors, provide weather sweeps applied to door bottoms.
F. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.
G. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.10 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 millimeters or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Comply with manufacturer's written instructions.
B. Do not install damaged components.
C. Fit joints to produce hairline joints free of burrs and distortion.
D. Rigidly secure nonmovement joints.
E. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
F. Seal perimeter and other joints watertight unless otherwise indicated.
G. Metal Protection:
   1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.
   2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

H. Set continuous sill members and flashing in full sealant bed, as specified in Section 07 92 00 "Joint Sealants," to produce weathertight installation.
I. Install joint filler behind sealant as recommended by sealant manufacturer.
J. Install components plumb and true in alignment with established lines and grades.

3.3 INSTALLATION OF OPERABLE UNITS

A. Install operable units level and plumb, securely anchored, and without distortion. Adjust weather-stripping contact and hardware movement to produce proper operation.

3.4 INSTALLATION OF GLAZING

A. Install glazing as specified in Section 08 80 00 "Glazing."

3.5 INSTALLATION OF ALUMINUM-FRAMED ENTRANCE DOORS

A. Install entrance doors to produce smooth operation and tight fit at contact points.
   1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.

   2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

3.6 ERECTION TOLERANCES

A. Install aluminum-framed entrances and storefronts to comply with the following maximum tolerances:
   1. Plumb: 1/8-inch in 10 feet; 1/4-inch in 40 feet.
   2. Level: 1/8-inch in 20 feet; 1/4-inch in 40 feet.
   3. Alignment:
      a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2-inch-wide, limit offset from true alignment to 1/16-inch.
      b. Where surfaces are separated by reveal or protruding element from 1/2- to 1-inch-wide, limit offset from true alignment to 1/8-inch.
      c. Where surfaces are separated by reveal or protruding element of 1-inch-wide or more, limit offset from true alignment to 1/4-inch.
   4. Location: Limit variation from plane to 1/8-inch in 12 feet; 1/2-inch over total length.

END OF SECTION

SECTION 08 80 00 - GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Glass products.
2. Insulating glass.
3. Glazing sealants.
4. Glazing tapes.
5. Miscellaneous glazing materials.

B. Related Requirements:
1. Division 01 Specification Sections apply to Work of this Section.

2. Section 08 41 13 "Aluminum Framed-Entrances and Storefronts."

1.2 DEFINITIONS

A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

B. Glass Thicknesses: Indicated by thickness designations in millimeters in accordance with ASTM C1036.

C. IBC: International Building Code.

D. Interspace: Space between lites of an insulating-glass unit.

1.3 COORDINATION

A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances to achieve proper safety margins for glazing retention under each design load case, load case combination, and service condition.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project Site.
1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Review temporary protection requirements for glazing during and after installation.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Glass Samples: For each type of glass product other than clear monolithic vision glass; 12 inches square.
   1. Tinted glass.
   2. Coated glass.
   3. Insulating glass.
   4. Spandrel glass.

C. Glazing Accessory Samples: For sealants and colored spacers, in 12-inch lengths. Install sealant samples between 2 strips of material representative in color of adjoining framing system.

D. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

E. Delegated Design Submittal: For glass indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by qualified professional engineer responsible for their preparation.

F. Product to be designed for use for all areas within Texas as defined by the Texas Department of Insurance.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For installer.

B. Product Certificates: For glass.

C. Product Test Reports: For fabricated glass and glazing sealants, for tests performed by a qualified testing agency.
   1. For glazing sealants, provide test reports based on testing current sealant formulations within previous 36-month period.

D. Preconstruction adhesion and compatibility test report.

E. Sample Warranties: For special warranties.

1.7 QUALITY ASSURANCE

A. Fabricated-Glass Manufacturer Qualifications: A qualified manufacturer of fabricated glass units who is approved and certified by primary glass manufacturer.

B. Installer Qualifications: A qualified glazing contractor for this Project who is certified under the North American Contractor Certification Program (NACC) for Architectural Glass & Metal (AG&M) contractors.

C. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.

D. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C1021 to conduct the testing indicated.

E. Mockups: Build mockups to demonstrate aesthetic effects and to set quality standards for materials and execution.
   1. Install glazing in mockups specified in Section 08 41 13 "Aluminum-Framed Entrances and Storefronts" to match glazing systems required for Project, including glazing methods.
   2. Build mockup to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
      a. Build mockup of typical wall area as shown on Drawings.
      b. Approval of mockup does not constitute approval of deviations from the Contract Documents contained in mockup unless Architect specifically approves such deviations in writing.
      c. Subject to compliance with requirements, approved mockup SHALL NOT become part of the completed Work.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials in accordance with manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. Comply with insulating-glass manufacturer's written instructions for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
   1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or are below 40 degrees F.

1.10 MOCKUP

A. Build mockup to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
   1. Build mockup of typical wall area as shown on Drawings.
   2. Approval of mockup does not constitute approval of deviations from the Contract Documents contained in mockup unless Architect specifically approves such deviations in writing.
   3. Subject to compliance with requirements, approved mockup SHALL NOT become part of the completed Work.

1.11 WARRANTY

A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.
   1. Warranty Period: Ten years from date of Substantial Completion.

B. Manufacturer's Special Warranty for Laminated Glass: Manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.
   1. Warranty Period: Five years from date of Substantial Completion.

C. Manufacturer's Special Warranty for Insulating Glass: Manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is obstruction of vision by dust, moisture, or film on interior surfaces of glass.
   1. Warranty Period: Ten years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. General Glass Manufactures: Unless specified otherwise and subject to compliance with requirements, provide products by the following:
   1. Guardian Glass; SunGuard.
   2. Pilkington North America.
   3. Viracon, Inc.

B. Source Limitations for Glass: Obtain glass from single source from single manufacturer.

C. Source Limitations for Glazing Accessories: For each product and installation method, obtain from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design glazing.

C. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.

D. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:
   1. For monolithic-glass lites, properties are based on units with lites 6 millimeters thick.
   2. For laminated-glass lites, properties are based on products of construction indicated.
   3. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
   4. U-Factors: Center-of-glazing values, in accordance with NFRC 100 and based on most current non-beta version of LBL's WINDOW computer program, expressed as Btu/sq. ft. by h by degrees F.
   5. SHGC and Visible Transmittance: Center-of-glazing values, in accordance with NFRC 200 and based on most current non-beta version of LBL's WINDOW computer program.
   6. Visible Reflectance: Center-of-glazing values, in accordance with NFRC 300.

2.3 GLASS PRODUCTS, GENERAL

A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.
   1. NGA Publications: "Laminated Glazing Reference Manual" and "Glazing Manual."
   2. AAMA Publications: AAMA GDSG-1, "Glass Design for Sloped Glazing," and AAMA TIR A7, "Sloped Glazing Guidelines."
   3. IGMA Publication for Sloped Glazing: IGMA TB-3001, "Guidelines for Sloped Glazing."
   4. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."

B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

C. Thickness: Where glass thickness is indicated, it is a minimum.
   1. Minimum Glass Thickness for Exterior Lites: 6 millimeters.

   2. Thickness of Tinted Glass: Provide same thickness for each tint color indicated throughout Project.

D. Strength: Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where fully tempered float glass is indicated, provide fully tempered float glass.

2.4 GLASS PRODUCTS

A. Clear Annealed Float Glass: ASTM C1036, Type I, Class 1 (clear), Quality-Q3.

B. Tinted Annealed Float Glass: ASTM C1036, Type I, Class 2 (tinted), Quality-Q3.

C. Fully Tempered Float Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.
   1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

D. Heat-Strengthened Float Glass: ASTM C1048, Kind HS (heat strengthened), Type I, Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.
   1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

2.5 LAMINATED GLASS

A. Windborne-Debris-Impact-Resistant Laminated Glass: Comply with requirements specified above for laminated glass except laminate glass with the following to comply with interlayer manufacturer's written instructions:
   1. Construction: Laminate glass with polyvinyl butyral interlayer reinforced with polyethylene terephthalate film to comply with interlayer manufacturer's written instructions.
   2. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.
   3. Interlayer Color: Clear unless otherwise indicated.

2.6 INSULATING GLASS

A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified in accordance with ASTM E2190.
   1. Sealing System: Dual seal, with manufacturer's standard primary and secondary sealants.

   2. Perimeter Spacer: Manufacturer's standard spacer material and construction.

   3. Desiccant: Molecular sieve or silica gel, or a blend of both.

2.7 GLAZING SEALANTS

A. General:
1. Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.

3. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range of industry colors.

B. Neutral-Curing Silicone Glazing Sealant, Class 100/50: Complying with ASTM C920, Type S, Grade NS, Use NT.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. GE Construction Sealants; Momentive Performance Materials Inc.
b. May National Associates, Inc.; a subsidiary of Sika Corporation.
c. Pecora Corporation.
d. Sika Corporation.
e. The Dow Chemical Company.
f. Tremco Incorporated.

2.8 GLAZING TAPES
A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C1281 and AAMA 800 for products indicated below:
1. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:
1. AAMA 810.1, Type 1, for glazing applications in which tape acts as primary sealant.

2.9 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, recommended in writing by manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks:
   1. Type recommended in writing by sealant or glass manufacturer.
D. Spacers:
   1. Type recommended in writing by sealant or glass manufacturer.
E. Edge Blocks:
   1. Type recommended in writing by sealant or glass manufacturer.

F. Cylindrical Glazing Sealant Backing: ASTM C1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

2.10 FABRICATION OF GLAZING UNITS

A. Protect glazing materials in accordance with manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. Comply with insulating-glass manufacturer's written instructions for venting and sealing units to avoid hermetic seal ruptures due to altitude change required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

C. Protect glazing materials in accordance with manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.
   1. Comply with insulating-glass manufacturer's written instructions for venting and sealing units to avoid hermetic seal ruptures due to altitude change.
      a. Temperature Change: 120 degrees F, ambient; 180 degrees F, material surfaces.

D. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.

E. Grind smooth and polish exposed glass edges and corners.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing, glazing channels, and stops, with installer present, for compliance with the following:
   1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
   2. Presence and functioning of weep systems.
   3. Minimum required face and edge clearances.
   4. Effective sealing between joints of glass-framing members.
B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.
B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that leave visible marks in the completed Work.

3.3 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project Site and legally dispose of off Project Site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.
C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.
D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
F. Provide spacers for glass lites where length plus width is larger than 50 inches.
    1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
    2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and in accordance with requirements in referenced glazing publications.
H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
I. Set glass lites with proper orientation so that coatings face exterior or interior as specified.

J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.
K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended in writing by gasket manufacturer.

3.4 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.
B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
C. Cover vertical framing joints by applying tapes to heads and sills first, then to jambs. Cover horizontal framing joints by applying tapes to jambs, then to heads and sills.
D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
E. Do not remove release paper from tape until right before each glazing unit is installed.

F. Apply heel bead of elastomeric sealant.
G. Center glass lites in openings on setting blocks, and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 GASKET GLAZING (DRY)

A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.
C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended in writing by gasket manufacturer.
D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended in writing by gasket manufacturer.
E. Install gaskets so they protrude past face of glazing stops.

3.6 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.
B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.
C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.7 CLEANING AND PROTECTION

A. Immediately after installation, remove nonpermanent labels and clean surfaces.
B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.
    1. If, despite such protection, contaminating substances do contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.
C. Remove and replace glass that is damaged during construction period.

D. Wash glass on both exposed surfaces not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

3.8 MONOLITHIC GLASS SCHEDULE

A. Glass Type G02: Clear fully tempered float glass.
    1. Minimum Thickness: 1/4-inch.
    2. Safety glazing required.

3.9 INSULATING-LAMINATED-GLASS SCHEDULE

A. Glass Type G01: Low-E-Coated, Tinted Insulating Laminated. Conform with ASTM C1172 and complying with testing requirements in CPSC 16CFR-1201 for Category II material and with "Windborne-Debris-Impact Resistance."
    1. Exterior Lite: 6mm (1/4-inch) Guardian SunGuard SuperNeutral SNR 43 Low-E #2 Gray, heat-strengthened, ASTM C1048, Kind HS.
    2. Cavity: 1/2-inch air.
    3. Interior Lite: 9-millimeter (1-1/32-inch) Laminate - 1/8-inch Clear - 0.090-inch Clear PVB - 1/8-inch Clear.
    4. Center of Glass (COG) Performance Characteristics.

5. Thermal:
    a. Winter U-Factor: 0.24.
    b. Solar Heat Gain Coefficient (SHGC): 0.22.
6. Optical:
    a. Visible Light Transmittance: 43 percent.
    b. Visible Light Reflectance (outside): 28 percent.

END OF SECTION

SECTION 09 22 16 - NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Non-load-bearing steel framing systems for interior partitions.
2. Suspension systems for interior ceilings and soffits.

B. Related Requirements:
1. Division 01 Specification Sections apply to Work of this Section.
2. Section 05 40 00 "Cold-Formed Metal Framing" for exterior and interior load-bearing and exterior non-load-bearing wall studs; floor joists; roof rafters and ceiling joists; and roof trusses.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.
1. Studs and Runners: Provide documentation that framing members' certification is according to SIFA's "Code Compliance Certification Program for Cold-Formed Steel Structural and Non-Structural Framing Members."

1.3 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For the following, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.
1. Embossed steel studs and runners.
2. Firestop tracks.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, according to ASTM E119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated, according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.

C. Horizontal Deflection: For wall assemblies, limited to following ratios of the wall height based on horizontal loading of 5 lbf./sq. ft. The ratios listed below are based on the scheduled finishes.
1. Ceramic and Stone Tile: 1/360.
2. Plaster: 1/360.
3. Gypsum Board and Other Finishes: 1/240.

2.2 ACCEPTABLE MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products of one of the following, unless noted otherwise in this Section:
   1. ClarkDietrich Building Systems.
   2. MBA Building Supplies.
   3. MRI Steel Framing, LLC.
   4. SCAFCO Corporation.

2.3 FRAMING SYSTEMS

A. Framing Members, General: Comply with ASTM C754 for conditions indicated.
   1. Steel Sheet Components: Comply with ASTM C645 requirements for metal unless otherwise indicated.
   2. Protective Coating: ASTM A653, G40, hot-dip galvanized unless otherwise indicated.

B. Studs and Runners: ASTM C645. Use either steel studs and runners or embossed steel studs and runners.
   1. Embossed Steel Studs and Runners:

C. Slip-Type Head Joints: Where indicated, provide one of the following:
   1. Clip System: Clips designed for use in head-of-wall deflection conditions that provide a positive attachment of studs to runners while allowing 1-1/2-inch minimum vertical movement.
   2. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.

D. Firestop Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.

E. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.

F. Cold-Rolled Channel Bridging: Steel, 0.0538-inch minimum base-metal thickness, with minimum 1/2-inch wide flanges.

G. Hat-Shaped, Rigid Furring Channels: ASTM C645.

H. Resilient Furring Channels: 1/2-inch deep, steel sheet members designed to reduce sound transmission.

I. Cold-Rolled Furring Channels: 0.053-inch uncoated-steel thickness, with minimum 1/2-inch wide flanges.
   1. Depth: 3/4-inch.
   2. Furring Brackets: Adjustable, corrugated-edge-type steel sheet with minimum uncoated-steel thickness of 0.0329-inch.
   3. Tie Wire: ASTM A 641, Class 1 zinc coating, soft temper, 0.062-inch diameter wire, or double strand of 0.048-inch diameter wire.

J. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches, wall attachment flange of 7/8-inch, minimum uncoated-metal thickness of 0.0179-inch, and depth required to fit insulation thickness indicated.
K. Sound Rated Framing System: Framing members as described in Paragraphs A and B above with pliable separator between framing members.
   1. Basis of Design: SCAFCO SoundGaurd Silent Steel Framing System.

2.4 SUSPENSION SYSTEMS
A. Tie Wire: ASTM A641, Class 1 zinc coating, soft temper, 0.062-inch diameter wire, or double strand of 0.048-inch diameter wire.
B. Hanger Attachments to Concrete:
   1. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with allowable load capacities calculated according to ICC-ES AC70, greater than or equal to the design load, as determined by testing per ASTM E1190 conducted by a qualified testing agency.
C. Wire Hangers: ASTM A641, Class 1 zinc coating, soft temper, 0.16-inch in diameter.
D. Furring Channels (Furring Members):
   1. Cold-Rolled Channels: 0.0538-inch uncoated-steel thickness, with minimum 1/2-inch wide flanges, 3/4-inch deep.
E. Grid Suspension System for Gypsum Board Ceilings: ASTM C645, direct-hung system composed of main beams and cross-furring members that interlock.

2.5 AUXILIARY MATERIALS
A. General: Provide auxiliary materials that comply with referenced installation standards.
   1. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.
B. Isolation Strip at Exterior Walls: Provide the following:
   1. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8-inch-thick, in width to suit steel stud size.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.
B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.
B. Coordination with Sprayed Fire-Resistive Materials:
   1. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling runners (tracks) to surfaces indicated to receive sprayed fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches o.c.
   2. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of non-load-bearing steel framing. Do not reduce thickness of fire-resistive materials below that are required for fire-resistance ratings indicated. Protect adjacent fire-resistive materials from damage.

3.3 INSTALLATION, GENERAL

A. Installation Standard: ASTM C754.
   1. Gypsum Board Assemblies: Also comply with requirements in ASTM C840 that apply to framing installation.
B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.
C. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
D. Install bracing at terminations in assemblies.
E. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.4 INSTALLING FRAMED ASSEMBLIES

A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
   1. Single-Layer Application: As required by horizontal deflection performance requirements unless otherwise indicated.
   2. Multilayer Application: As required by horizontal deflection performance requirements unless otherwise indicated.
   3. Tile Backing Panels: As required by horizontal deflection performance requirements unless otherwise indicated.
B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
C. Install studs so flanges within framing system point in same direction.

D. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts that penetrate partitions above ceiling.
   1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
   2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
      a. Install two studs at each jamb unless otherwise indicated.
      b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
      c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
   3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
   4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
      a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
   5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
   6. Curved Partitions:
      a. Bend track to uniform curve and locate straight lengths so they are tangent to arcs.
      b. Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of no fewer than 2 studs at ends of arcs, place studs 6 inches o.c.

E. Direct Furring:
   1. Screw to wood framing.
   2. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.

F. Z-Shaped Furring Members:
   1. Erect insulation, specified in Section 07 21 00 "Thermal Insulation," vertically and hold in place with Z-shaped furring members spaced 24 inches o.c.
   2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
   3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches from corner and cut insulation to fit.

G. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8-inch from the plane formed by faces of adjacent framing.

3.5 INSTALLING SUSPENSION SYSTEMS

A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
   1. Hangers: 48 inches o.c.
   2. Carrying Channels (Main Runners): 48 inches o.c.
   3. Furring Channels (Furring Members): 16 inches o.c.

B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.

C. Suspend hangers from building structure as follows:
   1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
      a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
   2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
      a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.
   3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
   4. Do not attach hangers to steel roof deck.
   5. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
   6. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
   7. Do not connect or suspend steel framing from ducts, pipes, or conduit.

D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.

E. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

F. Installation Tolerances: Install suspension systems that are level to within 1/8-inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION

SECTION 09 29 00 - GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Interior gypsum board.
   2. Moisture guard.

B. Related Requirements:
   1. Division 01 Specification Sections apply to Work of this Section.
   2. Section 06 16 00 "Sheathing" for gypsum sheathing for exterior walls.
   3. Section 09 22 16 "Non-Structural Metal Framing" for non-structural steel framing and suspension systems that support gypsum board panels.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Verification: For the following products:
   1. Trim Accessories: Full-size Sample in 12-inch-long length for each trim accessory indicated.

1.3 DELIVERY, STORAGE AND HANDLING

A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.4 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C840 requirements or gypsum board manufacturer's written instructions, whichever are more stringent.

B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, moisture damaged, and mold damaged.
   1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
   2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.

2.2 GYPSUM BOARD, GENERAL

A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.3 INTERIOR GYPSUM BOARD

A. Gypsum Wallboard: ASTM C1396.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. American Gypsum.
      b. CertainTeed Corporation.
      c. Georgia-Pacific Building Products.
      d. National Gypsum Company.
      e. USG.
   2. Thickness: 5/8-inch.
   3. Long Edges: Tapered.

B. Gypsum Board, Type X: ASTM C1396.
   1. Thickness: 5/8-inch.
   2. Long Edges: Tapered.

C. Flexible Gypsum Board: ASTM C1396. Manufactured to bend to fit radii and to be more flexible than standard regular-type gypsum board of same thickness.
   1. Thickness: 1/4-inch.
   2. Long Edges: Tapered.

D. Gypsum Ceiling Board: ASTM C1396.
   1. Thickness: 1/2-inch.
   2. Long Edges: Tapered.

E. Impact-Resistant Gypsum Board: ASTM C1396 gypsum board, tested according to ASTM C1629.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. American Gypsum.
      b. CertainTeed Corporation.
      c. Georgia-Pacific Building Products.
      d. National Gypsum Company.
      e. USG.
   2. Core: 5/8-inch, Type X.
   3. Surface Abrasion: ASTM C1629, meets or exceeds Level 3 requirements.
   4. Indentation: ASTM C1629, meets or exceeds Level 3 requirements.

5. Soft-Body Impact: ASTM C1629, meets or exceeds Level 3 requirements.
6. Hard-Body Impact: ASTM C1629, meets or exceeds Level 3 requirements according to test in Annex A1.
7. Long Edges: Tapered.
8. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.

F. Mold-Resistant Gypsum Board: ASTM C1396. With moisture- and mold-resistant core and paper surfaces.

2.4 SPECIALTY GYPSUM BOARD

A. Acoustically Enhanced Gypsum Board: ASTM C1396. Multilayer products constructed of two layers of gypsum boards sandwiching a viscoelastic sound-absorbing polymer core.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide Gold Bond Building Products, SoundBreak XP Wall Board or comparable product by one of the following:
      a. National Gypsum Company.
      b. Quiet Solution.
      c. Temple-Inland Building Products by Georgia-Pacific.
   2. Core: 5/8-inch, Type X.
   3. Long Edges: Tapered.

2.5 TILE BACKING PANELS

A. Cementitious Backer Units: ANSI A118.9 and ASTM C1288 or ASTM C1325, with manufacturer's standard edges.
   1. Thickness: 5/8-inch.
   2. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.

2.6 TRIM ACCESSORIES

A. Interior Trim: ASTM C1047.
   1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized-steel sheet.
   2. Shapes:
      a. Cornerbead.
      b. LC-Bead: J-shaped; exposed long flange receives joint compound.
      c. Expansion (control) joint.

2.7 PARTITION CLOSURE

A. Basis-of-Design Product: MULLION MATE extruded aluminum partition closure shall be manufactured by Gordon Interior Specialties Division, Gordon, Inc., 5023 Hazel Jones Road, Bossier City, LA 71111, 800.747.8954.
   1. Mullion Mate extruded aluminum partition closures are pre-assembled and spring loaded to provide a tight fit for vertical junctures of partitions and window walls. Mullion Mate is finished to match mullions in a spray applied water-borne cross-linked baked acrylic finish or Acrylic-Polyester hybrid powder coat paint finish or custom paints or anodized finish. They are sound

tested to a 38 STC rating with optional acoustical batts for sound attenuation.
2. Aluminum extrusions: 6063-T5 temper, tensile strength 31 KSI (ASTM B221).
3. Acoustical Batts for sound attenuation per Section 07 21 00 "Thermal Insulation."
4. Accessories:
   a. End Caps: Extruded 6063-T5 temper, tensile strength 31 KSI (ASTM B221).

2.8 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C475.
B. Joint Tape:
   1. Interior Gypsum Board: Paper.
C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.
   1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
   2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
      a. Use setting-type compound for installing paper-faced metal trim accessories.
   3. Fill Coat: For second coat, use setting-type, sandable topping compound.
   4. Finish Coat: For third coat, use setting-type, sandable topping compound.
   5. Skim Coat: For final coat of Level 5 finish, use setting-type, sandable topping compound.

2.9 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.
B. Steel Drill Screws: ASTM C1002 unless otherwise indicated.
   1. Use screws complying with ASTM C954 for fastening panels to steel members from 0.033- to 0.112-inch thick.
   2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.
C. Sound-Attenuation Blankets: ASTM C665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
   1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
D. Acoustical Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E90.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Hilti, Inc.
      b. Pecora Corporation.

c. United States Gypsum Company.

E. Thermal Insulation: As specified in Section 07 21 00 "Thermal Insulation."

F. Air Barrier: As specified in Section 07 27 26 "Fluid Applied Air Barriers."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates including welded hollow-metal frames and support framing, with installer present, for compliance with requirements and other conditions affecting performance of the Work.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

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

3.2 APPLYING AND FINISHING PANELS, GENERAL

A. Comply with ASTM C840.

B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16-inch of open space between panels. Do not force into place.

D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

E. Form control and expansion joints with space between edges of adjoining gypsum panels.

F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.

1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
2. Fit gypsum panels around ducts, pipes, and conduits.
3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch-wide joints to install sealant.

G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch-wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

I. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C919 and with manufacturer's written instructions for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.

J. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.3 APPLYING INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:
   1. Wallboard Type: As indicated on Drawings.
   2. Type X: Where required for fire-resistance-rated assembly and where indicated on the Drawings.
   3. Flexible Type: As indicated on Drawings.
   4. Ceiling Type: Ceiling surfaces.
   5. Impact-Resistant Type: As indicated on Drawings.

B. Single-Layer Application:
   1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
   2. On partitions/walls, apply gypsum panels in the most economical direction unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
      a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
      b. At stairwells and other high walls, install panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.
   3. On Z-shaped furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
   4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

C. Multilayer Application:
   1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints one framing member, 16 inches minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
   2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least 1 stud or furring member with base-layer joints unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.

3. On Z-shaped furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least 1 furring member. Locate edge joints of base layer over furring members.
4. Fastening Methods: Fasten base layers and face layers separately to supports with screws.

D. Curved Surfaces:
1. Install panels horizontally (perpendicular to supports) and unbroken, to extent possible, across curved surface plus 12-inch long straight sections at ends of curves and tangent to them.

3.4 INSTALLING TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
B. Control Joints: Install control joints at locations indicated on Drawings and according to ASTM C840 and in specific locations approved by Architect for visual effect.
C. Interior Trim: Install in the following locations:
1. Cornerbead: Use at outside corners unless otherwise indicated.
2. LC-Bead: Use at exposed panel edges.

3.5 FINISHING GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
B. Prefill open joints and damaged surface areas.
C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.
D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C840:
1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
2. Level 2: Panels that are substrate for tile.
3. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.
a. Primer and its application to surfaces are specified in Section 09 91 23 "Interior Painting."

3.6 PROTECTION

A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.
B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
C. Remove and replace panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION

SECTION 09 30 13 - CERAMIC TILING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Porcelain tile.
   2. Terrazzo Tile
   3. Tile backing panels.
   4. Waterproof membranes.
   5. Crack isolation membranes.

B. Related Requirements:
   1. Division 01 Specification Sections apply to Work of this Section.
   2. Section 07 92 00 "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.

1.2 DEFINITIONS

A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.

B. Face Size: Actual tile size, excluding spacer lugs.

C. Module Size: Actual tile size plus joint width indicated.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project Site.
   1. Review requirements in ANSI A108.01 for substrates and for preparation by other trades.
   2. Review of mockups and adhesion tests.
   3. Review of moisture testing.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:
   1. Product Data: For adhesives, indicating VOC content.

C. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.

D. Samples for Verification:
   1. Full-size units of each type and composition of tile and for each color and finish required. For ceramic mosaic tile in color blend patterns, provide full sheets of each color blend.
   2. Sample units of each type of trim and accessory for each color and finish required.
   3. Metal edge strips in 6-inch lengths.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For installer.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.
   2. Grout: Furnish quantity of grout equal to 3 percent of amount installed for each type, composition, and color indicated.

1.7 QUALITY ASSURANCE

A. Installer Qualifications:
   1. Installer employs at least one installer for Project that has completed the Advanced Certification for Tile Installers (ACT) certification for installation of large format tile.
B. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Build mockup of each type of floor tile installation.
   2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.
B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.
C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.
D. Store liquid materials in unopened containers and protected from freezing.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Tile: Obtain tile of each type and color or finish from single source or producer.
   1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.

B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from single manufacturer and each aggregate from single source or producer.
   1. Obtain setting and grouting materials, except for unmodified Portland cement and aggregate, from single manufacturer.
   2. Obtain waterproof membrane, except for sheet products, from manufacturer of setting and grouting materials.

2.2 PRODUCTS, GENERAL

A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.

B. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from 1 package show same range in colors as those taken from other packages and match approved Samples.

2.3 TILE PRODUCTS

A. Terrazzo Tile
   1. Manufacturers: Basis of design and Subject to compliance with requirements, provide products by the following
      a. As indicated on Interior Material Legend in Drawings Porcelain Tile Type.
   2. Thickness: As indicated on Interior Material Legend in Drawings.
   3. Size: As indicated on Interior Material Legend in Drawings.
   4. Grout: As indicated on Interior Material Legend in Drawings.

B. Porcelain Tile
   1. Manufacturers: Basis of design and Subject to compliance with requirements, provide products by the following:
      a. As indicated on Interior Material Legend in Drawings.
   2. Face Size: As indicated on Interior Material Legend in Drawings.
   3. Thickness: As indicated on Interior Material Legend in Drawings.
   4. Dynamic Coefficient of Friction: Not less than 0.42.
   5. Tile Color, Glaze, and Pattern: As indicated by manufacturer's designations.
   6. Grout Color: As indicated by manufacturer's designations and as indicated on Interior Material Legend in Drawings.

2.4 THRESHOLDS

A. General: Fabricate to sizes and profiles indicated or required to provide transition between adjacent floor finishes.

2.5 TILE BACKING PANELS

A. Cementitious Backer Units: ANSI A118.9 or ASTM C1325, Type A, in maximum lengths available to minimize end-to-end butt joints.
   1. Manufacturers: Subject to compliance with requirements, provide products by the following:
      a. Custom Building Products.
   2. Thickness: 5/8-inch.

2.6 WATERPROOF MEMBRANES

A. Waterproof Membrane, Fabric-Reinforced, Fluid-Applied: System consisting of liquid-latex rubber or elastomeric polymer and continuous fabric reinforcement.
   1. Manufacturers: Subject to compliance with requirements, provide products by the following:
      a. Custom Building Products.

2.7 CRACK ISOLATION MEMBRANES

A. Crack Isolation Membrane and Tile-Setting Adhesive: One-part, fluid-applied product intended for use as both a crack isolation membrane and tile-setting adhesive in a 2-step process.
   1. Adhesive shall comply with the indoor recommended exposure limit or 33 mcg/cu. m and that of acetaldehyde shall not exceed 9 mcg/cu. m.

2.8 SETTING MATERIALS

A. Primer (For Terrazzo Tile) over existing Terrazo only - not required over new concrete.
   1. Multi-Surface Bonding Primer (MBP) Single component waterbased primer for adhesion onto existing terrazzo.
      a. Product: Custom Building Products: MBP - Multi-Surface Bonding Primer.

B. Mortar (For Terrazzo Tile and Porcelain- Floor tile):
   1. Large Format tile mortar
      a. Non slump medium mortar bed up to 3/4-inch-thick.
      b. Sag and slip resistant
      c. Exceeds ANSI A118.1 SHET and A118.11

C. Improved Modified Dry-Set Mortar (Thinset): ANSI A118.15 for wall tile.
   1. Manufacturers: Subject to compliance with requirements, provide products by the following:
      a. Custom Building Products.

2. Provide prepackaged, dry-mortar mix combined with acrylic resin liquid-latex additive at Project site.
3. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.15.

D. Water-Cleanable, Tile-Setting Epoxy: ANSI A118.3.
1. Adhesives shall have a VOC content of 65 g/L or less.

2.9 GROUT MATERIALS

A. Pre-Mixed Single Component Grout:
1. No sealing required.
2. No efforescence.
3. Crack Resistant.
4. Composition: Advanced polymers with inorganic fillers and pigments.
5. Equal Product: Prism SCG Ultimate Perfomance Pre-Mixed Single Component grout.

2.10 MISCELLANEOUS MATERIALS

A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.
B. Metal Edge Strips: As indicated on Interior Material Legend in Drawings.
1. Manufacturers: Subject to compliance with requirements, provide products by the following:
a. Schluter Systems L.P.
C. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

2.11 MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.
B. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
1. Verify that substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile-setting materials, including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.

2. Additional preparation for areas with Existing Terrazzo to remain:
    a. In areas where terrazzo is to remain, terrazzo finish shall be removed to meet requirements of Primer manufacturer.
    b. Adhesion and Moisture testing per manufacturer's written requirements.
3. Verify that concrete substrates for tile floors installed with adhesives or thinset mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.
    a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.
    b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.
4. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
5. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.

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

3.2 PREPARATION

A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thinset mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.
B. Verify floor preparation meets requirements for primers.
C. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project Site before installing.

3.3 INSTALLATION OF CERAMIC TILE

A. Comply with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 series "Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.
    1. For the following installations, follow procedures in the ANSI A108 series of tile installation standards for providing 95 percent mortar coverage:
        a. Tile floors consisting of tiles 8 by 8 inches or larger.
        b. Tile floors consisting of rib-backed tiles.
B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

D. Where accent tile differs in thickness from field tile, vary setting-bed thickness so that tiles are flush.

E. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.
   1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
   2. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
   3. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.

F. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:
   1. Ceramic Mosaic Tile: Match gap of sheet joints.
   2. Porcelain Tile: 1/8-inch.
   3. Terrazzo tile: 1/8-inch.

G. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.

H. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
   1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.

I. Terrazzo tile installation: Zinc strips as indicated by Manufacturer.

J. Metal Edge Strips: Install where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with top of tile.

3.4 INSTALLATION OF TILE BACKING PANELS

A. Install panels and treat joints according to ANSI A108.11 and manufacturer's written instructions for type of application indicated. Use modified dry-set mortar for bonding material unless otherwise directed in manufacturer's written instructions.

3.5 INSTALLATION OF WATERPROOF MEMBRANES

A. Install waterproof membrane to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness that is bonded securely to substrate.

B. Allow waterproof membrane to cure and verify by testing that it is watertight before installing tile or setting materials over it.

3.6 ADJUSTING AND CLEANING

A. Remove and replace tile that is damaged or that does not match adjoining tile. Provide new matching units, installed as specified and in a manner to eliminate evidence of replacement.
B. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
    1. Remove grout residue from tile as soon as possible.
    2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.

3.7 PROTECTION

A. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.
B. Prohibit foot and wheel traffic from tiled floors for at least 7 days after grouting is completed.
C. Before final inspection, remove protective coverings, and rinse neutral protective cleaner from tile surfaces.

3.8 INTERIOR CERAMIC TILE INSTALLATION SCHEDULE

A. Interior Floor Installations, Concrete Subfloor: Porcelain floor tile.
B. Interior Floor Installations: Terrazzo tile.
    1. Apply primer prior to bonding mortar, according to manufacturer's written instructions, when installing over existing Terrazo.
    2. Bond coat for Cured Bed: Large format tile mortar.
    3. Grout: Single component grout with zinc strips.
    4. Zinc Strips: 1/8-inch width and depth to match tile, where needed at Terrazo tile.
    5. TCNA F122: Thinset mortar on waterproof membrane at Basement only.
        a. Ceramic Tile Type: Porcelain tile.
        b. Thinset Mortar: Improved modified dry-setmortar.
        c. Grout: High-performance Single component grout rout.
C. Interior Wall Installations, Wood or Metal Studs, or Furring:
    1. TCNA W244C or TCNA W244F: Thinset mortar on cementitious backer units.
        a. Thinset Mortar: Improved modified dry-set mortar.
        b. Grout: Single Component Grout grout.

END OF SECTION

SECTION 09 51 13 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes acoustical panels and exposed suspension systems for interior ceilings.
B. Related Requirements:
   1. Division 01 Specification Sections apply to Work of this Section.
C. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.
B. Samples for Verification: For each component indicated and for each exposed finish required, prepared on samples of sizes indicated below:
   1. Acoustical Panels: Set of 6-inch square amples of each type, color, pattern, and texture.
   2. Exposed Suspension-System Members, Moldings, and Trim: Set of 6-inch-long samples of each type, finish, and color.
   3. Clips: Full-size hold-down clips.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
   1. Ceiling suspension-system members.
   2. Structural members to which suspension systems will be attached.
   3. Method of attaching hangers to building structure.
      a. Furnish layouts for cast-in-place anchors, clips, and other ceiling attachment devices whose installation is specified in other Sections.
   4. Carrying channels or other supplemental support for hanger-wire attachment where conditions do not permit installation of hanger wires at required spacing.
   5. Size and location of initial access modules for acoustical panels.
   6. Items penetrating finished ceiling and ceiling-mounted items including the following:
      a. Lighting fixtures.
      b. Diffusers.
      c. Grilles.
      d. Speakers.
      e. Sprinklers.
      f. Access panels.
      g. Perimeter moldings.

7. Show operation of hinged and sliding components covered by or adjacent to acoustical panels.
8. Minimum Drawing Scale: 1/8-inch equal to 1 foot.

B. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For finishes to include in maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Acoustical Ceiling Units: Full-size panels equal to 2 ercent of quantity installed.
2. Suspension-System Components: Quantity of each exposed component equal to 2 percent of quantity installed.
3. Hold-Down Clips: Equal to 2 percent of quantity installed.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels, suspension-system components, and accessories to Project site and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.
B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
1. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical panel ceiling installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain each type of acoustical ceiling panel and its supporting suspension system from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Flame-Spread Index: Class A according to ASTM E1264.
   2. Smoke-Developed Index: 50 or less.

2.3 ACOUSTICAL PANELS ACT1

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   1. Armstrong World Industries, Inc.
B. Acoustical Panel Standard: Provide manufacturer's standard panels according to ASTM E 1264 and designated by type, form, pattern, acoustical rating, and light reflectance unless otherwise indicated.
   1. Reference Interior Material Legend for selection.

2.4 METAL SUSPENSION SYSTEM ACT1

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   1. Armstrong World Industries, Inc.
B. Metal Suspension-System Standard: Provide manufacturer's standard, direct-hung, metal suspension system and accessories according to ASTM C635 and designated by type, structural classification, and finish indicated.
   1. High-Humidity Finish: Where indicated, provide coating tested and classified for "severe environment performance" according to ASTM C635.
C. Wide-Face, Capped, Double-Web, Fire-Rated, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; prepainted, electrolytically zinc coated, or hot-dip galvanized, G30 coating designation; with prefinished 15/16-inch-wide metal caps on flanges.
   1. Structural Classification: Intermediate -duty system.
   2. End Condition of Cross Runners: Override (stepped) type.
   3. Face Design: Flat, flush.
   4. Cap Material: Cold-rolled steel.
   5. Cap Finish: Painted to match color of acoustical unit.

2.5 ACCESSORIES

A. Attachment Devices: Size for five times the design load indicated in ASTM C35, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

B. Wire Hangers, Braces, and Ties: Provide wires as follows:
   1. Zinc-Coated, Carbon-Steel Wire: ASTM A641, Class 1 zinc coating, soft temper.
   2. Size: Wire diameter sufficient for its stress at three times hanger design load (ASTM C635, Table 1, "Direct Hung") will be less than yield stress of wire, but not less than 0.106-inch-diameter wire.

C. Hold-Down Clips: Manufacturer's standard hold-down.

2.6 METAL EDGE MOLDINGS AND TRIM

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   1. Armstrong World Industries, Inc.

B. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension-system runners.
   1. Edge moldings shall fit acoustical panel edge details and suspension systems indicated and match width and configuration of exposed runners unless otherwise indicated.
   2. For lay-in panels with reveal edge details, provide stepped edge molding that forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.

B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.

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

3.2 PREPARATION

A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders unless otherwise indicated, and comply with layout shown on reflected ceiling plans.

B. Layout openings for penetrations centered on the penetrating items.

3.3 INSTALLATION

A. Install acoustical panel ceilings according to ASTM C636, seismic design requirements, and manufacturer's written instructions.
B. Suspend ceiling hangers from building's structural members and as follows:
   1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
   2. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
   3. Do not attach hangers to steel deck tabs.
C. Install acoustical panels with undamaged edges and fit accurately into suspension-system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide precise fit.
   1. Arrange directionally patterned acoustical panels as follows:
      a. Install panels with pattern running in one direction parallel to long axis of space.
   2. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension-system runners and moldings.
   3. For reveal-edged panels on suspension-system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
   4. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.
   5. Install hold-down clips in areas indicated; space according to panel manufacturer's written instructions unless otherwise indicated.

3.4 ERECTION TOLERANCES

A. Suspended Ceilings: Install main and cross runners level to a tolerance of 1/8-inch in 12 feet, non-cumulative.
B. Moldings and Trim: Install moldings and trim to substrate and level with ceiling suspension system to a tolerance of 1/8-inch in 12 feet, non-cumulative.

3.5 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension-system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage.
B. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION

SECTION 09 65 13 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Thermoplastic-rubber base.
   2. Rubber molding accessories.
B. Related Requirements:
   1. Division 01 Specification Sections apply to Work of this Section.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.
B. Samples for Verification: For each type of product indicated and for each color, texture, and pattern required in manufacturer's standard-size samples, but not less than 12 inches long.
C. Product Schedule: For resilient base and accessory products. Use same designations indicated on Drawings.

1.3 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, of each type, color, pattern, and size of resilient product installed.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 degrees F or more than 90 degrees F.

1.5 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 degrees F or more than 95 degrees F, in spaces to receive resilient products during the following periods:
   1. 48 hours before installation.
   2. During installation.
   3. 48 hours after installation.
B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 degrees F or more than 95 degrees F.
C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 THERMOPLASTIC-RUBBER BASE - RB1

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Roppe Corporation, USA.
B. Product Standard: ASTM F1861, Type TP (rubber, thermoplastic).
   1. Group: I (solid, homogeneous).
   2. Style and Location:
      a. Style B, Cove: Provide in areas with resilient floor coverings.
      b. Style D, Sculptured: Provide in areas indicated.
         1) Profile: As indicated on Interior Material Legend.
C. Thickness: 0.125-inch and as indicated by profile selected.
D. Height: 4 inches.
E. Lengths: Cut lengths 48 inches long or coils in manufacturer's standard length.
F. Outside Corners: Preformed.
G. Inside Corners: Preformed.
H. Colors: As indicated by manufacturer's designations and as indicated in Interior Material Legend in Drawings. Match Architect's sample.

2.2 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.
B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.
   1. Adhesives shall have a VOC content of 50 g/L or less and 60 g/L or less for rubber stair treads.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
   1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
B. Proceed with installation only after unsatisfactory conditions have been corrected.
   1. Installation of resilient products indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

3.3 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.
B. Apply resilient base to walls, columns, pilasters, casework,and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.
D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
E. Do not stretch resilient base during installation.
F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.
G. Job-Formed Corners:
    1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 5 inches in length.
    2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 5 inches in length.
        a. Miter or cope.

3.4 RESILIENT ACCESSORY INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient accessories.
B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

3.5 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.
B. Perform the following operations immediately after completing resilient-product installation:
    1. Remove adhesive and other blemishes from surfaces.
    2. Sweep and vacuum horizontal surfaces thoroughly.
    3. Damp-mop horizontal surfaces to remove marks and soil.
C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
D. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION

SECTION 09 65 19 - RESILIENT TILE FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Solid vinyl floor tile.
B. Related Requirements:
   1. Division 01 Specification Sections apply to Work of this Section.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.
B. Samples: For each exposed product and for each color and pattern specified.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are competent in techniques required by manufacturer for floor tile installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For resilient floor tile, as determined by testing identical products according to ASTM E648 or NFPA 253 by a qualified testing agency.
   1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

2.2 SOLID VINYL FLOOR TILE LVT1

A. Products: Subject to compliance with requirements, provide the following:
   1. As indicated on Interior Material Legend in Drawings.
B. Size: As indicated on Interior Material Legend in Drawings.
C. Colors and Patterns: As indicated by manufacturer's designations and as indicated on Interior Material Legend in Drawings.

2.3 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by floor tile manufacturer for applications indicated.
B. Adhesives: Water-resistant type recommended by floor tile and adhesive manufacturers to suit floor tile and substrate conditions indicated.
    1. Adhesives shall have a VOC content of 50 g/L or less.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prepare substrates according to floor tile manufacturer's written instructions to ensure adhesion of resilient products.
B. Concrete Substrates: Prepare according to ASTM F710.
    1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
    2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by floor tile manufacturer. Do not use solvents.
    3. Alkalinity and Adhesion Testing: Perform tests recommended by floor tile manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
    4. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft., and perform no fewer than 3 tests in each installation area and with test areas evenly spaced in installation areas.
    5. Provide adhesion test where asbestos abatement has occurred.
C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
D. Do not install floor tiles until materials are the same temperature as space where they are to be installed.
    1. At least 48 hours in advance of installation, move resilient floor tile and installation materials into spaces where they will be installed.
E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.

3.2 FLOOR TILE INSTALLATION

A. Comply with manufacturer's written instructions for installing floor tile.
B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.
    1. Lay tiles square with room axis.

C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.
   1. Lay tiles with grain running in one direction.

D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.

E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent marking device.

G. Adhere floor tiles to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

END OF SECTION

SECTION 09 67 23 - RESINOUS FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. High-performance resinous flooring systems.
B. Related Requirements:
   1. Division 01 Specification Sections apply to Work of this Section.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.
B. Installer Certificates for Qualification: Signed by manufacturer stating that installers comply with specified requirements.
C. Material Certificates: For each resinous flooring component, from manufacturer.
D. Maintenance Data: For maintenance manuals.
E. Samples: Submit two 6- by 6-inch samples of each resinous flooring system applied to a rigid backing. Provide sample which is a true representation of proposed field applied finish. Provide sample color and texture for approval from Owner in writing or approved by General Contractor prior to installation.
F. Product Schedule: For resinous flooring.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of flooring systems required for this Project.
   1. Engage an installer who is approved in writing by resinous flooring manufacturer as qualified to apply resinous flooring systems indicated.
   2. Installer Letter of Qualification: Installer to provide letter stating that they have been in business for at least 5 years and listing 5 projects in the last 2 years of similar scope. For each project provide: project name, location, date of installation, contact information, size of project, and manufacturer of materials with system information.
B. Source Limitations: Obtain primary resinous flooring materials, including primers, resins, hardening agents, grouting coats, and topcoats, from single source from single manufacturer. Provide secondary materials, including patching and fill material, joint sealant, and repair materials, of type and from source recommended by manufacturer of primary materials.
C. Pre-installation Conference: Conduct conference at Project Site before work and mockups begin.

D. Mockups: Apply mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution. Do not cover up mockup area.
   1. Apply full-thickness mockups on 16 square foot floor area selected by Architect.
   2. Finish surfaces for verification of products, color, texture, and sheen.
   3. Simulate finished lighting conditions for Architect's review of mockups.
   4. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
   5. Mockup shall demonstrate desired slip resistance for review and approval by Owner’s representative in writing.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storage and mixing with other components.
   1. Maintain containers in clean condition, free of foreign materials and residue.
   2. Remove rags and waste from storage areas daily.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Comply with resinous flooring manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting resinous flooring application.
B. Lighting: Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during resinous flooring application.
C. Close spaces to traffic during resinous flooring application and for not less than 24 hours after application unless manufacturer recommends a longer period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Basis of Design and subject to compliance with requirements, provide products by:
   1. The Sherwin Williams Company, Cleveland, OH. swflooring@sherwin.com.
B. Resuflor Deco Quartz One:
   1. Primer: Resuflor MPE at 133-160 sq. ft. per gallon.
   2. Bodycoat: Resuflor MPE at 133-160 sq. ft. per gallon.
   3. Broadcast (1): 5900F Decorative Quartz at 400 lbs. per 1,000 sq. ft.
   4. Bodycoat: Resuflor MPE at 65-70 sq. ft. per gallon.
   5. Broadcast (2): 5900F Decorative Quartz at 400 lbs. per 1,000 sq. ft.
   6. Grout Coat: Accelera One at 100 sq. ft. per gallon.
   7. Seal Coat: Accelera One at 200 sq. ft. per gallon.

2.2 MATERIALS

A. VOC Content of Resinous Flooring: Provide resinous flooring systems, for use inside the weatherproofing system, that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   1. Resinous Flooring: 100 g/L.

2.3 HIGH-PERFORMANCE RESINOUS FLOORING

A. Resinous Flooring: Abrasion-, impact- and chemical-resistant, high-performance, resin-based, monolithic floor surfacing designed to produce a seamless floor.
B. System Characteristics:
   1. Color and Pattern: As indicated on Interior Material Legend in Drawings.
   2. Slip Resistance: Provide slip resistant finish.

PART 3 - EXECUTION

3.1 PREPARATION

A. Inspection: Prior to commencing Work, thoroughly examine all underlying and adjoining work, surfaces and conditions upon which Work is in any way dependent for perfect results. Report all conditions which affect Work. Commencement of Work constitutes acceptance of surfaces.
B. Surface Preparation: Remove all surface contamination, loose or weakly adherent particles, laitance, grease, oil, curing compounds, paint, dust and debris by blast track method or approved mechanical means (acid etch not allowed). If surface is questionable, try a test patch. Create a minimum surface profile for the system specified in accordance with the methods described in ICRI No. 03732 to achieve profile numbers as follows:
   1. Thin film, to 10 mils — CSP-1 to CSP-3.
   2. Thin and medium films, 10 to 40 mils — CSP-3 to CSP-5.
   3. Self-leveling mortars, to 3/16-inch — CSP-4 to CSP-6.
   4. Mortars and laminates, to 1/4-inch or more — CSP-5 to CSP-10.
C. Verify that concrete substrates are dry and moisture-vapor emissions are within acceptable levels according to manufacturer's written instructions.
   1. Moisture Testing: Perform tests indicated below.
      a. Calcium Chloride Test: Perform anhydrous calcium chloride test per ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lbs. of water/1,000 sq. ft. in 24 hours. Perform tests so that each test area does not exceed 1,000 sq. ft. and perform 3 tests for the first 1,000 sq. ft. and one additional test for every additional 1,000 sq ft.
      b. In-Situ Probe Test: Perform relative-humidity test using in-situ probes per ASTM F2170. Proceed with installation only after substrates have a maximum 75 percent relative-humidity-level measurement.

3.2 ENVIRONMENTAL CONDITIONS

A. Follow all manufacturers' installation instructions.
B. Repair damaged and deteriorated concrete according to resinous flooring manufacturer's written instructions.
C. Alkalinity and Adhesion Testing: Verify that concrete substrates have pH within acceptable range. Perform tests recommended by manufacturer. Proceed with application only after substrates pass testing.
D. Resinous Materials: Mix components and prepare materials according to resinous flooring manufacturer's written instructions.
E. Use patching and fill material to fill holes and depressions in substrates according to manufacturer's written instructions.
F. Treat control joints and other nonmoving substrate cracks to prevent cracks from reflecting through resinous flooring according to manufacturer's written instructions.

3.3 APPLICATIONS

A. Install resinous floor over properly prepared concrete surface in strict accordance with the manufacturer's directions.
    1. Install the primer and/or base coats over thoroughly cleaned and prepared concrete.
    2. Install topcoat over flooring after excess aggregate has been removed.
    3. Maintain a slab temperature of 60 degrees F to 80 degrees F for 24 hours minimum before applying floor topping, or as instructed by manufacturer.
B. Apply components of resinous flooring system according to manufacturer's written instructions to produce a uniform, monolithic wearing surface of thickness indicated.
    1. Coordinate application of components to provide optimum adhesion of resinous flooring system to substrate, and optimum intercoat adhesion.
    2. Cure resinous flooring components according to manufacturer's written instructions. Prevent contamination during application and curing processes.
    3. At substrate expansion and isolation joints, comply with resinous flooring manufacturer's written instructions.
C. Sealant: Saw cut resinous floor topping at expansion joints in concrete slab. Fill sawcuts with sealant prior to final seal coat application. Follow manufacturer's written recommendations.
D. Apply primer over prepared substrate at manufacturer's recommended spreading rate.
E. Slip Resistant Finish: Provide grit for slip resistance.
F. Apply topcoats in number indicated for flooring system and at spreading rates recommended in writing by manufacturer.

3.4 COMPLETED WORK

A. Cleaning: Upon completion of the Work, clean up and remove from the premises surplus materials, tools, appliances, empty cans, cartons and rubbish resulting from the Work. Clean off all spattering and drippings, and all resulting stains.

B. Protection: Protect Work in accordance with manufacturer's directions from damage and wear during the remainder of the construction period. Use protective methods and materials, including temporary covering, recommended in writing by resinous flooring manufacturer.

END OF SECTION

SECTION 09 68 16 - SHEET CARPETING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Synthetic non woven with attached cushion.
B. Related Requirements:
   1. Division 01 Specification Sections apply to Work of this Section.
   2. Section 09 65 13 "Resilient Base and Accessories" for resilient wall base and accessories installed with carpet.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include manufacturer's written data on physical characteristics and durability.
B. Include manufacturer's written installation recommendations for each type of substrate.
   1. Sustainable Design Submittals:
   2. Product Data: For adhesives, indicating VOC content.
   3. Shop Drawings: For carpet installation, showing the following:
      a. Seam locations, types, and methods.
   4. Type of subfloor.
   5. Type of installation.
   6. Pattern type, repeat size, location, direction, and starting point.
   7. Pile direction.
   8. Types, colors, and locations of edge, transition, and other accessory strips.
   9. Transition details to other flooring materials.
C. Samples for Verification: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.
   1. Carpet: 12-inch-square sample.
   2. Exposed Edge, Transition, and Other Accessory Stripping: 12-inch-long samples.

1.3 INFORMATIONAL SUBMITTALS

A. Sample Warranties: For special warranties.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For carpet to include in maintenance manuals. Include the following:
   1. Methods for maintaining carpet, including cleaning, and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
   2. Precautions for cleaning materials and methods that could be detrimental to carpet and carpet cushion.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Carpet: Full-width rolls equal to 5 percent of amount installed for each type indicated, but not less than 10 sq. yards.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who is certified by the International Certified Floorcovering Installers Association at the Master II certification level.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Comply with the Carpet and Rug Institute's CRI 104.
B. Deliver carpet in original mill protective covering with mill register numbers and tags attached.

1.8 FIELD CONDITIONS

A. Comply with the Carpet and Rug Institute's CRI 104 for temperature, humidity, and ventilation limitations.
B. Environmental Limitations: Do not deliver or install carpet and carpet cushion until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at levels planned for building occupants during the remainder of the construction period.
C. Do not install carpet and carpet cushion over concrete slabs until slabs have cured, are sufficiently dry to bond with adhesive, and have pH range recommended by carpet manufacturer.

1.9 WARRANTY

A. Special Warranty for Carpet: Manufacturer agrees to repair or replace components of carpet installation that fail in materials or workmanship within specified warranty period.
   1. Warranty does not include deterioration or failure of carpet due to unusual traffic, failure of substrate, vandalism, or abuse.
   2. Failures include, but are not limited to, the following:
      a. More than 10 percent loss of face fiber, edge raveling, snags, and runs.
      b. Loss of tuft bind strength.
      c. Excess static discharge.

PART 2 - PRODUCTS

2.1 SYNTHETIC NON WOVEN (CPT1)

A. Manufacturers: Subject to compliance with requirements, provide products by the following:
   1. Tandus; a Tarkett company as indicated on Interior Material Legend in Drawings.
B. Color: as indicated on Interior Material Legend in Drawings.
C. Pattern: as indicated on Interior Material Legend in Drawings.
D. Fiber Content: Dynex SD Nylon 100 percent Solution Dyed.
E. Face Construction: Patterned Loop.
F. Backing: Powerbond.
G. Applied Treatments:
   1. Applied Soil-Resistance Treatment: Manufacturer's standard material.

2.2 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet anufacturer.
   1. Peel and Stick RS Adhesive System.
B. Seam Adhesive: Hot-melt adhesive tape or similar product recommended by carpet manufacturer for sealing and taping seams and butting cut edges at backing to form secure seams and to prevent pile loss at seams.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet performance.
B. Examine carpet for type, color, pattern, and potential defects.

C. Concrete Slabs: Verify that finishes comply with requirements specified in Section 03 30 00 "Cast-in-Place Concrete" and that surfaces are free of cracks, ridges, depressions, scale, and foreign deposits.
   1. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft., and perform no fewer than 3 tests in each installation area and with test areas evenly spaced in installation areas.
      a. Provide testing results prior to installation.
      b. Provide testing per Manufacturer's written instructions.

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

3.2 PREPARATION

A. General: Comply with the Carpet and Rug Institute's CRI 104 and with carpet manufacturer's written installation instructions for preparing substrates.

B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8-inch-wide or wider, and protrusions more than 1/32-inch, unless more stringent requirements are required by manufacturer's written instructions.

C. Concrete Substrates: Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by adhesive and carpet anufacturers.

D. Broom and vacuum clean substrates to be covered immediately before installing carpet.

3.3 INSTALLATION

A. Comply with the Carpet and Rug Institute's CRI 104 and carpet manufacturer's written installation instructions for the following:
   1. Preapplied adhesive installation.

B. Comply with carpet manufacturer's written instructions and Shop Drawings for seam locations and direction of carpet; maintain uniformity of carpet direction and lay of pile. At doorways, center seams under the door in closed position.

C. Install pattern parallel to walls and borders.

D. Do not bridge building expansion joints with carpet.

E. Cut and fit carpet to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet manufacturer.

F. Extend carpet into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

G. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on carpet as marked on subfloor. Use nonpermanent, nonstaining marking device.

3.4 CLEANING AND PROTECTION

A. Perform the following operations immediately after installing carpet:
   1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet manufacturer.
   2. Remove yarns that protrude from carpet surface.
   3. Vacuum carpet using commercial machine with face-beater element.

B. Protect installed carpet to comply with the Carpet and Rug Institute's CRI 104.

C. Protect carpet against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods recommended in writing by carpet manufacturer.

END OF SECTION

SECTION 09 72 00 - WALL COVERINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Vinyl wall protection covering.
B. Related Requirements:
   1. Division 01 Specification Sections apply to Work of this Section.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include data on physical characteristics, durability, fade resistance, and fire-test-response characteristics.
B. Shop Drawings: Show location and extent of each wall-covering type. Indicate pattern placement seams and termination points.
C. Samples: For each type of wall covering and for each color, pattern, texture, and finish specified, full width by 36 inches long in size.
   1. Wall-Covering Sample: From same production run to be used for the Work, with specified treatments applied.
      a. Show complete pattern repeat.
D. Samples for Verification: For each type of wall covering and for each color, pattern, texture, and finish specified, full width by 36 inches long in size.
   1. Wall-Covering Sample: From same production run to be used for the Work, with specified treatments applied.
   2. Strikeoffs for custom wall graphic.
E. Product Schedule: For wall coverings. Use same designations indicated on Drawings.

1.3 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each wall covering, for tests performed by a qualified testing agency.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For wall coverings to include in maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same production run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Wall-Covering Materials: For standard type, color, texture, and finish, full width by length to equal to 5 percent of amount installed.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install wall coverings until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and HVAC system is operating and maintaining ambient temperature and humidity conditions at levels intended for occupants after Project completion during the remainder of the construction period.
   1. Wood-Veneer Wall Coverings: Condition spaces for not less than 48 hours before installation.
B. Lighting: Do not install wall covering until lighting that matches conditions intended for occupants after Project completion is provided on the surfaces to receive wall covering.
C. Ventilation: Provide continuous ventilation during installation and for not less than the time recommended by wall-covering manufacturer for full drying or curing.
D. Pre-installation meeting.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: As determined by testing identical wall coverings applied with identical adhesives to substrates in accordance with test method indicated below by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
      a. Flame-Spread Index: 5 or less.
      b. Smoke-Developed Index: 40 or less.

2.2 VINYL WALL COVERING VWC1 and VWC2

A. Manufacturers: Basis of design and subject to compliance with requirements, provide products by the following:
   1. As indicated on Interior Material Legend.
B. Description: Provide vinyl products in rolls from same production run and complying with the following:
   1. FS CCC-W-408D for Type III, Heavy Duty.
   2. ASTM F793 for peelable strippable wall coverings.
C. Total Weight: 35 ounces per linear yard, excluding coatings.
D. Width: 52 inches.
E. Backing:
   1. Fiber Content: Dense Cotton or dense Polyester/Cotton.
F. Colors, Textures, and Patterns: as indicated on Interior Material Legend in Drawings. Custom Graphics are designated.

2.3 ACCESSORIES

A. Adhesive: Mildew-resistant, nonstaining, strippable adhesive, for use with specific wall covering and substrate application indicated and as recommended in writing by wall-covering manufacturer.
   1. Adhesives shall have a VOC content of 50g/L or less.
B. Primer/Sealer: Mildew resistant, complying with requirements in Section 09 91 23 "Interior Painting" and recommended in writing by primer/sealer and wall-covering manufacturers for intended substrate.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with installer present, for compliance with requirements for installation surfaces being true in plane and vertical and horizontal alignment, maximum moisture content, and other conditions affecting performance of the Work.
B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Comply with manufacturer's written instructions for surface preparation.
B. Clean substrates of substances that could impair bond of wall covering, including dirt, oil, grease, mold, and mildew.
C. Prepare substrates to achieve a smooth, dry, clean, structurally sound surface free of flaking, unsound coatings, cracks, and defects.
   1. Moisture Content: Maximum of 4 percent on new plaster, concrete, and concrete masonry units when tested with an electronic moisture meter.
   2. Gypsum Board: Apply primer/sealer as recommended in writing by primer/sealer manufacturer and wall-covering manufacturer.
   3. Painted Surfaces:
      a. Check for pigment bleeding. Apply primer/sealer to areas susceptible to pigment bleeding as recommended in writing by primer/sealer manufacturer.
      b. Sand gloss, semigloss, and eggshell finishes with fine sandpaper.
D. Remove hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.
E. Acclimatize wall-covering materials by removing them from packaging in the installation areas not less than 6 days before installation.

3.3 INSTALLATION OF WALL COVERING

A. Comply with wall-covering manufacturers' written installation instructions applicable to products and applications indicated.
B. Cut wall-covering strips in roll number sequence. Change the roll numbers at partition breaks and corners.
C. Install strips in same order as cut from roll.
    1. For solid-color, even-texture, or random-match wall coverings, reverse every other strip.
D. Install wall covering without lifted or curling edges and without visible shrinkage.
E. Match pattern per manufacturers direction above the finished floor.
F. Install seams vertical and plumb at least 6 inches from outside corners and 8 inches from inside corners unless a change of pattern or color exists at corner. Horizontal seams are not permitted.
G. Trim edges and seams for color uniformity, pattern match, and tight closure. Butt seams without overlaps or gaps between strips.
H. Fully bond wall covering to substrate. Remove air bubbles, wrinkles, blisters, and other defects.

3.4 CLEANING

A. Remove excess adhesive at seams, perimeter edges, and adjacent surfaces.
B. Use cleaning methods recommended in writing by wall-covering manufacturer.
C. Replace strips that cannot be cleaned.
D. Reinstall hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.

END OF SECTION

SECTION 09 84 14 - ACOUSTIC STRETCHED-FABRIC WALL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
   1. Acoustic stretched-fabric wall systems.
B. Related Requirements:
   1. Division 01 Specification Sections apply to Work of this Section.

1.2 SUBMITTALS

A. Product data:
   1. Submit manufacturer's product data including certified laboratory test reports and other data required to show compliance with these Specifications.
B. Samples:
   1. Submit 9- by 11-inch samples of representative panel with factory detailed edge, and representative samples of mounting devices.

1.3 QUALITY ASSURANCE

A. Pre-installation conference:
   1. Conduct conference at Project Site to comply with requirements in Division 01.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Project conditions:
   1. Protect system components from excessive moisture in shipment, storage, and handling. Deliver in unopened bundles and store in a dry place with adequate air circulation. Do not deliver material to building until wet conditions such as concrete, plaster, paint, and adhesives have been completed and cured to a condition of equilibrium.

1.5 LIMITED WARRANTY

A. Limited warranty:
   1. Provide manufacturer's standard limited 10-year warranty against manufacturing defects in material or workmanship.

PART 2 - PRODUCTS

2.1 SOUND ABSORPTIVE STRETCH FABRIC SYSTEM

A. Basis-of-Design: Conwed Eurospan® Acoustical Wall System.
   1. Construction: Comprised of three basic components: a fiberglass acoustic core, perimeter tension track, and outer textile covering.
   2. Fiberglass density: High impact.
   3. Core thickness: 2 inches.
   4. Width: Max of 16 feet and custom.
   5. Length: Custom.
   6. Corners: Square.
   7. Edge profile: Square.
   8. Fabric finish: Per Interior Material Legend in Drawings.
   9. Mounting type: Square perimeter track and Square mid joint track.
   10. Flammability (ASTM E84): System shall have a Class “A” rating per ASTM E84.
   11. Acoustical performance: Values below are for panels mounted in accordance with ASTM C423 (Type A Mounting) and vary by panel thickness and finish
       a. Noise reduction coefficient (NRC) for 2-inch thickness.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Verify wet work such as plastering, and concrete is complete and dry. Verify building is enclosed and under standard occupancy conditions (60 to 85 degrees F and not more than 70 percent relative humidity) prior to start of installation. Commencement of installation constitutes Installer’s acceptance of surfaces and conditions.
B. Install products in accordance with manufacturer’s written instructions and in proper relationship with adjacent construction.
C. Touch-up, repair or replace damaged units until satisfactory results are obtained.

END OF SECTION

SECTION 09 91 13 - EXTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes surface preparation and the application of paint systems on the following exterior substrates:
   1. Concrete.
   2. Concrete masonry units (CMU).
   3. Steel.
   4. Stainless-steel flashing.
   5. Wood.

B. Related Requirements:
   1. Division 01 Specification Sections apply to Work of this Section.
   2. Section 05 12 00 "Structural Steel Framing" for shop priming of metal substrates with primers specified in this Section.
   3. Section 09 91 23 "Interior Painting" for surface preparation and the application of paint systems on interior substrates.

1.2 DEFINITIONS

A. Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D523, a matte flat finish.

B. Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D523, a high-side sheen flat, velvet-like finish.

C. Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D523, an eggshell finish.

D. Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D523, a satin-like finish.

E. Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D523, a semi-gloss finish.

F. Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D523, a gloss finish.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

B. Samples for Verification: For each type of paint system and each color and gloss of topcoat.
   1. Submit samples on rigid backing, 8 inches square.
   2. Step coats on samples to show each coat required for system.
   3. Label each coat of each sample.
   4. Label each sample for location and application area.

C. Product List: For each product indicated, include the following:
   1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Handling: Deliver products to Project Site in an undamaged condition in manufacturer's original sealed containers, complete with labels and instructions for handling, storing, unpacking, protecting, and installing. Packaging shall bear the manufacture's label with the following information:
   1. Product name and type (description).
   2. Batch date.
   3. Color number.
   4. VOC content.
   5. Environmental handling requirements.
   6. Surface preparation requirements.
   7. Application instructions.

B. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 degrees F.
   1. Maintain containers in clean condition, free of foreign materials and residue.
   2. Remove rags and waste from storage areas daily.

1.5 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50- and 95-degrees F.

B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 degrees F above the dew point; or to damp or wet surfaces.

C. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
   1. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Sherwin-Williams Company products indicated or comparable product from one of the following:
   1. Benjamin Moore & Co.
   2. Kwal, Division of Sherwin-Williams.
   3. Glidden Professional, Division of PPG Architectural Finishes, Inc.
   4. PPG Architectural Finishes, Inc.
   5. Kelly Moore.
   6. Dunn Edwards.

B. Source Limitations: Obtain paint materials from single source from single listed manufacturer.
   1. Manufacturer's designations listed on a separate color schedule are for color reference only and do not indicate prior approval.

2.2 PAINT, GENERAL

A. Standards: Provide products that comply with Manufacture's Premium 1st Quality standards indicated and like VOC limits.
B. Material Compatibility:
   1. Provide materials for use within each paint system that are compatible with one another, and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
   2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.
C. VOC Content: Provide materials that comply with VOC limits of authorities having jurisdiction.
D. Colors: As indicated in a color schedule.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers. Where acceptability of substrate conditions is in question, apply samples and perform in-situ testing to verify compatibility, adhesion, and film integrity of new paint application.
   1. Report, in writing, conditions that may affect application, appearance, or performance of paint.
B. Substrate Conditions:
   1. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
      a. Concrete: 12 percent.
      b. Masonry (Clay and CMU): 12 percent.
      c. Wood: 15 percent.
      d. Portland Cement Plaster: 12 percent.
      e. Gypsum Board: 12 percent.
   2. Portland Cement Plaster Substrates: Verify that plaster is fully cured.
   3. Exterior Gypsum Board Substrates: Verify that finishing compound is sanded smooth.
C. Proceed with coating application only after unsatisfactory conditions have been corrected; application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates and paint systems indicated.
B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
    1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.
C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
    1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
E. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.
F. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer but not less than the following:
    1. SSPC-SP 3, "Power Tool Cleaning."
G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
H. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
I. Aluminum Substrates: Remove loose surface oxidation.
J. Wood Substrates:
    1. Scrape and clean knots. Before applying primer, apply coat of knot sealer recommended in writing by topcoat manufacturer for exterior use in paint system indicated.
    2. Sand surfaces that will be exposed to view, and dust off.
    3. Prime edges, ends, faces, undersides, and backsides of wood.
    4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions and recommendations in "MPI Manual."
    1. Use applicators and techniques suited for paint and substrate indicated.
    2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.

3. Paint both sides and edges of exterior doors and entire exposed surface of exterior door frames.
4. Paint entire exposed surface of window frames and sashes.
5. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
6. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

B. Tint undercoats same color as topcoat but tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
1. Paint the following work where exposed to view:
a. Equipment, including panelboards and switch gear.
b. Uninsulated metal piping.
c. Uninsulated plastic piping.
d. Pipe hangers and supports.
e. Metal conduit.
f. Plastic conduit.
g. Tanks that do not have factory-applied final finishes.

3.4 FIELD QUALITY CONTROL

A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
1. Contractor shall touch up and restore painted surfaces damaged by testing.
2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project Site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 EXTERIOR PAINTING SCHEDULE

A. Concrete, Nontraffic Surfaces:
   1. Latex System:
      a. Prime Coat: Primer sealer, latex, exterior: S-W Loxon Concrete & Masonry Primer Sealer, A24W8300, at 8.0 mils wet, 3.2 mils dry.
      b. Intermediate Coat: Latex, exterior, matching topcoat.
      c. Topcoat: Latex, exterior, low-sheen (Gloss Level 3-4): S-W A-100 Exterior Latex Low Sheen, A12 Series, at 4.0 mils wet, 1.5 mils dry, per coat.

B. Concrete Substrates, Pedestrian Traffic Surfaces:
   1. Latex Floor Paint System:
      a. First Coat: Floor paint, latex, slip-resistant, matching topcoat.
      b. Topcoat: Floor paint, latex, slip-resistant, low gloss (maximum Gloss Level 3): S-W ArmorSeal Tread-Plex, B90 Series, at 1.5 to 2.0 mils dry per coat.

C. CMU Substrates:
   1. Latex System:
      a. Block Filler: Block filler, latex, interior/exterior: S-W PrepRite Block Filler, B25W25, at 75 to 125 sq. ft. per gal.
      b. Intermediate Coat: Latex, exterior, matching topcoat.
      c. Topcoat: Latex, exterior, satin (Gloss Level 3-4): S-W A-100 Exterior Latex Satin, A82 Series, at 4.0 mils wet, 1.5 mils dry, per coat.

D. Ferrous Metal, Galvanized-Metal, and Aluminum Substrates:
   1. Water-Based Light Industrial Coating System:
      a. Prime Coat: Primer, water-based, anti-corrosive for metal: S-W Pro Industrial Pro-Cryl Universal Primer, B66-310 Series, 5.0 to 10.0 mils wet, 2.0 to 4.0 mils dry.
      b. Intermediate Coat: Light industrial coating, exterior, water based, matching topcoat.
      c. Topcoat: Light industrial coating, exterior, water based, eggshell (Gloss Level 3): S-W Pro Industrial Eg-Shel Acrylic B66-660 Series, at 2.5 to 4.0 mils dry, per coat.

E. Wood Substrates: Including exposed wood items not indicated to receive shop-applied finish.
   1. Latex System:
      a. Prime Coat: Primer, latex for exterior wood, per manufacturer's recommendations.
      b. Intermediate Coat: Latex, exterior, matching topcoat.
      c. Topcoat: Latex, exterior, satin (Gloss Level 3-4): S-W A-100 Exterior Latex Satin, A82 Series, at 4.0 mils wet, 1.5 mils dry, per coat.

END OF SECTION

SECTION 09 91 23 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Surface preparation and the application of paint systems on the following interior substrates:
      a. Concrete.
      b. Concrete masonry units (CMU).
      c. Steel.
      d. Cast iron.
      e. Galvanized metal.
      f. Aluminum (not anodized or otherwise coated).
      g. Wood.
      h. Gypsum board.
   2. Fire and smoke assembly identification.

B. Related Requirements:
   1. Division 01 Specification Sections apply to Work of this Section.
   2. Section 09 91 13 "Exterior Painting" for surface preparation and the application of paint systems on exterior substrates.

1.2 DEFINITIONS

A. Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D523, a matte flat finish.

B. Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D523, a high-side sheen flat, velvet-like finish.

C. Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D523, an eggshell finish.

D. Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D523, a satin-like finish.

E. Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D523, a semi-gloss finish.

F. Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D523, a gloss finish.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

B. Samples for Verification: For each type of paint system and in each color and gloss of topcoat.
   1. Submit samples on rigid backing, 8 inches square.
   2. Step coats on samples to show each coat required for system.
   3. Label each coat of each sample.
   4. Label each Sample for location and application area.

C. Product List: For each product indicated, include the following:
   1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
   2. VOC content.

1.4 CLOSEOUT SUBMITTALS

A. Coating Maintenance Manual: Provide coating maintenance manual including area summary with finish schedule, area detail designating location where each product/color/finish was used, product data pages, material safety data sheets, care and cleaning instructions, touch-up procedures, and color samples of each color and finish used.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Paint: 5 percent, but not less than 1 gallon of each material and color applied.

1.6 QUALITY ASSURANCE

A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   a. Vertical and Horizontal Surfaces: Provide samples of at least 50 sq. ft.
   b. Other Items: Archtect will designate items or areas required.
   2. Final approval of color selections will be based on mockups.
      a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Archtect at no added cost to Owner.
   3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Archtect specifically approves such deviations in writing.
   4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Handling: Deliver products to Project Site in an undamaged condition in manufacturer's original sealed containers, complete with labels and instructions for handling, storing, unpacking, protecting, and installing. Packaging shall bear the manufacturer's label with the following information:
   1. Product name and type (description).
   2. Batch date.
   3. Color number.
   4. VOC content.

5. Environmental handling requirements.
6. Surface preparation requirements.
7. Application instructions.

B. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 degrees F.
1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.8 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 degrees F.
B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 degrees F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Sherwin-Williams Company products indicated or comparable product from one of the following:
1. Glidden Professional, Division of PPG Architectural Finishes, Inc.
2. PPG Architectural Finishes, Inc.

B. Source Limitations: Obtain paint materials from single source from single listed manufacturer.
1. Manufacturer's designations listed on a separate color schedule are for color reference only and do not indicate prior approval.

2.2 PAINT, GENERAL

A. Standards: Provide products that comply with Manufacture's Premium 1st Quality standards indicated and like VOC limits.
B. Material Compatibility:
1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

C. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction and, for interior paints and coatings applied at Project Site, the following VOC limits, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24) unless noted otherwise.
1. Nonflat Paints and Coatings: 150 g/L.
2. Dry-Fog Coatings: 400 g/L.
3. Primers, Sealers, and Undercoaters: 200 g/L.
4. Anticorrosive and Antirust Paints Applied to Ferrous Metals: 250 g/L.
5. Zinc-Rich Industrial Maintenance Primers: 340 g/L.

6. Pretreatment Wash Primers: 420 g/L.
7. Floor Coatings: 100 g/L.
8. Shellacs, Clear: 730 g/L.
9. Shellacs, Pigmented: 550 g/L.

D. Colors: As selected by Architect from manufacturer's full range. Refer to Interior Material Legend for color selections.

2.3 SOURCE QUALITY CONTROL

A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:
1. Owner will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project Site, samples may be taken at Project Site. Samples will be identified, sealed, and certified by testing agency.
2. Testing agency will perform tests for compliance with product requirements.
3. Owner may direct Contractor to stop applying coatings if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project Site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the 2 paints are incompatible.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers. Where acceptability of substrate conditions is in question, apply samples and perform in-situ testing to verify compatibility, adhesion, and film integrity of new paint application.
1. Report, in writing, conditions that may affect application, appearance, or performance of paint.

B. Substrate Conditions:
1. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
a. Concrete: 12 percent.
b. Masonry (Clay and CMU): 12 percent.
c. Wood: 15 percent.
d. Gypsum Board: 12 percent.
2. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.

C. Proceed with coating application only after unsatisfactory conditions have been corrected; application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates indicated.
B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
   1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
   1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
   1. Concrete Floors: Remove oil, dust, grease, dirt, and other foreign materials. Comply with SSPC-SP-13/NACE 6 or ICRI 03732.
E. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceed that permitted in manufacturer's written instructions.
F. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer.
G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
H. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
I. Aluminum Substrates: Remove loose surface oxidation.
J. Wood Substrates:
   1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
   2. Sand surfaces that will be exposed to view, and dust off.
   3. Prime edges, ends, faces, undersides, and backsides of wood.
   4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."
   1. Use applicators and techniques suited for paint and substrate indicated.
   2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.

3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
1. Paint the following work where exposed in equipment rooms:
    a. Equipment, including panelboards and switch gear.
    b. Uninsulated metal piping.
    c. Uninsulated plastic piping.
    d. Pipe hangers and supports.
    e. Metal conduit.
    f. Plastic conduit.
    g. Tanks that do not have factory-applied final finishes.
2. Paint the following work where exposed in occupied spaces:
    a. Equipment, including panelboards.
    b. Uninsulated metal piping.
    c. Uninsulated plastic piping.
    d. Pipe hangers and supports.
    e. Metal conduit.
    f. Plastic conduit.
    g. Other items as directed by Architect.
3. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

F. Fire and Smoke Assembly Identification: Where assembly types are identified in Drawings, provide stenciled identification in accessible concealed spaces and where noted in Drawings.
1. Assembly Types Requiring Identification: Fire walls, fire barriers, fire partitions, smoke barriers, and smoke partitions.
2. Accessible concealed spaces include below accessible floors, above ceilings, and attic spaces.
3. Locate within 15 feet of partition ends and at intervals not exceeding 30 feet measured horizontally.
4. Lettering not less than 3 inches in height with a minimum 3/8-inch stroke in a contrasting color.
5. Wording: "Fire and/or smoke barrier - Protect all openings."

3.4 FIELD QUALITY CONTROL

A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
   1. Contractor shall touch up and restore painted surfaces damaged by testing.
   2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project Site.
B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 INTERIOR PAINTING SCHEDULE

A. Concrete Substrates, Pedestrian Traffic Surfaces:
   1. Clear Acrylic System, Gloss Finish:
      a. First Coat: S-W H&C Concrete Sealer Wet Look Water Base, at 100 to 200 sq. ft. per gallon.
      b. Second Coat: S-W H&C Concrete Sealer Wet Look Water Base, at 100 to 200 sq. ft. per gallon.
B. CMU Substrates:
   1. Water-Based Light Industrial Coating System:
      a. Block Filler: Block filler, latex, interior/exterior: S-W PrepRite Block Filler, B25W25, at 100 to 200 sq. ft. per gallon.
      b. Intermediate Coat: Light industrial coating, interior, water based, matching topcoat.
      c. Topcoat: Light industrial coating, interior, water based, eggshell (Gloss Level 3): S-W Pro Industrial Pre-Catalyzed Water Based Epoxy, K45-151 Series, at 4.0 mils wet, 1.5 mils dry, per coat.
      d. Topcoat: Light industrial coating, interior, water based, semi-gloss (Gloss Level 5): S-W Pro Industrial Pre-Catalyzed Water Based Epoxy, K46-151 Series, at 4.0 mils wet, 1.5 mils dry, per coat.

C. Wood Substrates: Including exposed wood items not indicated to receive shop-applied finish.
   1. Latex System:
      a. Prime Coat: Primer sealer, latex, interior: S-W PrepRite ProBlock Primer Sealer, B51-620 Series, at 4.0 mils wet, 1.4 mils dry.
      b. Intermediate Coat: Latex, interior, matching topcoat.
      c. Topcoat: Latex, interior, semi-gloss (Gloss Level 4): S-W ProMar 200 Zero VOC Latex Semi-Gloss, B31-2600 Series, at 4.0 mils wet, 1.6 mils dry, per coat.

D. Gypsum Board Substrates:
   1. Latex System:
      a. Prime Coat: Primer, latex, interior: S-W ProMar 200 Zero VOC Latex Primer, B28W2600, at 4.0 mils wet, 1.5 mils dry.
      b. Intermediate Coat: Latex, interior, matching topcoat.
      c. Topcoat: Latex, interior, eggshell (Gloss Level 3): S-W ProMar 200 Zero VOC Latex Eg-Shel, B20-2600 Series, at 4.0 mils wet, 1.7 mils dry, per coat.
   2. Water-Based Light Industrial Coating System: Provide at all corridor locations and as indicated on Interior Drawings.
      a. Prime Coat: Primer sealer, latex, interior: S-W ProMar 200 Zero VOC Latex Primer, B28W2600, at 4.0 mils wet, 1.5 mils dry.
      b. Intermediate Coat: Light industrial coating, interior, water based, matching topcoat.
      c. Topcoat: Light industrial coating, interior, water based, semi-gloss (Gloss Level 5): S-W Pro Industrial Pre-Catalyzed Waterbased Epoxy, K46-151 Series, at 4.0 mils wet, 1.5 mils dry, per coat.

END OF SECTION

SECTION 09 96 00 - HIGH-PERFORMANCE COATINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Surface preparation and application of high-performance coating systems.

B. Related Requirements:
   1. Division 01 Specification Sections apply to Work of this Section.
   2. Section 05 12 00 "Structural Steel Framing" for shop priming of metal substrates with primers specified in this Section.
   3. Section 09 91 13 "Exterior Painting" for special-use coatings and general field painting.
   4. Section 09 91 23 "Interior Painting" for special-use coatings and general field painting.

1.2 DEFINITIONS

A. Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D523, an eggshell finish.

B. Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D523, a semi-gloss finish.

C. Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D523, a gloss finish.

D. Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D523, a high-gloss finish.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include preparation requirements and application instructions.

B. Samples for Verification: For each type of coating system, and in each color and gloss of topcoat indicated.
   1. Submit samples on rigid backing, 8 inches square.
   2. Step coats on samples to show each coat required for system.
   3. Label each coat of each sample.
   4. Label each sample for location and application area.

C. Product List: For each product indicated, include the following:
   1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Handling: Deliver products to Project Site in an undamaged condition in manufacturer's original sealed containers, complete with labels and instructions for handling, storing, unpacking, protecting, and installing. Packaging shall bear the manufacture's label with the following information:

1. Product name and type (description).
2. Batch date.
3. Color number.
4. VOC content.
5. Environmental handling requirements.
6. Surface preparation requirements.
7. Application instructions.

B. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 degrees F.
   1. Maintain containers in clean condition, free of foreign materials and residue.
   2. Remove rags and waste from storage areas daily.

1.5 FIELD CONDITIONS

A. Apply coatings only when temperature of surfaces to be coated and surrounding air temperatures are between 50 and 95 degrees F.

B. Do not apply coatings when relative humidity exceeds 85 percent; at temperatures less than 5 degrees F above the dew point; or to damp or wet surfaces.

C. Do not apply exterior coatings in snow, rain, fog, or mist.

D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
   1. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide The Sherwin-Williams Company; products indicated or comparable product from one of the following:
   1. Benjamin Moore & Co.
   2. PPG Architectural Finishes, Inc.
   3. Tnemec Inc.

B. Source Limitations: Obtain paint materials from single source from single listed manufacturer.
   1. Manufacturer's designations listed on a separate color schedule are for color reference only and do not indicate prior approval.

2.2 HIGH-PERFORMANCE COATINGS, GENERAL

A. MPI Standards: Provide products that comply with MPI standards indicated and are listed in "MPI Approved Products List."

B. Material Compatibility:
   1. Provide materials for use within each coating system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.

2. For each coat in a coating system, provide products recommended in writing by manufacturers of topcoat for use in coating system and on substrate indicated.
3. Provide products of same manufacturer for each coat in a coating system.

C. Colors: As indicated in color schedule.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers. Where acceptability of substrate conditions is in question, apply samples and perform in-situ testing to verify compatibility, adhesion, and film integrity of new paint application.
   1. Report in writing conditions that may affect application, appearance, or performance of paint.

B. Substrate Conditions:
   1. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
      a. Concrete: 12 percent.
      b. Concrete Masonry: 12 percent.
      c. Gypsum Board: 12 percent.
   2. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.
   3. Plaster Substrates: Verify that plaster is fully cured.

C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

D. Proceed with coating application only after unsatisfactory conditions have been corrected; application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
   1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.

C. Clean substrates of substances that could impair bond of coatings, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
   1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce coating systems indicated.

D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
E. Masonry Substrates: Remove efflorescence and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces or if alkalinity of mortar joints exceed that permitted in manufacturer's written instructions.
F. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer.
    1. SSPC-SP 10/NACE No. 2, "Near-White Blast Cleaning."
G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
H. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied coatings.
I. Aluminum Substrates: Remove loose surface oxidation.

3.3 APPLICATION

A. Apply high-performance coatings according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."
    1. Use applicators and techniques suited for coating and substrate indicated.
    2. Coat surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, coat surfaces behind permanently fixed equipment or furniture with prime coat only.
    3. Coat back sides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
    4. Do not apply coatings over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of the same material are to be applied. Tint undercoats to match color of finish coat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.
C. If undercoats or other conditions show through final coat, apply additional coats until cured film has a uniform coating finish, color, and appearance.
D. Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Produce sharp glass lines and color breaks.

3.4 FIELD QUALITY CONTROL

A. Dry Film Thickness Testing: Owner will engage the services of a qualified testing and inspecting agency to inspect and test coatings for dry film thickness.
    1. Contractor shall touch up and restore coated surfaces damaged by testing.
    2. If test results show that dry film thickness of applied coating does not comply with coating manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with coating manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project Site.
B. After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
C. Protect work of other trades against damage from coating operation. Correct damage by cleaning, repairing, replacing, and recoating, as approved by Architect, and leave in an undamaged condition.
D. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces.

3.6 EXTERIOR HIGH-PERFORMANCE COATING SCHEDULE

A. Concrete Substrates, Horizontal Surfaces:
   1. Pigmented Polyurethane over Epoxy Slip-Resistant Deck Coating System:
      a. Prime Coat: Epoxy, gloss (Gloss Level 6): S-W Armorseal 1000 HS, B67W2001 Series, at 2.5 to 4.0 mils dry, per coat.
      b. Intermediate: Polyurethane, gloss matching topcoat.
      c. Topcoat: Polyurethane, 2-component, pigmented, gloss (Gloss Level 6): S-W Armorseal HS Polyurethane, B65W220 Series, at 2.0 to 3.0 mils dry, per coat, with manufacturer's recommended slip-resistant aggregate.
B. CMU Substrates:
   1. Pigmented Polyurethane over High-Build Epoxy System:
      a. Block Filler: Block filler, epoxy: S-W Kem Cati-Coat HS Epoxy Filler/Sealer, at 10 to 20 mils dry, per coat.
      b. Intermediate Coat: Epoxy, high-build, low gloss: S-W Macropoxy 646 Fast Cure Epoxy, B58 Series, at 5 to 10 mils dry, per coat.
      c. Topcoat: Polyurethane, 2-component, pigmented, semi-gloss (Gloss Level 5): S-W Acrolon 218 HS Acrylic Polyurethane, B65-650 Series, at 3.0 to 6.0 mils dry, per coat.
C. Steel Substrates:
   1. Pigmented Polyurethane System:
      a. Prime Coat: Alkyd anti-corrosive, quick dry: S-W Kem Kromik Universal Primer, B62WZ111 Series, at 3 to 4 mils dry, per coat.
      b. Intermediate Coat: Polyurethane, 2-component, pigmented, matching topcoat.
      c. Topcoat: Polyurethane, 2-component, pigmented, semi-gloss (Gloss Level 5): S-W Acrolon 218 HS Acrylic Polyurethane, B65-650 Series, at 3.0 to 6.0 mils dry, per coat.
   2. Pigmented Polyurethane over Epoxy Zinc-Rich Primer System:
      a. Prime Coat: Primer, zinc-rich, epoxy: S-W Zinc Clad IV, at 3.0 to 5.0 mils dry, per coat.
      b. Intermediate Coat: Epoxy, high-build, low gloss: S-W Macropoxy 646 Fast Cure Epoxy, B58 Series, at 5 to 10 mils dry, per coat.

c. Topcoat: Polyurethane, 2-component, pigmented, semi-gloss (Gloss Level 5): S-W Acrolon 218 HS Acrylic Polyurethane, B65-650 Series, at 3.0 to 6.0 mils dry, per coat.

D. Galvanized-Metal Substrates:
   1. Pigmented Polyurethane over Vinyl Wash Primer System:
      a. Prime Coat: Primer, vinyl wash: S-W DTM Wash Primer, B71Y1, at 0.7 to 1.3 mils dry, per coat.
      b. First Topcoat: Polyurethane, 2-component, pigmented, matching topcoat.
      c. Second Topcoat: Polyurethane, 2-component, pigmented, semi-gloss (Gloss Level 5): S-W Acrolon 218 HS Acrylic Polyurethane, B65-650 Series, at 3.0 to 6.0 mils dry, per coat.

E. Aluminum (Not Anodized or Otherwise Coated) Substrates:
   1. Pigmented Polyurethane System:
      a. Prime Coat: Primer, vinyl wash: S-W DTM Wash Primer, at 0.2 to 0.4 mils dry, per coat.
      b. First Topcoat: Polyurethane, 2-component, pigmented, matching topcoat.
      c. Second Topcoat: Polyurethane, 2-component, pigmented, semi-gloss (Gloss Level 5): S-W Acrolon 218 HS Acrylic Polyurethane, B65-650 Series, at 3.0 to 6.0 mils dry, per coat.

END OF SECTION

SECTION 10 14 00 – SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Interior toilet room sings.
   2. Interior room name signage.
   3. Reserved Handicapped Parking signs and Fire Lane signs.
B. Related Requirements:
   1. Division 01 Specification Sections apply to Work of this Section.

1.2 SUBMITTALS

A. Samples: At the same time Shop Drawings are submitted, submit full-sized sample of each type of sign conforming to Specification requirements as to letter size, spacing, and style.
B. Shop Drawings and Manufactures' Brochures: Submit in accordance with Section 01 33 00 "Submittals."
C. Template: Submit full-size template drawing for approval of letter size, stock, spacing, and setting screws.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements indicated, provide products by one of the following:
   1. Lassiter Industries.
   2. ASI Sign Systems, Grand Prairie, Texas.
   3. Nelson-Harkins, Chicago, Illinois.
B. Substitutions: Under provisions of the General Conditions.

2.2 INTERIOR ROOM SIGNS

A. General: Provide room identification signs on walls at rooms as scheduled on Drawings and herein.
B. Mechanically or adhesively attach as recommended by sign manufacturer.
C. Plaque: Plastic 5- by 6-inch nameplate, acetate insert, acrylic accent bar, with brushed aluminum plate with raised Braille and ADA number.
D. Graphic Process:
   1. Raise tactile characters 1/32-inch from sign face.
   2. Provide Grade 2 braille for each text immediately below text.
E. Font: Optima.

F. Schedule:
   1. Provide 1 sign at each of the following locations and as otherwise required by code.
      a. Public Toilet Rooms: Identification signs with handicapped accessibility symbol and indicated as appropriate at each toilet room.
      b. Other signage as indicated on Drawings.
G. Place signs in locations indicated on Drawings and per TAS requirements.
H. Properly finish edges of signs and with letters and numbers evenly and accurately cut.
I. Spacing of Letters and Numbers: Optically correct.
J. Acceptable Product: Lassiter Industries; Changeable Message Series CM009.
K. Ensure that signage provided meets ADA/TAS requirements.
L. Where sign is mounted on glass, provide matching blank plate on back side of glass.

2.3 RESERVED HANDICAPPED PARKING SIGNS AND FIRE LANE SIGNS

A. Screen printed, 18-guage bonderized steel with blue baked enamel finish and white screen-printed copy.
B. Size: Refer to Drawings.
C. Copy:
   1. “Reserved Parking.”
   2. “Van Accessible.”
D. Post: Refer to Drawings. Provide 2-inch square tube frame with powder coat “Hunter Green” painted finish. Top portion of frame shall have metal mesh background for sign attachment. Mesh paint color to be “Hunter Green.”

PART 3 - EXECUTION

3.1 DELIVERY AND STORAGE

A. Deliver and store identifying devices in protective wrappings until ready for installation.

3.2 INTERIOR INSTALLATION – ROOM SIGNS

A. Install signs plumb, level, and square and in proper planes with other Work, at heights as indicated on Drawings and per ADA/TAS.
B. Mount on wall surface, 56 inches above finish floor surface to bottom of sign; 4 inches from door frame to meet Texas Accessibility Standards.
C. Anchor each plastic sign with sufficient amount of adhesive for proper installation as recommended by manufacturer for substrate.

3.3 CLEANING

A. Remove protective materials and clean all signs. Clean surfaces with plain water or water with soap or household detergent.

END OF SECTION

SECTION 10 21 13.14 - STAINLESS-STEEL TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Stainless steel partitions and urinal screens.
B. Related Requirements:
   1. Division 01 Specification Sections apply to Work of this Section.
   2. Section 05 50 00 "Metal Fabrications": Concealed steel support members.
   3. Section 06 10 00 "Rough Carpentry": Concealed wood framing and blocking for compartment support.
   4. Section 10 28 13 "Toilet Accessories."

1.2 REFERENCES

A. ASTM International:
   1. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
   2. ASTM D1735 - Standard Practice for Testing Water Resistance of Coatings Using Water Fog Apparatus
   3. ASTM D2247 - Standard Practice for Testing Water Resistance of Coatings in 100 percent Relative Humidity.
B. United States Green Building Council (USGBC): LEED Green Building Rating System.

1.3 SUBMITTALS

A. Submit under provisions of Section 01 30 00 "Administrative Requirements."
B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Literature indicating typical panel, pilaster, door, hardware, and fastening.
   2. Preparation instructions and recommendations.
   3. Storage and handling requirements and recommendations.
   4. Installation methods.
C. Shop Drawings:
   1. Dimensioned plans indicating layout of toilet compartments.
   2. Dimensioned elevations indicating heights of doors, pilasters, separation partitions, and other components; indicate locations and sizes of openings in compartment separation partitions for toilet and bath accessories to be installed in partitions; indicate floor and ceiling clearances.
   3. Details indicating anchoring components (bolt layouts) and methods for Project conditions; indicate components required for installation, but not supplied by toilet compartment manufacturer.
D. Verification Samples: For each finish product specified, 2 samples representing actual product, color, texture and pattern.
E. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store and handle materials and products in strict compliance with manufacturer's instructions and recommendations and industry standards.
B. Store products indoors in manufacturer's or fabricator's original containers and packaging, with labels clearly identifying product name and manufacturer. Protect from damage.
C. Lay cartons flat, with adequate support to ensure flatness and to prevent damage to pre-finished surfaces.
D. Do not store where ambient temperature exceeds 120 degrees F.

1.5 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.
B. Do not deliver materials or begin installation until building is enclosed, with complete protection from outside weather, and building temperature maintained at a minimum of 60 degrees F.

1.6 WARRANTY

A. Manufacturers Standard Warranty: Provide warranty for Stainless Steel Material: Against corrosion or discoloration for 5 years, assuming proper maintenance according to manufacturer's recommendations.

1.7 COORDINATION

A. Coordinate Work with placement of support framing and anchors in walls and ceilings.

PART 2 - PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: ASI Global Partitions, Integrated Privacy Compartments, which is located at: 900 Clary Connector; Eastanollee, GA 30538; Tel: 706.827.2700; Fax: 706.827.2710; Web:http://asi-globalpartitions.com
B. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00 "Product Requirements."

2.2 COMPARTMENTS AND SCREENS

A. Toilet Compartments: Floor Mounted Overhead braced.
   1. Compartment Depth and Width: As scheduled and indicated on Drawings.

2. Door Width: 24 inches, minimum; at ADA accessible compartments 36 inches minimum.
3. Height Above Floor: 9 inches
4. Door/Panel Height: 72 inches.

B. Privacy and Urinal Screens: Wall hung.
1. Screen Panel Size: 22 inches wide by 48 inches high.
2. Height Above Floor: 12 inches for 48 inches high.

2.3 STAINLESS STEEL TOILET COMPARTMENTS

A. Doors, Panels, Screens, and Pilasters: Tension leveled 304 stainless steel face sheet with number 4 finish, bonded under pressure to honeycomb core with non-toxic adhesive.
1. Doors, Screens, and Panels: 1-inch-thick, 22-gauge steel.
2. Pilasters: Pilasters: Overhead Braced,1-1/4 inches thick, 22-gauge steel.
3. Edge Moldings: Continuous roll-formed, interlocking 22-gauge steel crown molding, welded and ground smooth at corners.
4. Finish: Type 304 stainless steel No. 4 Satin finish.
5. Edge Moldings for Door: Integrated sight line blocking molding affixed to door during fabrication. Formed by continuous roll form process 304 SS 22-gauge steel molding, TIG welded and ground smooth.

B. No-Sight System: Integral to door construction required.
1. Add on no sight strips not allowed.
2. Brushed finish.
3. Use of 304 SS required.

C. Door Hardware: Attached with theft resistant barrel nuts and shoulder screws.
1. Finish: Chromium plated Zamac.
2. Hinges: Top hinge recessed and interlocked in door, with nylon pin in the plane of the door, through-bolted. Bottom hinge recessed in door, with mating box and pintle nylon cams providing the bearing surface; adjustable to allow door to rest at any position within a 270-degree range; through-bolted.
3. Strike and Keeper: Privacy Indicator latch installed on factory prepared door. Emergency access provided by slotted occupancy indicator.
4. Handicapped Access: Provided via slide latch functionality of Privacy Indicator latch.
5. Coat Hook and Bumper: Manufacturer's standard surface mounted. No tamper resistant screws required.
6. Door Pull: Standard on ADA compartments. Two per ADA door.
7. Fastening Hardware: Theft resistant heads.

D. Mounting Brackets: Chromium plated Zamac stirrup brackets with theft resistant screws.

E. Pilaster Shoes: Type 304 Stainless Steel, No. 4 satin finish. Three inches high secured to floor with concrete anchors. Shoe to have enclosed bottom and is integral to structure of the compartment.

F. Headrail: Manufacturer's standard, Anodized Aluminum with anti-grip profile.

G. Pilaster Anchors: Floor Anchored/Overhead Braced.

H. Easy Stall shoe system, 1/4- by 2-inch screws attach Easy Stall shoe to floor. Pilaster to be inserted into shoe and secured after height adjusted. Leveling adjustment to be concealed by pilaster shoe. Height/leveling adjustment to be made via machine thread bolts inserted into threaded insert in bottom of pilaster.

PART 3 - EXECUTION

3.1 EXAMINATION AND PREPARATION

A. Inspect and prepare substrates using the methods recommended by the manufacturer for achieving best result for the substrates under Project conditions. Clean surfaces thoroughly prior to installation.
B. Do not proceed with installation until substrates have been prepared using the methods recommended by the manufacturer and deviations from manufacturer's recommended tolerances are corrected. Commencement of installation constitutes acceptance of conditions.
C. If preparation is the responsibility of another installer, notify Architect in writing of deviations from manufacturer's recommended installation tolerances and conditions.
    1. Verify dimensions of areas to receive compartments.
    2. Verify locations of built-in framing, anchorage, bracing, and plumbing fixtures.

3.2 INSTALLATION

A. Install in accordance with approved Shop Drawings and manufacturer's instructions.
B. Fasten components to adjacent materials and to other components using purpose-designed fastening devices.
C. Adjust pilaster anchors for substrate variations; conceal anchors with pilaster shoes.
D. Equip each compartment door with hinges and door latch.
E. Install door strike keeper on pilasters in alignment with door latch.
F. Equip each compartment door with one coat hook and bumper.
G. Installation Tolerances:
    1. Maximum variations from plumb or level: 1/8-inch.
    2. Clearance between wall surface and panels or pilasters: 1-1/2 inches maximum.

3.3 ADJUSTING

A. Adjust and align hardware to uniform clearance at vertical edge of doors.
B. Adjust adjacent components for consistency of line or plane.

3.4 PROTECTION

A. Protect installed products until completion of Project.
B. Touch-up, repair or replace damaged products before Substantial Completion.
C. Remove factory protective coverings and clean finish surfaces in accordance with manufacturer's instructions before substantial completion.

END OF SECTION

SECTION 10 21 16 - SOLID SURFACE SHOWER RECEPTORS AND WALLS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Solid Surface Shower Receptors.
   2. Solid Surface Wall.
B. Related Requirements:
   1. Division 01 Specification Sections apply to Work of this Section.

1.2 REFERENCES

A. American National Standards Institute (ANSI).
B. American with Disabilities Act Accessibility Guidelines (ADAAG).

1.3 SYSTEM DESCRIPTION

A. Performance Requirements: Provide shower receptors that conform to the following requirements of regulatory agencies and the quality control of manufacturer.
   1. Provide shower receptors and walls that conform to ANSI 124.1.2-2005 when tested for workmanship and finish, structural integrity and material characteristics.
   2. Fungal and Bacterial Resistance: Provide manufacturer recommended surface that does not support fungal and bacterial growth as tested in accordance with ASTM G21 and ASTM G22.

1.4 SUBMITTALS

A. Product Data: Manufacturer's printed product data for each type of shower receptors specified.
B. Samples: Verification samples minimum of 1-1/2- by 3-inch samples indicating color and pattern.
C. Manufacturer's Installation Instruction: Printed installation instructions for shower receptors.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in unopened factory packaging to the jobsite.
B. Inspect materials at delivery to assure that specified products have been received.
C. Store in original packaging in an interior climate controlled location away from direct sunlight.

1.6 PROJECT CONDITIONS

A. Environmental Requirements: Products must be installed in an interior climate controlled environment.

1.7 WARRANTY

A. Limited 10 Year Warranty against material and manufacturing defects.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Basis of Design Manufacturer: Inpro® Corporation, PO Box 406 Muskego, WI 53150 USA, Telephone: 800.222.5556, Fax: 888.715.8407, www.inprocorp.com.
B. Substitutions: Permitted.
C. Provide all shower receptors and wall panels from a single source.

2.2 MANUFACTURED UNITS

A. ADA Transfer Shower Receptor:
   1. Size to be 37-9/16 inches by 36-3/4 inches (36 inches by 36 inches finished).
   2. Drain Location:
      a. Center drain.
   3. Threshold:
      a. Integral ADA compliant threshold.
B. Shower Drain:
   1. Shower drain shall be Oatey number 42150, Brass, No-caulk, Drain w/Brass or Polished Stainless Steel Strainer. Drain body is sealed to shower base with a fiber and rubber washer. Drain is secured to 2-inch, 40 DWV pipe with a mechanically compressed gasket that does not require caulking. Drain top to accommodate 4-1/4-inch Universal Snap-Tite Strainer.
C. Solid Surface Sheet:
   1. 1/4-inch thickness:
      a. Sizes, width by length:
         1) 36 inches wide by 96-inch lengths.
         2) 60 inches wide by 96-inch lengths.
      b. Edge Options:
         1) Eased.

2.3 ACCESSORIES

A. Trim:
   1. Inside Corner Wedge Molding, 15/16-inch.
   2. Inside Corner Molding - L-Shaped, 1- by 1-inch.
   3. Batten Strip, 2-1/2 inches.
   4. Outside Corner Molding - L-Shaped 1- by 1-inch.
   5. Perimeter Trim, 2-1/2 inches by 1/2-inch.

6. Outside Corner Perimeter Trim, 2-1/2 inches by 1-inch.
7. Panel Molding, 2-1/4 inches by 13/16-inch.
8. Wall Base, 5 inches by 1/2-inch.
9. Beveled Edge Trim, 1-3/16 inches by 1/2-inch.

B. Recessed Dishes:
1. Oval Recessed Soap Dish, 9 inches by 8-3/4 inches.
2. Large Shower Caddy, 7-7/8 inches by 15 inches by 3-5/8 inches.

C. Solid Surface Bonding Adhesive.
D. Adhesive Cartridge Dispenser.
E. Adhesive Mixing Tips.
F. Silicone Adhesive/Sealant.

2.4 MATERIALS

A. Solid Surface: Shower receptors shall be manufactured from polyester/acrylic blended resins with natural filler material.
B. Receptor floor to be solid cast product with integral threshold and water barrier.

2.5 FINISHES

A. Select color from manufacturer's recommended color palette.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions in which shower receptors will be installed.

3.2 PREPARATION

A. General: Prior to installation, clean area to remove dust, debris and loose particles.

3.3 INSTALLATION

A. General: Install components plumb and level, scribe adjacent finishes, in accordance with approved shop drawings and recommended installation instructions.

3.4 CLEANING

A. At completion of the installation, clean surfaces in accordance with manufacturer's clean-up and maintenance instructions.

END OF SECTION

SECTION 10 22 39 - FOLDING PANEL PARTITIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Manually operated acoustical panel partitions.

B. Related Requirements:
1. Division 01 Specification Sections apply to Work of this Section.
2. Section 05 50 00 "Metal Fabrications" for supports that attach supporting tracks to overhead structural system.

1.2 DEFINITIONS

A. STC: Sound Transmission Class.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For operable panel partitions.
1. Include plans, elevations, sections, attachment details, and numbered panel installation sequence.
2. Indicate stacking and operating clearances. Indicate location and installation requirements for hardware and track, blocking, and direction of travel.
3. Include diagrams for power, signal, and control wiring.

C. Samples for Verification: For each type of exposed material, finish, covering, or facing, prepared on Samples of size indicated below:
1. Textile Facing Material: Full width by not less than 36-inch long section of fabric from dye lot to be used for the Work, with specified treatments applied. Show complete pattern repeat.

2. Panel Facing Material: Manufacturer's standard-size unit, not less than 3 inches square.
3. Panel Edge Material: Not less than 3 inches long.
4. Hardware: One of each exposed door-operating device.

D. Delegated Design Submittal: For operable panel partitions.
1. Include design calculations for seismic restraints that brace tracks to structure above.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
1. Partition track, track supports and bracing, switches, turning space, and storage layout.

2. Suspended ceiling components.
3. Structural members to which suspension systems will be attached.
4. Size and location of initial access modules for acoustical tile.
5. Items penetrating finished ceiling including the following:
    a. Lighting fixtures.
    b. HVAC ductwork, outlets, and inlets.
    c. Sprinklers.
    d. Access panels.
6. Plenum and acoustical barriers.

B. Setting Drawings: For embedded items and cutouts required in other work, including support-beam, mounting-hole template.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For operable panel partitions to include in maintenance manuals.
    1. In addition to items specified, include the following:
        a. Panel finish facings and finishes for exposed trim and accessories. Include precautions for cleaning materials and methods that could be detrimental to finishes and performance.
        b. Seals, hardware, track, track switches, carriers, and other operating components.

        c. Electric operator and controls.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same production run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
    1. Panel Finish-Facing Material: Furnish full width in quantity to cover both sides of two panels when installed.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protectively package and sequence panels in order for installation. Clearly mark packages and panels with numbering system used on Shop Drawings. Do not use permanent markings on panels.

1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of operable panel partitions that fail in materials or workmanship within specified warranty period.
    1. Failures include, but are not limited to, the following:
        a. Faulty operation of operable panel partitions.
        b. Deterioration of metals, metal finishes, and other materials beyond normal use.
    2. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design seismic bracing of tracks to structure above.

B. Seismic Performance: Operable panel partitions are to withstand the effects of earthquake motions determined according to ASCE/SEI 7.
   1. The term "withstand" means "the partition panels will remain in place without separation of any parts when subjected to the seismic forces specified."

C. Acoustical Performance: Provide operable panel partitions tested by a qualified testing agency for the following acoustical properties according to test methods indicated:
   1. Sound-Transmission Requirements: Operable panel partition assembly tested for laboratory sound-transmission loss performance according to ASTME90, determined by ASTM E413, and rated for not less than the STC indicated.

D. Fire-Test-Response Characteristics: Provide panels with finishes complying with one of the following as determined by testing identical products by a testing and inspecting agency acceptable to authorities having jurisdiction:
   1. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

   2. Fire Growth Contribution: Complying with acceptance criteria of local code and authorities having jurisdiction when tested according to NFPA 265 Method B Protocol or NFPA 286.

2.2 OPERABLE ACOUSTICAL PANELS

A. Operable Acoustical Panels: Partition system, including panels, seals, finish facing, suspension system, operators, and accessories.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Skyfold, Inc.
      b. Moderco Inc.
      c. Modernfold, Inc.
      d. Kwik-Wall, Inc.

B. Panel Operation: Manually operated, paired panels.

C. Panel Construction: As required to support panel from suspension components and with reinforcement for hardware attachment. Fabricate panels with tight hairline joints and concealed fasteners. Fabricate panels so finished in-place partition is rigid; level; plumb; aligned, with tight joints and uniform appearance; and free of bow, warp, twist, deformation, and surface and finish irregularities.

D. Dimensions: Fabricate operable acoustical panel partitions to form an assembled system of dimensions indicated and verified by field measurements.
   1. Panel Width: Equal widths.

E. STC: Not less than 52.

F. Panel Weight: 8 lb/sq. ft. maximum.

G. Panel Thickness: Maximum dimension of 3-1/2 inches.

H. Panel Materials:
1. Steel Frame: Steel sheet, manufacturer's standard nominal minimum thickness for uncoated steel.

2. Steel Face/Liner Sheets: Tension-leveled steel sheet, manufacturer's standard minimum nominal thickness for uncoated steel.

3. Aluminum: Alloy and temper recommended by aluminum producer and finisher for type of use, corrosion resistance, and finish indicated; ASTM B221 for extrusions; manufacturer's standard strengths and thicknesses for type of use.
a. Frame Reinforcement: Manufacturer's standard steel or aluminum.
4. Gypsum Board: ASTM C1396.
5. Cement Board: ASTM C1288.
6. Particleboard: ANSI A208.1.
7. Medium-Density Fiberboard: ANSI A208.2.
8. Plywood: DOC PS 1.

I. Panel Closure: Manufacturer's standard unless otherwise indicated.
1. Initial Closure: Resilient, bulb-shaped acoustical seal.

2. Final Closure: Constant-force, lever-operated mechanical closure expanding from panel edge to create a constant-pressure acoustical seal.

J. Hardware: Manufacturer's standard as required to operate operable panel partition and accessories; with decorative, protective finish.
1. Hinges: Manufacturer's standard.

2.3 SEALS

A. Description: Seals that produce operable panel partitions complying with performance requirements and the following:
1. Manufacturer's standard seals unless otherwise indicated.
2. Seals made from materials and in profiles that minimize sound leakage.
3. Seals fitting tight at contact surfaces and sealing continuously between adjacent panels and between operable panel partition perimeter and adjacent surfaces, when operable panel partition is extended and closed.

B. Horizontal Top Seals: Continuous-contact, resilient seal exerting uniform constant pressure on track resilient, mechanical, retractable, constant-force-contact seal exerting uniform constant pressure on track when extended.

C. Horizontal Bottom Seals:
1. Resilient, mechanical, retractable, constant-force-contact seal exerting uniform constant pressure on floor when extended, ensuring horizontal and vertical sealing and resisting panel movement.

2. Mechanically Operated for Acoustical Panels: Extension and retraction of bottom seal by operating handle or built-in operating mechanism, with operating range not less than 2 inches between retracted seal and floor finish.

2.4 PANEL FINISH FACINGS

A. Description: Finish facings for panels that comply with indicated fire-test-response characteristics and that are factory applied to operable panel partitions with appropriate backing, using mildew-resistant nonstaining adhesive as recommended by facing manufacturer's written instructions.
   1. Apply 1-piece, seamless facings free of air bubbles, wrinkles, blisters, and other defects, with invisible seams complying with Shop Drawings for location, and with no gaps or overlaps. Horizontal seams are not permitted. Tightly secure and conceal raw and selvage edges of facing for finished appearance.

B. Panel Fabric: Per Interior Material Legend.

C. Cap-Trimmed Edges: Protective perimeter-edge trim with tight hairline joints concealing edges of panel and finish facing, finished as follows:
   1. Aluminum: Finished with manufacturer's standard clear anodic finish.

2.5 SUSPENSION SYSTEMS

A. Tracks: Steel or aluminum mounted directly to overhead structural support, designed for operation, size, and weight of operable panel partition indicated. Size track to support partition operation and storage without damage to suspension system, operable panel partitions, or adjacent construction. Limit track deflection to no more than 0.10-inch between bracket supports. Provide a continuous system of track sections and accessories to accommodate configuration and layout indicated for partition operation and storage.
   1. Panel Guide: Aluminum guide on both sides of the track to facilitate straightening of the panels; finished with factory-applied, decorative, protective finish.

   2. Head Closure Trim: As required for acoustical performance; with factory-applied, decorative, protective finish.

B. Carriers: Trolley system as required for configuration type, size, and weight of partition and for easy operation; with ball-bearing wheels.
   1. Multidirectional Carriers: Capable of negotiating intersections without track switches.

C. Track Intersections, Switches, and Accessories: As required for operation, storage, track configuration, and layout indicated for operable panel partitions, and compatible with partition assembly specified. Fabricate track intersections and switches from steel or aluminum.
   1. L Intersections: Allow panels to change 90 degrees in direction of travel.

2. T Intersections: Allow panels to pass through or change 90 degrees to another direction of travel.
3. X Intersections: Allow panels to pass through or change travel direction full circle in 90-degree increments and allow 1 partition to cross track of another.

4. Multidirectional Switches: Adjustable switch configuring track into L, T, or X intersections and allowing panels to be moved in all pass-through, 90-degree change, and cross-over travel direction combinations.

2.6 ACCESSORIES

A. Storage Pocket Door: Full height at end of partition runs to conceal stacked partition; of same materials, finish, construction, thickness, and acoustical qualities as panels; complete with operating hardware and acoustical seals at soffit, floor, and jambs. Hinges in finish to match other exposed hardware.
   1. Manufacturer's standard method to secure storage pocket door in closed position.

B. Work Surfaces: Quantities, placement, and size indicated.
   1. Surface: Classrooms: Porcelain steel marker/projection surface. Cafeteria:
   2. Surface Color: As selected by Architect from manufacturer's full range.

   3. Size: Full width and height of panel.
   4. Trim: Aluminum slip-on or snap-on trim with no visible screws or exposed joints and with corners mitered to a neat, hairline joint.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine flooring, floor levelness, structural support, and opening, with installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of operable panel partitions.
B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install operable panel partitions and accessories after other finishing operations, including painting, have been completed in area of partition installation.
B. Install panels in numbered sequence indicated on Shop Drawings.
C. Broken, cracked, chipped, deformed, or unmatched panels are not acceptable.
D. Broken, cracked, deformed, or unmatched gasketing or gasketing with gaps at butted ends is not acceptable.

E. Light-Leakage Test: Illuminate 1 side of partition installation and observe vertical joints and top and bottom seals for voids. Adjust partitions for alignment and full closure of vertical joints and full closure along top and bottom seals. Perform test and make adjustments before NIC testing.

3.3 ADJUSTING

A. Adjust operable panel partitions, hardware, and other moving parts to function smoothly, and lubricate as recommended by manufacturer.

B. Adjust storage pocket doors to operate smoothly and easily, without binding or warping.

C. Verify that safety devices are properly functioning.

3.4 MAINTENANCE SERVICE

A. Maintenance Service: Beginning at Substantial Completion, maintenance service is to include 12 months' full maintenance by manufacturer's authorized service representative. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper operable-partition operation. Parts and supplies are to be manufacturer's authorized replacement parts and supplies.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain operable panel partitions.

END OF SECTION

SECTION 10 26 00 - WALL AND DOOR PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Rigid sheet wall protection.
   2. Rigid sheet.
   3. Adhesives.
B. Related Requirements:
   1. Division 01 Specification Sections apply to Work of this Section.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM).
B. International Standards Organization for Standardization (ISO).
C. National Fire Protection Association (NFPA).
D. National Sanitation Foundation (NSF).
E. Society of Automotive Engineers (SAE).
F. International Standards Organization for Standardization (ISO).

1.3 SYSTEM DESCRIPTION

A. Performance Requirements for Rigid Sheet:
   1. Fire Performance Characteristics:
      a. Class A fire rating.
      b. Surface burning per ASTM E84.
         1) Flame spread of 25 or less and smoke development of 450 or less.
   2. Chemical and Stain Resistance in accordance with ASTM D543:
      a. “No Change” from reagents.
   3. Effect of Household Chemicals in accordance with ASTM D1308:
      a. “No Change” from reagents.
   4. Mold Growth Resistance in accordance with ASTM D3273:
      a. No growth.
   5. Abrasion Resistance in accordance with ASTM D4060:
      a. Result: 0.01 percent weight loss; CS-17 wheels 1,000-gram weight at 25 cycles.
   6. Impact Resistance in accordance to ASTM D4226:
      a. Mean failure energy of 11.5 in-lbs.
   7. Fungi Resistance in accordance to ASTM G21 and ISO 846 method A:
      a. Shall show no fungal growth.
   8. Bacterial Resistance in accordance to ASTM G22 and ISO 846 method C:
      a. Shall show no bacterial growth.
   9. Effect of Liquids in accordance with ISO 2812:
      a. Shall have a “0” rating (no effect) from reagents.

10. Cleanroom Particle Concentration:
    a. An ISO class number of “Class 6” when evaluated using the test procedure outlined in VDI 2083-17 2013 section 6.2 (Particle Emission) and classified using ISO 14644.1-2015.
    b. Provide Achieves a classification of "Class 5" when utilizing Federal Standard 209E for the determination for classification.
11. Indoor Air Quality: ISO 16000-9.
    a. TVOC concentration of <5 µg/m3 and Styrene concentration was <1 µg/m3.
12. GREENGUARD Certified.
13. Color Consistency: Provide components matched in accordance with SAE J-1545 - (Delta E) with a color difference no greater than 1.0 units using CIE Lab, CIE CMC, CIE LCh, Hunter Lab or similar color space scale systems.
14. NSF Certified.

1.4 SUBMITTALS

A. Product Data: Manufacturer's printed product data for each type of specified.
B. Detail Drawings: Mounting details with the appropriate adhesives for specific Project substrates.
C. Samples: Verification samples of rigid sheet, 5 by 8 inches piece of each type and color indicated.
D. Manufacturer's Installation Instruction: Printed installation instructions.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in unopened factory packaging to the job site
B. Inspect materials at delivery to assure that specified products have been received.
C. Store in original packaging in a climate-controlled location away from direct sunlight.

1.6 PROJECT CONDITIONS

A. Environmental Requirements: Products must be installed in an interior climate-controlled environment. Do not install products under environmental conditions outside of manufacturer's defined limitations.

1.7 WARRANTY

A. Standard manufacturer Limited Lifetime Warranty against material and manufacturing defects.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Basis-Of-Design Product: Inpro Corporation, IPC Door and Wall Protection Systems, PO Box 406 Muskego, WI 53150 USA; Telephone: 800.222.5556, Fax: 888.715.8407, Website: www.inprocorp.com.
   1. Submit comparable products of one the following for approval by Architect:
      a. Insert name of manufacture of comparable product.
      b. Submit requests for substitution in accordance with Instructions to Bidders and Division 01 General Requirements.

2.2 MANUFACTURED UNITS

A. Basis of Design: Inpro Continuum™ Rigid Sheet:
   1. Sheet Size:
      a. 4 by 10 feet, 0.080 inches equal to 5/64-inch, 61010-XXXX, Available.
   2. Finishes:
      a. As indicated on Interior Material Legend.

B. Accessories:
   1. Trim:
      a. Top Cap; Length: 10 feet – 61710.
      b. Vertical Divider Bar; Length: 10 feet – 61810.
      c. Inside Corner; Length: 10 feet – 61910.
      d. Outside Corner; Length: 10 feet – 62010.

C. Corner Wraps:
      a. 6-Inch Inside Corner Wrap - 696NIC.
      b. 6-Inch Outside Corner Wrap - 696NOC.
      c. End Wall Wrap - 696EW (Note: Custom per condition, provide field measured order form).
      d. Z-Wrap - 696EWZ (Note: Custom per condition, provide field measured order form).
   2. Color Matched Caulk:
      a. Coordinating with sheet color.

2.3 MATERIALS

A. Vinyl Sheet: Rigid Sheet shall be manufactured from 100 percent chemical and stain-resistant unplasticized polyvinyl chloride (uPVC). No plasticizers shall be added (plasticizers may aid in bacterial growth).

B. Extruded Vinyl: Vinyl Trims shall be manufactured from 100 percent chemical and stain-resistant unplasticized polyvinyl chloride (uPVC). No plasticizers shall be added (plasticizers may aid in bacterial growth).

2.4 ACCESSORIES

A. Top caps, inside corners, divider bars, and outside corners shall be made of extruded uPVC.
B. Color Match Caulk to be made of pick-resistant shore 50A sealant.
C. Adhesives shall be supplied by Inpro to ensure proper installation.
   1. Non-Porous Adhesive 548.

2.5 FINISHES

A. As indicated on Interior Material Legend in Drawings.
B. Vinyl Accessories: Top caps, inside corners, divider bars and outside corners shall be of a color matching the rigid sheet.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions in which the rigid sheet will be installed.
   1. Complete all finishing operations, including painting, before beginning installation of materials.
B. Wall surface shall be dry and free from dirt, grease, and loose paint.

3.2 PREPARATION

A. General: Prior to installation, clean the substrate to remove dust, debris and loose particles.
B. Acclimate product in temperatures between 65 to 80 degrees F and humidity level less than 80 percent, 24 hours before installation.
C. The area of installation must be temperature and humidity controlled for at least 48 hours after installation.

3.3 INSTALLATION

A. General: Locate the rigid sheet as indicated on the approved detail drawing for the appropriate substrate and in compliance with the Manufacturer installation instructions. Install level and plumb at the height indicated on the Drawings.
   1. Adhere to the substrate with specified adhesive appropriate for wall construction, trowel on, and allow approximately 20 minutes working time before firming.
   2. Apply sheet to the wall, ensure the sheet is square to previous, and maintain 1/8-inch gap at seam. Use an extension roller to adhere the sheet to the wall.

3.4 CLEANING

A. At the completion of the installation, clean surfaces in accordance with the manufacturer clean-up and maintenance instructions.

END OF SECTION

SECTION 10 28 13 - TOILET ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Public-use washroom accessories.
B. Related Requirements:
   1. Division 01 Specification Sections apply to Work of this Section.

1.2 COORDINATION

A. Coordinate accessory locations with other Work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.
B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
   2. Include anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
   3. Include electrical characteristics.
B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.
   1. Identify locations using room designations indicated.
   2. Identify accessories using designations indicated.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For accessories to include in maintenance manuals.

1.5 WARRANTY

A. Manufacturer's Special Warranty for Mirrors: Manufacturer agrees to repair or replace mirrors that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, visible silver spoilage defects.
   2. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PUBLIC-USE WASHROOM ACCESSORIES

A. Source Limitations: Obtain public-use washroom accessories from single source from single manufacturer.
B. Toilet Tissue (Roll) Dispenser (TPD):
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   2. Basis-of-Design Product: Subject to compliance with requirements, provide Bobrick B-2740 or comparable product by one of the following:
      a. A&J Washroom Accessories, Inc.
      b. American Specialties, Inc.; ASI Group.
      c. Bobrick Washroom Equipment, Inc.
      d. Bradley Corporation.
      e. Architect approved equivalent.
   3. Description: Double-roll dispenser.
   4. Mounting: Surface mounted.
   5. Operation: Noncontrol delivery with standard spindle.
   6. Capacity: Designed for 4-1/2 or 5 inches.
   7. Material and Finish: Satin-finish aluminum bracket with plastic spindle.
C. Paper Towel (Folded) Dispenser (PTDWR):
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   2. Basis-of-Design Product: Subject to compliance with requirements, provide Bobrick B-29744 or comparable product by one of the following:
      a. A&J Washroom Accessories, Inc.
      b. American Specialties, Inc.; ASI Group.
      c. Bobrick Washroom Equipment, Inc.
      d. Bradley Corporation.
      e. Architect approved equivalent.
   3. Mounting: Surface mounted.
   4. Minimum Capacity: 800 feet-0 inches roll.
   5. Material and Finish: Stainless steel, No. 4 finish (satin).
   6. Lockset: Tumbler type.
D. Liquid-Soap Dispenser (SD):
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   2. Basis-of-Design Product: Subject to compliance with requirements, provide Bobrick B-211 or comparable product by one of the following:
      a. A&J Washroom Accessories, Inc.
      b. American Specialties, Inc.; ASI Group.
      c. Bobrick Washroom Equipment, Inc.
      d. Bradley Corporation.
      e. Architect approved equivalent.

3. Description: Designed for dispensing soap in liquid or lotion form.
4. Mounting: Vertically oriented, surface mounted.
5. Capacity: 34 ounces.
6. Materials: Stainless Steel.
7. Lockset: Tumbler type.
8. Refill Indicator: Window type.

E. Grab Bar:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide Bobrick B-6806 or comparable product by one of the following:
   a. A&J Washroom Accessories, Inc.
   b. American Specialties, Inc.; ASI Group.
   c. Bobrick Washroom Equipment, Inc.
   d. Bradley Corporation.
   e. Architect approved equivalent.
3. Mounting: Flanges with concealed fasteners.
4. Material: Stainless steel, 0.05-inch-thick.
   a. Finish: Smooth, No. 4 finish (satin).
5. Outside Diameter: 1-1/2 inches.
6. Configuration and Length: As indicated on Drawings.

F. Mirror Unit (M1):
1. Subject to compliance with requirements below.
2. Beveled edge – cut to fit size per Drawings. Mirrors to be tempered for safety
3. Frame: Per Drawings.
4. Hangers: Produce rigid, tamper- and theft-resistant installation, using method indicated below.
   a. Wall bracket of galvanized steel, equipped with concealed locking devices requiring a special tool to remove.
5. Size: Per Drawings.

G. Sanitary Napkin Disposal:
1. Basis of Design Product: Bobrick B-4354.
2. Surface mounted with concealed fasteners.
3. Material: Stainless steel brushed.
4. Provide 1 in each female toilet stall.

H. Mobile Devices Holder:
1. Basis of Design Product: Bobrick Klutch B-635.
2. Surface mounted with concealed fasteners.
3. Material: Stainless steel brushed.
4. Provide 1 in each toilet stall (Men and Women).

I. Stainless Steel Shelf:
1. Basis of Design Product: Bobrick 295 series.
2. Surface mounted with concealed fasteners.
3. Material: Stainless steel brushed.
4. Provide 1 in each toilet stall (Men and Women).
5. Size: Per Drawings.

J. Electric Hand Dryer:
   1. Basis of Design Product: Dyson Airblade V AB12.
   2. Mounting per manufacturer recommendations.
   3. Material: Stainless steel brushed.
   4. Refer to Drawings for location and electrical connection

2.2 MATERIALS

A. Stainless Steel: ASTM A666, Type 304, 0.031-inch minimum nominal thickness unless otherwise indicated.
B. Galvanized-Steel Sheet: ASTM A653, with G60 hot-dip zinc coating.
C. Issued for Regulatory Approval, Permitting, or Construction.
D. Galvanized-Steel Mounting Devices: ASTM A153, hot-dip galvanized after fabrication.
E. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.
F. Chrome Plating: ASTM B56, Service Condition Number SC 2 (moderate service).
G. Mirrors: ASTM C1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 millimeters thick.

2.3 FABRICATION

A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.
B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of 6 keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
B. Grab Bars: Install to withstand a downward load of at least 250 lbf, when tested according to ASTM F446.
C. Prior to full installation provide mockup on site for coordination and verification with Owner.

3.2 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.
B. Remove temporary labels and protective coatings.
C. Clean and polish exposed surfaces according to manufacturer's written instructions.

END OF SECTION

SECTION 10 44 13 - FIRE PROTECTION CABINETS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Fire-protection cabinets for the following:
a. Portable fire extinguisher.
B. Related Requirements:
1. Division 01 Specification Sections apply to Work of this Section.

2. Section 10 44 16 "Fire Extinguishers" for portable, hand-carried fire extinguishers accommodated by fire-protection cabinets

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.
1. Show door hardware, cabinet type, trim style, and panel style. Include roughing-in dimensions and details showing recessed-, semirecessed-, or surface-mounting method and relationships of box and trim to surrounding construction.

B. Shop Drawings: For fire-protection cabinets.
1. Include plans, elevations, sections, details, and attachments to other Work.

C. Samples: For each type of exposed finish required.
D. Samples for Verification: For each type of exposed finish required, prepared on samples 6 by 6 inches square.
E. Product Schedule: For fire-protection cabinets. Indicate whether recessed, semirecessed, or surface mounted. Coordinate final fire-protection cabinet schedule with fire-extinguisher schedule to ensure proper fit and function. Use same designations indicated on Drawings.

1.3 COORDINATION

A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

B. Coordinate sizes and locations of fire-protection cabinets with wall depths.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain fire-protection cabinets, accessories, and fire extinguishers from single source from single manufacturer.

2.2 FIRE-PROTECTION CABINET (FEC)

A. Cabinet Type: Suitable for fire extinguisher.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Activar Construction Products Group, Inc. - JL Industries.
      b. Larsens Manufacturing Company.
      c. Potter Roemer LLC; a Division of Morris Group International.

B. Cabinet Material: Cold-rolled steel sheet.
C. Semi-recessed Cabinet: One-piece combination trim and perimeter door frame overlapping surrounding wall surface, with exposed trim face and wall return at outer edge (backbend).

D. Cabinet Trim and Door Material: Steel sheet.
E. Door Style: Fully glazed panel with frame.
F. Door Glazing: Tempered float glass (clear).
G. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated. Provide manufacturer's standard hinge, permitting door to open 180 degrees.
H. Accessories:
   1. Door Lock: Cam lock that allows door to be opened during emergency by pulling sharply on door handle.
   2. Identification: Verify lettering with authorities having jurisdiction for letter style, size, spacing, and location.
      a. Identify fire extinguisher in fire-protection cabinet with the words "FIRE EXTINGUISHER."
         1) Location: Applied to cabinet door.
         2) Lettering Color: Red.
         3) Orientation: Vertical.
I. Materials:
   1. Cold-Rolled Steel: ASTM A1008, Commercial Steel (CS), Type B.
      a. Finish: Baked enamel, TGIC polyester powder coat, HAA polyester powder coat, epoxy powder coat, or polyester/epoxy hybrid powder coat, complying with AAMA 2603.

      b. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

      c. Color: As selected by Architect from manufacturer's standard range.
   2. Tempered Float Glass: ASTM C1048, Kind FT, Condition A, Type I, Quality q3, 3 mm thick, Class 1 (clear).

2.3 FABRICATION

A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.
   1. Weld joints and grind smooth.
   2. Miter corners and grind smooth.
   3. Provide factory-drilled mounting holes.

B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles.
   1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2-inch thick.
   2. Miter and weld perimeter door frames and grind smooth.
C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.4 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's AMP 500, "Metal Finishes Manual for Architectural and Metal Products," for recommendations for applying and designating finishes.
B. Protect mechanical finishes on exposed surfaces of fire-protection cabinets from damage by applying a strippable, temporary protective covering before shipping.
C. Finish fire-protection cabinets after assembly.
D. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls and partitions for suitable framing depth and blocking where semi-recessed cabinets will be installed.
B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare recesses for semi-recessed fire-protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

A. General: Install fire-protection cabinets in locations and at mounting heights indicated in Drawings. If not indicated in Drawings, at height indicated below:
   1. General Fire-Protection Cabinet Mounting Height: 42 inches above finished floor to top of fire extinguisher.

B. Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb.
   1. Fasten mounting brackets to inside surface of fire-protection cabinets, square and plumb.

C. Identification:
   1. Apply vinyl lettering on field-painted fire-protection cabinets after painting is complete.

3.4 ADJUSTING AND CLEANING

A. Remove temporary protective coverings and strippable films, if any, as fire-protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.
B. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.
C. On completion of fire-protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.
D. Touch up marred finishes or replace fire-protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire-protection cabinet and mounting bracket manufacturers.
E. Replace fire-protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 10 44 16 - FIRE EXTINGUISHERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Portable, hand-carried fire extinguishers.
   2. Mounting brackets for fire extinguishers.
B. Related Requirements:
   1. Divisions 01 Specification Sections apply to Work of this Section.
   2. Section 10 44 13 "Fire Protection Cabinets."

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher and mounting brackets.
B. Product Schedule: For fire extinguishers. Coordinate final fire-extinguisher schedule with fire-protection cabinet schedule to ensure proper fit and function. Use same designations indicated on Drawings.

1.3 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

1.4 COORDINATION

A. Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.

1.5 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Failure of hydrostatic test according to NFPA 10.
      b. Faulty operation of valves or release levers.
   2. Warranty Period: 6 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."
B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.
    1. Provide fire extinguishers approved, listed, and labeled by FM Global.

2.2 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

A. Fire Extinguishers: Type, size, and capacity for each fire-protection cabinet (FEC) and mounting bracket (FEB) indicated.
    1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
        a. JL Industries, Inc.; a division of the Activar Construction Products Group.
        b. Larsens Manufacturing Company.
        c. Potter Roemer LLC.
    2. Valves: Manufacturer's standard.
    3. Handles and Levers: Manufacturer's standard.
    4. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B, and bar coding for documenting fire-extinguisher location, inspections, maintenance, and recharging.
B. Multipurpose Dry-Chemical Type in Steel Container: UL-rated 3-A:40-B:C, 5-lb nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.

2.3 MOUNTING BRACKETS (FEB)

A. Mounting Brackets: Manufacturer's standard steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or red baked-enamel finish.
    1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
        a. Guardian Fire Equipment, Inc.
        b. JL Industries, Inc.; a division of the Activar Construction Products Group.
        c. Larsens Manufacturing Company.
B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.
    1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.
        a. Orientation: Vertical.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fire extinguishers for proper charging and tagging.
   1. Remove and replace damaged, defective, or undercharged fire extinguishers.
B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install fire extinguishers in locations indicated and in compliance with requirements of authorities having jurisdiction.
   1. Mounting Brackets:
      a. Fire extinguishers weighing 40 pounds or less: 54 inches above finished floor to top of cabinet.
      b. Fire extinguishers weighing more than 40 pounds: 42 inches above finished floor to top of cabinet.
B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION

SECTION 12 24 13 - ROLLER WINDOW SHADES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Manually operated roller shades with single and double rollers.
B. Related Requirements:
   1. Division 01 Specification Sections apply to Work of this Section.
   2. Section 06 10 00 "Rough Carpentry" for wood blocking and grounds for mounting roller shades and accessories.
   3. Section 07 92 00 "Joint Sealants" for sealing the perimeters of installation accessories for light-blocking shades with a sealant.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, features, finishes, and operating instructions for roller shades.
B. Shop Drawings: Show fabrication and installation details for roller shades, including shadeband materials, their orientation to rollers, and their seam and batten locations.
C. Samples for Verification: For each type of roller shade.
   1. Shadeband Material: Not less than 3 inches square. Mark interior face of material if applicable.
   2. Installation Accessories: Full-size unit, not less than 10 inches long.
D. Product Schedule: For roller shades. Use same designations indicated on Drawings.

1.3 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each type of shadeband material, for tests performed by manufacturer and witnessed by a qualified testing agency.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For roller shades to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.
B. Mockups: Build mockups to verify selections made under sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.
   1. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver roller shades in factory packages, marked with manufacturer, product name, and location of installation using same designations indicated on Drawings.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not install roller shades until construction and finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
B. Field Measurements: Where roller shades are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operating hardware of operable glazed units through entire operating range. Notify Architect of installation conditions that vary from Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 - PRODUCTS

2.1 MANUALLY OPERATED SHADES WITH SINGLE ROLLERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Draper Inc.
   2. Hunter Douglas Contract.
   3. MechoShade Systems, Inc.
   4. Timberblind.

B. Chain-and-Clutch Operating Mechanisms: With continuous-loop bead chain and clutch that stops shade movement when bead chain is released; permanently adjusted and lubricated.
   1. Bead Chains: Manufacturer's standard.
      a. Loop Length: Full length of roller shade.
      b. Limit Stops: Provide upper and lower ball stops.
      c. Chain-Retainer Type: Clip, jamb mount.
   2. Spring Lift-Assist Mechanisms: Manufacturer's standard for balancing roller shade weight and for lifting heavy roller shades.
      a. Provide for shadebands that weigh more than 10 pounds or for shades as recommended by manufacturer, whichever criterion is more stringent.

C. Crank-and-Gear Operating Mechanisms: Sealed gearbox drive system controlled by crank handle.
   1. Crank-Handle Type: Permanently mounted.

D. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.
   1. Roller Drive-End Location: Right side of interior face of shade.
   2. Direction of Shadeband Roll: Regular, from back (exterior face) of roller.
   3. Shadeband-to-Roller Attachment: Manufacturer's standard method.

E. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.

F. Roller-Coupling Assemblies: Coordinated with operating mechanism and designed to join up to three inline rollers into a multiband shade that is operated by one roller drive-end assembly.

G. Shadebands:
   1. Shadeband Material: Light-filtering fabric.
   2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.
      a. Type: Enclosed in sealed pocket of shadeband material.
      b. Color and Finish: As selected by Architect from manufacturer's full range.

H. Installation Accessories:
   1. Exposed Headbox: Rectangular, extruded-aluminum enclosure including front fascia, top and back covers, endcaps, and removable bottom closure.
      a. Height: Manufacturer's standard height required to enclose roller and shadeband assembly when shade is fully open, but not less than 3 inches.
   2. Installation Accessories Color and Finish: As selected from manufacturer's full range.

2.2 MANUALLY OPERATED SHADES WITH DOUBLE ROLLERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Draper Inc.
   2. Hunter Douglas Contract.
   3. MechoShade Systems, Inc.
   4. Timberblind.

B. Chain-and-Clutch Operating Mechanisms: With continuous-loop bead chain and clutch that stops shade movement when bead chain is released; permanently adjusted and lubricated.
   1. Bead Chains: Manufacturer's standard.
      a. Loop Length: Full length of roller shade.
      b. Limit Stops: Provide upper and lower ball stops.
      c. Chain-Retainer Type: Clip, jamb mount.
   2. Spring Lift-Assist Mechanisms: Manufacturer's standard for balancing roller shade weight and for lifting heavy roller shades.
      a. Provide for shadebands that weigh more than 10 pounds or for shades as recommended by manufacturer, whichever criterion is more stringent.

C. Crank-and-Gear Operating Mechanisms: Sealed gearbox drive system controlled by crank handle.
   1. Crank-Handle Type: Permanently mounted.

D. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.
   1. Double-Roller Mounting Configuration: Offset, outside roller over and inside roller under.
   2. Inside Roller:
      a. Drive-End Location: Right side of interior face of shade.
      b. Direction of Shadeband Roll: Regular, from back (exterior face) of roller.
   3. Outside Roller:
      a. Drive-End Location: Right side of interior face of shade.
      b. Direction of Shadeband Roll: Regular, from back (exterior face) of roller.
   4. Shadeband-to-Roller Attachment: Manufacturer's standard method.

E. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller mounting configuration, roller assemblies, operating mechanisms, installation accessories, and installation locations and conditions indicated.

F. Roller-Coupling Assemblies: Coordinated with operating mechanism and designed to join up to three inline rollers into a multiband shade that is operated by one roller drive-end assembly.

G. Inside Shadebands:
   1. Shadeband Material: Light-filtering fabric.
   2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.
      a. Type: Enclosed in sealed pocket of shadeband material.
      b. Color and Finish: As selected by Architect from manufacturer's full range.

H. Outside Shadebands:
   1. Shadeband Material: Light-blocking fabric.
   2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.
      a. Type: Enclosed in sealed pocket of shadeband material.
      b. Color and Finish: As selected by Architect from manufacturer's full range.

I. Installation Accessories:
   1. Exposed Headbox: Rectangular, extruded-aluminum enclosure including front fascia, top and back covers, endcaps, and removable bottom closure.
      a. Height: Manufacturer's standard height required to enclose roller and shadeband assembly when shade is fully open, but not less than 4 inches.
   2. Side Channels: With light seals and designed to eliminate light gaps at sides of shades as shades are drawn down. Provide side channels with shadeband guides or other means of aligning shadebands with channels at tops.
   3. Methods of sealing light gaps at bottoms of shades vary among manufacturers. Shadeband bottom bars fit into bottom channels or butt against bottom angles to seal light leaks.Bottom (Sill) Channel or Angle: With light seals and designed to eliminate light gaps at bottoms of shades when shades are closed.
   4. Installation Accessories Color and Finish: As selected from manufacturer's full range.

2.3 SHADEBAND MATERIALS

A. Shadeband Material Flame-Resistance Rating: Comply with NFPA 701. Testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

B. Light-Filtering Fabric: Woven fabric, stain and fade resistant.
   1. Source: Roller shade manufacturer.
   2. Type: Fiberglass and Vinyl.
   3. Thickness: 0.027-inch.
   4. Weight: 12.48.
   5. Roll Width: 98 inches.
   6. Orientation on Shadeband: Up the bolt.
   7. Openness Factor: 5 percent.
   8. Color: As indicated on Interior Material Legends.

C. Light-Blocking Fabric: Opaque fabric, stain and fade resistant.
   1. Source: Roller shade manufacturer.
   2. Type: Fiberglass and acrylic
   3. Thickness: 0.021-inch.
   4. Weight:14.7 ounces per square yard.

5. Roll Width: 94.5 inches.
6. Orientation on Shadeband: Up the bolt.
7. Color: As indicated on Interior Material Legend.

2.4 ROLLER SHADE FABRICATION

A. Product Safety Standard: Fabricate roller shades to comply with WCMA A 100.1, including requirements for flexible, chain-loop devices; lead content of components; and warning labels.
B. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows, measured at 74 degrees F:
   1. Between (Inside) Jamb Installation: Width equal to jamb-to-jamb dimension of opening in which shade is installed less 1/4-inch per side or 1/2-inch total, plus or minus 1/8-inch. Length equal to head-to-sill or -floor dimension of opening in which shade is installed less 1/4-inch, plus or minus 1/8-inch.
C. Shadeband Fabrication: Fabricate shadebands without battens or seams to extent possible, except as follows:
   1. Vertical Shades: Where width-to-length ratio of shadeband is equal to or greater than 1:4, provide battens and seams at uniform spacings along shadeband length to ensure shadeband tracking and alignment through its full range of movement without distortion of the material.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with installer present, for compliance with requirements for installation tolerances, operational clearances, and other conditions affecting performance of the Work.
B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 ROLLER SHADE INSTALLATION

A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions.
   1. Opaque Shadebands: Located so shadeband is not closer than 2 inches to interior face of glass. Allow clearances for window operation hardware.
B. Electrical Connections: Connect motor-operated roller shades to building electrical system.
C. Roller Shade Locations: At exterior windows as indicated on Drawings.

3.3 ADJUSTING

A. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

3.4 CLEANING AND PROTECTION

A. Clean roller shade surfaces, after installation, according to manufacturer's written instructions.
B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that roller shades are without damage or deterioration at time of Substantial Completion.
C. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain motor-operated roller shades.

END OF SECTION

SECTION 12 36 23.13 - PLASTIC-LAMINATE-CLAD COUNTERTOPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Plastic-laminate-clad countertops.
2. Accessories.

B. Related Requirements:
1. Division 01 Specification Sections apply to Work of this Section.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.
1. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.

B. Shop Drawings:
1. Plans, sections, details, edge and backsplash profiles, and attachments to other work.
2. Locations and details of joints.
3. Locations and sizes of cutouts and holes for items installed in countertop.
4. Apply AWI's Quality Certification or WI's Certified Compliance Program label to Shop Drawings.

C. Samples for Verification:
1. Plastic Laminates: For each type, color, pattern, and surface finish required, 8 by 10 inches in size.
2. Wood-Grain Plastic Laminates: For each type, color, pattern, and surface finish required, 12 by 24 inches in size.
3. Fabrication Sample: For each type and profile of countertop required, provide one sample applied to core material with specified edge material applied to one edge.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Indicate locations and sizes of cutouts and holes for items installed in countertop and backsplashes.

1.4 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.
1. Shop Certification: AWI's Quality Certification Program accredited participant or WI's Certified Compliance Program licensee.

B. Installer Qualifications: Fabricator of products, AWI's Quality Certification Program accredited participant, or WI's Certified Compliance Program licensee.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver countertops only after casework and supports on which they will be installed have been completed in installation areas.
B. Store countertops in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.
C. Keep surfaces of countertops covered with protective covering during handling and installation.

1.6 FIELD CONDITIONS

A. Environmental Limitations without Humidity Control: Do not deliver or install countertops until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels planned for building occupants during the remainder of the construction period.
B. Environmental Limitations with Humidity Control: Do not deliver or install countertops until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 degrees F and relative humidity between 25 and 55 percent during the remainder of the construction period.
C. Field Measurements: Where countertops are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
D. Established Dimensions: Where countertops are indicated to fit to other construction, establish dimensions for areas where countertops are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 PLASTIC-LAMINATE-CLAD COUNTERTOPS

A. Plastic-Laminate-Clad Countertop Type:
B. Quality Standard: Unless otherwise indicated, comply with ANSI/AWI 1236 for grades of plastic-laminate-clad countertops indicated for construction, finishes, installation, and other requirements.
C. Grade: Custom.
D. High-Pressure Decorative Laminate: ISO 4586-3, Grade HGS.
    1. Manufacturers: Subject to compliance with requirements, provide products by the following:
        a. As indicated on Interior Material Legend.
E. 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 sample on Interior Material Legend.

F. Edge Treatment: PVC edging.
G. Core Thickness: 3/4-inch.
   1. Build up countertop thickness to 1-1/2 inches at front, back, and ends with additional layers of core material laminated to top, bullnose edge.
H. Backer Sheet: Provide plastic-laminate backer sheet, ISO 4586-3, grade to match exposed surface, on underside of countertop substrate.
I. Paper Backing: Provide paper backing on underside of countertop substrate.

2.2 ACCESSORIES

A. Grommets:
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Doug Mockett & Company, Inc.
   2. Wire-Management Grommets: Circular, grommets and matching caps with slot for wire passage.
      a. Finish: Metal.
      b. Outside Diameter: 2 inches.
      c. Color: Brushed, nickel plated.

2.3 WOOD MATERIALS

A. Wood Products: Provide materials that comply with requirements of referenced quality standard unless otherwise indicated.
B. Composite Panel Products: Provide materials that comply with requirements of referenced quality standard for each type of countertop and quality grade specified unless otherwise indicated.
   1. Particleboard: ANSI A208.1.

2.4 MISCELLANEOUS MATERIALS

A. Adhesive for Bonding Plastic Laminate: As selected by fabricator to comply with requirements.
   1. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.
B. Installation Adhesive: Manufacturer's standard product that is recommended for application indicated.
   1. Verify adhesives have a VOC content of 70 g/L or less.

2.5 FABRICATION

A. Fabricate countertops to dimensions, profiles, and details indicated. Provide front and end overhang of 1 inch over base cabinets. Ease edges to radius indicated for the following:
   1. Solid-Wood (Lumber) Members: 1/16-inch unless otherwise indicated.

B. Complete fabrication, including assembly, to maximum extent possible before shipment to Project Site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
   1. Notify Architect 7 days in advance of dates and times countertop fabrication will be complete.
   2. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended, and check measurements of assemblies against field measurements before disassembling for shipment.

C. Shop cut openings to maximum extent possible to receive appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately, and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.
   1. Seal edges of cutouts by saturating with varnish.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates to receive countertops and conditions under which countertops will be installed, with installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of countertops.
B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Before installation, condition countertops to average prevailing humidity conditions in installation areas.
B. Examine shop-fabricated work for completion and complete work as required, including removal of packing.

3.3 INSTALLATION

A. Grade: Install countertops to comply with same grade as item to be installed.
B. Assemble countertops and complete fabrication at Project Site to extent that it was not completed in the shop.
   1. Seal edges of cutouts by saturating with varnish.
C. Field Jointing: Where possible, make in the same manner as shop jointing, using dowels, splines, adhesives, and fasteners recommended by manufacturer. Prepare edges to be joined in shop so Project-Site processing of top and edge surfaces is not required. Locate field joints where indicated on Shop Drawings.
   1. Secure field joints in countertops with concealed clamping devices located within 6 inches of front and back edges and at intervals not exceeding 24 inches. Tighten in accordance with manufacturer's written instructions to exert a constant, heavy-clamping pressure at joints.

D. Countertop Installation:
   1. Scribe and cut countertops to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
   2. Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.
   3. Anchor wall cleating necessary for proper setting for countertops not supported by casework.
   4. Install countertops level and true in line. Use concealed shims as required to maintain not more than 1/8-inch-in-96-inch variation from a straight, level plane.
   5. Secure backsplashes to walls with adhesive.
   6. Seal joints between countertop and backsplash, if any, and joints where countertop and backsplash abut walls with mildew-resistant silicone sealant or another permanently elastic sealing compound recommended by countertop material manufacturer.

3.4 ADJUSTING AND CLEANING

A. Repair damaged and defective countertops, where possible, to eliminate functional and visual defects. Where impossible to repair, replace countertops. Adjust joinery for uniform appearance.
B. Clean countertops on exposed and semiexposed surfaces.
C. Protection: Provide kraft paper or other suitable covering over countertop surfaces, taped to underside of countertop at a minimum of 48 inches o.c. Remove protection at Substantial Completion.

END OF SECTION

SECTION 12 36 61.16 - SOLID SURFACING COUNTERTOPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Solid surface material countertops.
   2. Solid surface material backsplashes.
   3. Solid surface material end splashes.
   4. Solid surface material sinks.

B. Related Requirements:
   1. Division 01 Specification Sections apply to Work of this Section.

1.2 ACTION SUBMITTALS

A. Product Data: For countertop materials and sinks.

B. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.
   1. Show locations and details of joints.
   2. Show direction of directional pattern, if any.

C. Samples for Verification: For the following products:
   1. Countertop material, 6 inches square.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: For solid surface material countertops to include in maintenance manuals. Include product data for care products used or recommended by installer and names, addresses, and telephone numbers of local sources for products.

1.4 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate countertops similar to that required for this Project, and whose products have a record of successful in-service performance. Provide 5 years of documented experience in similar projects.

B. Installer Qualifications: Fabricator of countertops.

1.5 FIELD CONDITIONS

A. Field Measurements: Verify dimensions of countertops by field measurements after base cabinets are installed but before countertop fabrication is complete.

1.6 COORDINATION

A. Coordinate locations of utilities that will penetrate countertops or backsplashes.

PART 2 - PRODUCTS

2.1 SOLID SURFACE COUNTERTOP MATERIALS

A. Solid Surface Material: Homogeneous-filled plastic resin complying with ISFA 2-01.
   1. Manufacturers: Basis of design and subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. As indicated on Interior Material Legend in Drawings.
   2. Type: Provide Standard type or Veneer type made from material complying with requirements for Standard type, as indicated unless Special Purpose type is indicated.
   3. Integral Sink Bowls: Comply with CSA B45.5/IAPMO Z124.
      a. LG Hausys ADA Vanity 1419. Coordinate connections with Plumbing specifications and Drawings.
   4. Colors and Patterns: As selected on Interior Material Legend in Drawings.
B. Particleboard: ANSI A208.1, Grade M-2-Exterior Glue.

2.2 FABRICATION

A. Fabricate countertops according to solid surface material manufacturer's written instructions and to the AWI/AWMAC/WI's "Architectural Woodwork Standards."
   1. Grade: Custom.
B. Configuration:
   1. Front: Straight, slightly eased at top.
   2. Backsplash: Straight, slightly eased at corner.
   3. End Splash: Matching backsplash.
C. Countertops:
   1. 1/2-inch-thick, solid surface material with front edge built up with same material.
D. Backsplashes: 1/2-inch-thick, solid surface material.
E. Fabricate tops with shop-applied edges and backsplashes unless otherwise indicated. Comply with solid surface material manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.
   1. Install integral sink bowls in countertops in the shop.
F. Joints:
   1. Fabricate countertops without joints.
G. Cutouts and Holes:
   1. Undercounter Plumbing Fixtures: Make cutouts for fixtures in shop using template or pattern furnished by fixture manufacturer. Form cutouts to smooth, even curves.
      a. Provide vertical edges, slightly eased at juncture of cutout edges with top and bottom surfaces of countertop and projecting 3/16 inch into fixture opening.

2.3 INSTALLATION MATERIALS

A. Adhesive: Product recommended by solid surface material manufacturer.
   1. Adhesives shall have a VOC content of 70 g/L or less.
B. Sealant for Countertops: Comply with applicable requirements in Section 07 92 00 "Joint Sealants."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates to receive solid surface material countertops and conditions under which countertops will be installed, with installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of countertops.
B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install countertops level to a tolerance of 1/8-inch in 8 feet, 1/4-inch maximum. Do not exceed 1/64-inch difference between planes of adjacent units.
B. Fasten subtops to cabinets by screwing through subtops into cornerblocks of base cabinets. Shim as needed to align subtops in a level plane.
C. Secure countertops to subtops with adhesive according to solid surface material manufacturer's written instructions. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
D. Install backsplashes and end splashes by adhering countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears.
E. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.
   1. Seal edges of cutouts in particleboard subtops by saturating with varnish.
F. Apply sealant to gaps at walls; comply with Section 07 92 00 "Joint Sealants."

END OF SECTION

SECTION 12 48 16 - ENTRANCE GRILLE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Stainless steel grating panels.
B. Related Requirements:
   1. Division 01 Specification Sections apply to Work of this Section.

1.2 SUBMITTALS

A. Submit a quality manual showing evidence of being an ISO 9001 certified company.
B. Submit Shop Drawings showing compliance with the Specifications including layout of unit with required sectioning, framing, support system, mounting type, and locations along with tolerances, prior to manufacturing of grating.
C. Submit design calculations, by a Registered Engineer, including loading conditions, support design, and deflection calculations of the stainless-steel grating panels.
D. Four- by four-inch standard sample size can be submitted for verification purposes

1.3 WARRANTY

A. Manufacturing Warranty Period: One year from acceptance and furnish owner items found to be defective within the 1-year period.
B. Extended warranties are available at additional cost and must be approved by management prior to receipt of purchase order.

1.4 QUALITY ASSURANCE

A. Grating shall be manufactured by an ISO 9001-2015 Certified company, fabricated by ASME Section IX Certified welders.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design Manufacturer: Hendrick Architectural Products, Carbondale, Pennsylvania 18407. Email: sales@hendrickarchproducts.com. Phone: 877.840.0881. Fax: 570.282.1506.

2.2 MATERIALS

A. Construction: Floor Panels shall consist of precision spaced, mechanically interlocked profile wires and U-clip supports from Type 316 stainless steel. The traffic surface shall be of smooth profile bar shape with inwardly enlarging openings to minimize the likelihood of debris entrapment.

B. Anti-Slip coating on 1-1/4 inches wide evenly spaced throughout unit with maximum 4-inch spacing or on alternating profile bar.
C. The bars, U-clips, mounting brackets, and banding shall be welded to form a single unit as shown on the Drawings.
D. Bars to be T-16 and mechanically interlocked using a U-clip support structure and spaced 0.187-inch apart.
E. The area for this opening shall be 57.19 percent. Opening size shall be controlled and continuously monitored during manufacture.
F. The maximum opening between the wires is 3/16-inch to be high heel safe.
G. The direction of walking or flow must be perpendicular to the wire direction.
H. Supports: U-clip supports will be spaced on approximately 3-inch centers.

2.3 MOUNTING

A. Hidden mounting tabs with slotted holes type 316 stainless steel to secure screen to concrete surface.

2.4 PERFORMANCE

A. Entrance grilles capable of withstanding 300 pounds per square foot pedestrian load, 1,000 pounds rolling load using a 5-inch diameter by 2-inch width polyurethane tread for 1,000 passes.
B. Entrance grilles that meet or exceed the minimum coefficient of friction of 1.1 as tested by the James Machine using neolite in wet and dry applications.
C. Tolerances: Panels shall be designed and fabricated to ensure that the completed tread panels are within the tolerances specified herein while under a no-load condition. Panel length and width shall be within 1/8-inch plus or minus.

PART 3 - EXECUTION

3.1 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.
    1. Do not proceed until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Manufacturer shall offer assistance and guidance to provide a template of irregular shaped grid assemblies to ensure a proper installation.

3.3 INSTALLATION

A. Install Work of this Section in strict accordance with the manufacturer's recommendations.
B. Set grid type at height recommended by manufacturer for most effective cleaning action.
C. Coordinate top of grid surfaces with bottom of doors that swing across to provide ample clearance between door and grid.

3.4 CLEANING

A. Clean the tread surface and recessed well as frequently as recommended by manufacturer to reduce the effects of accumulated soiling that may hinder performance and lifetime.

3.5 PROTECTION

A. After installation of frame and concrete work, it is recommended to provide a temporary filler until surrounding Work is complete.
B. Final installation of floor grating should not take place until Project has reached Substantial Completion stage.

END OF SECTION

SECTION 22 05 29 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Pipe hangers and supports.
   2. Hanger rods.
   3. Formed steel channel.

B. Related Requirements:
   1. Division 01 Specification Sections apply to Work of this Section.
   2. Section 03 10 00 "Concrete Forming and Accessories" for execution requirements for placement of inserts or sleeves in concrete forms specified by this Section.
   3. Section 03 30 00 "Cast-In-Place Concrete" for execution requirements for placement of concrete housekeeping pads specified by this Section.
   4. Section 07 84 43 "Joint Firestopping" for product requirements for firestopping for placement by this Section.
   5. Section 07 92 00 "Joint Sealant" for product requirements for sealant materials for placement by this Section.
   6. Section 09 91 23 "Interior Painting" for product and execution requirements for painting specified by this Section.
   7. Section 22 11 00 "Facility Water Distribution" for execution requirements for placement of hangers and supports specified by this Section.
   8. Section 22 13 00 "Facility Sanitary Sewerage" for execution requirements for placement of hangers and supports specified by this Section.

1.2 REFERENCES

A. American Society of Mechanical Engineers:
   1. ASME B31.1 - Power Piping.
   2. ASME B31.5 - Refrigeration Piping.
   3. ASME B31.9 - Building Services Piping.

B. ASTM International:
   1. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
   2. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
   3. ASTM E814 - Standard Test Method for Fire Tests of Through Penetration Fire Stops.
   4. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers.
   5. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems.

C. American Welding Society:
   1. AWS D1.1 - Structural Welding Code - Steel.

D. FM Global:
   1. FM - Approval Guide, A Guide to Equipment, Materials & Services Approved By Factory Mutual Research For Property Conservation.
E. Manufacturers Standardization Society of the Valve and Fittings Industry:
   1. MSS SP 58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.
   2. MSS SP 69 - Pipe Hangers and Supports - Selection and Application.
   3. MSS SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices.

1.3 SUBMITTALS

A. Refer to Division 01 and Section 23 05 00 "General Mechanical Requirements."
B. Product Data:
   1. Hangers and Supports: Submit manufacturers catalog data including load capacity.
C. Design Data: Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers.
D. Manufacturer's Installation Instructions:
   1. Hangers and Supports: Submit special procedures and assembly of components.
E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with AWSD1.1 for welding hanger and support attachments to building structure.
B. Perform Work in accordance with state and local standards.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum 3 years' experience.
B. Installer: Company specializing in performing Work of this Section with minimum 3 years' experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labeled with manufacturer's identification.
B. Protect from weather and construction traffic, dirt, water, chemical, and damage, by storing in original packaging.

1.7 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.8 WARRANTY

A. Refer to Section 23 05 00 "General Mechanical Requirements" for product warranties.

PART 2 - PRODUCTS

2.1 PIPE HANGERS AND SUPPORTS

A. Plumbing Piping - DWV:
   1. Conform to ASME B31.9, ASTM F708, MSS SP58, MSS SP69, or MSS SP89.
   2. Hangers for Pipe Sizes 1/2- to 1-1/2-Inch: Malleable iron or Carbon steel, adjustable swivel, split ring.
   3. Hangers for Pipe Sizes 2 Inches and Larger: Carbon steel, adjustable, clevis.
   4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
   5. Wall Support for Pipe Sizes 3 Inches and Smaller: Cast iron hook.
   6. Wall Support for Pipe Sizes 4 Inches and Larger: Welded steel bracket and wrought steel clamp.
   7. Vertical Support: Steel riser clamp.
   8. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
   9. Copper Pipe Support: Copper-plated, carbon-steel adjustable, ring.

B. Plumbing Piping - Water:
   1. Conform to ASME B31.9, ASTM F708, MSS SP58, MSS SP69, or MSS SP89.
   2. Hangers for Pipe Sizes 1/2- to 1-1/2-Inch: Malleable iron or Carbon steel, adjustable swivel, split ring.
   3. Hangers for Cold Pipe Sizes 2 Inches and Larger: Carbon steel, adjustable, clevis.
   4. Hangers for Hot Pipe Sizes 2 to 4 Inches: Carbon steel, adjustable, clevis.
   5. Hangers for Hot Pipe Sizes 6 Inches and Larger: Adjustable steel yoke, cast iron roll, double hanger.
   6. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
   7. Multiple or Trapeze Hangers for Hot Pipe Sizes 6 Inches and Larger: Steel channels with welded spacers and hanger rods, cast iron roll.
   8. Wall Support for Pipe Sizes 3 Inches and Smaller: Cast iron hook.
   9. Wall Support for Pipe Sizes 4 Inches and Larger: Welded steel bracket and wrought steel clamp.
   10. Wall Support for Hot Pipe Sizes 6 Inches and Larger: Welded steel bracket and wrought steel clamp with adjustable steel yoke and cast iron roll.
   11. Vertical Support: Steel riser clamp.
   12. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
   13. Floor Support for Hot Pipe Sizes 4 Inches and Smaller: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

14. Floor Support for Hot Pipe Sizes 6 Inches and Larger: Adjustable cast iron roll and stand, steel screws, and concrete pier or steel support.
15. Copper Pipe Support: Copper-plated, Carbon-steel ring.

2.2 ACCESSORIES

A. Hanger Rods: Mild steel threaded both ends, threaded on one end, or continuous threaded.

2.3 FORMED STEEL CHANNEL

A. Product Description: Galvanized 12-gauge-thick steel with holes 1-1/2 inches on center.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify openings are ready to receive sleeves.
B. Verify the existing conditions before starting Work.

3.2 INSTALLATION - PIPE HANGERS AND SUPPORTS

A. Install in accordance with ASME B31.1, ASME B31.5, ASME 31.9, ASTM F708, MSS SP 58, MSS SP 69, or MSS SP 89.
B. Support horizontal piping as scheduled.
C. Install hangers with minimum 1/2-inch space between finished covering and adjacent Work.
D. Place hangers within 12 inches of each horizontal elbow.
E. Use hangers with 1-1/2-inch minimum vertical adjustment.
F. Support horizontal cast iron pipe adjacent to each hub, with 5 feet maximum spacing between hangers.
G. Support vertical piping at every floor. Support vertical cast iron pipe at each floor at hub.
H. Where piping is installed in parallel and at same elevation, provide multiple pipe or trapeze hangers.
I. Support riser piping independently of connected horizontal piping.
J. Provide copper plated hangers and supports for copper piping.
K. Design hangers for pipe movement without disengagement of supported pipe.
L. Manufactured hangers are normally supplied in black steel.
M. Prime coat exposed steel hangers and supports. Refer to Section 09 91 23 "Interior Painting." Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
N. Provide clearance in hangers and from structure and other equipment for installation of insulation. Refer to Section 22 07 00 "Plumbing Insulation."

3.3 INSTALLATION - EQUIPMENT BASES AND SUPPORTS

A. Provide housekeeping pads of concrete, minimum 4 inches thick and extending 6 inches beyond supported equipment.
B. Using templates furnished with equipment, install anchor bolts, and accessories for mounting and anchoring equipment.
C. Construct supports of steel members, formed steel channel, or steel pipe and fittings. Brace and fasten with flanges bolted to structure.
D. Provide rigid anchors for pipes after vibration isolation components are installed.

3.4 INSTALLATION - FLASHING

A. Flashing for new construction is usually specified with walls, floor, and roofs.
B. Provide flexible flashing and metal counterflashing where piping penetrates weather or waterproofed walls, floors, and roofs.
C. Flash floor drains in floors with topping over finished areas with lead, 10 inches clear on sides with minimum 36- by 36-inch sheet size. Fasten flashing to drain clamp device.
D. Seal floor and mop sink drains watertight to adjacent materials.
E. Adjust storm collars tight to pipe with bolts; caulk around top edge. Use storm collars above roof jacks. Screw vertical flange section to face of curb.

3.5 CLEANING

A. Clean adjacent surfaces of firestopping materials.

3.6 PROTECTION OF FINISHED WORK

A. Protect adjacent surfaces from damage by material installation.

3.7 SCHEDULES

A. Pipe Hanger Spacing:

PIPE MATERIAL	MAXIMUM HANGER SPACING, Feet	HANGER ROD DIAMETER, Inches
Cast Iron, all pipe sizes	5	5/8
Copper tube, 1-1/4 inches and smaller	6	1/2
Copper tube, 1-1/2 inches and larger	10	1/2

END OF SECTION

SECTION 22 07 00 - PLUMBING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Plumbing piping insulation, jackets, and accessories.
2. Plumbing equipment insulation, jackets, and accessories.

B. Related Requirements:
1. Division 01 Specification Sections apply to Work of this Section.

1.2 REFERENCES

A. ASTM International:
1. ASTM A240 - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
2. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless-Steel Sheet, Strip, Plate, and Flat Bar.
3. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
4. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement.
5. ASTM C449 - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement.
6. ASTM C450 - Standard Practice for Fabrication of Thermal Insulating Fitting Covers for NPS Piping, and Vessel Lagging.
7. ASTM C533 - Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation.
8. ASTM C534 - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
9. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation.
10. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
11. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.
12. ASTM C585 - Standard Practice for Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS System).
13. ASTM C591 - Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation.
14. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
15. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
16. ASTM C921 - Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.

17. ASTM C1136 - Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.
18. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
19. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.

1.3 SUBMITTALS

A. Product Data: Submit product description, thermal characteristics, and list of materials and thickness for each service, and location.
B. Manufacturer's Installation Instructions: Submit manufacturer-published literature indicating proper installation procedures.
C. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

A. Use smoke developed index of 50 within plenums.
B. Verify flame spread index and smoke developed index with types of insulation specified in body of Section. Some insulation types included in this Section cannot be used in plenums.
C. Test pipe insulation for maximum flame spread index of 25 and maximum smoke developed index of not exceeding 50 in accordance with ASTM E84.
D. Pipe insulation manufactured in accordance with ASTM C585 for inner and outer diameters.
E. Factory fabricated fitting covers manufactured in accordance with ASTM C450.
F. Perform Work in accordance with state and local standards.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum 3 years' experience.
B. Applicator: Company specializing in performing Work of this Section with minimum 3 years' experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.
B. Protect insulation from weather and construction traffic, dirt, water, chemical, and damage, by storing in original wrapping.

1.7 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.8 WARRANTY

A. Refer to Section 23 05 00 "General Mechanical Requirements" for product warranties.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Glass Fiber and Mineral Fiber Insulation:
   1. Manufacturers:
      a. Johns Manville; a Berkshire Hathaway company.
      b. Knauf Insulation.
      c. Manson Insulation Inc.
      d. Owens Corning.
      e. Substitutions: Refer to Division 01 and Section 23 05 00 "General Mechanical Requirements."

2.2 PIPE INSULATION

A. Type P-1: ASTM C547, molded glass fiber pipe insulation.
   1. Thermal Conductivity: 0.23 at 75 degrees F.
   2. Operating Temperature Range: 0 to 850 degrees F.
   3. Vapor Barrier Jacket: ASTM C1136, Type I, factory applied reinforced foil kraft with self-sealing adhesive joints.
   4. Jacket Temperature Limit: minus 20 to 150 degrees F.

2.3 PIPE INSULATION JACKETS

A. Aluminum Pipe Jacket:
   1. ASTM B209.
   2. Thickness: 0.020-inch thick sheet.
   3. Finish: Embossed.
   4. Joining: Longitudinal slip joints and 2-inch laps.
   5. Fittings: 0.016-inch-thick die shaped fitting covers with factory attached protective liner.
   6. Metal Jacket Bands: 3/8-inch wide; 0.015-inch-thick aluminum.

B. Stainless Steel Pipe Jacket:
   1. ASTM A240 OR ASTM 666 Type 304 stainless steel.
   2. Thickness: 0.016-inch-thick.
   3. Finish: Corrugated.
   4. Metal Jacket Bands: 3/8-inch wide; 0.010-inch-thick stainless steel.

2.4 PIPE INSULATION ACCESSORIES

A. Vapor Retarder Lap Adhesive: Compatible with insulation.
B. Covering Adhesive Mastic: Compatible with insulation.
C. Adhesives: Compatible with insulation.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify piping has been tested before applying insulation materials.
B. Verify surfaces are clean and dry, with foreign material removed.

3.2 INSTALLATION - PIPING SYSTEMS

A. Piping Exposed to View in Finished Spaces: Locate insulation and cover seams in least visible locations.
B. Piping Systems Conveying Fluids Below Ambient Temperature:
   1. Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, and expansion joints.
   2. Furnish factory-applied or field-applied vapor retarder jackets. Secure factory-applied jackets with pressure sensitive adhesive self-sealing longitudinal laps and butt strips. Secure field-applied jackets with outward clinch expanding staples and seal staple penetrations with vapor retarder mastic.
   3. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor retarder adhesive.
C. Hot Piping Systems Less Than 140 Degrees F:
   1. Furnish factory-applied or field-applied standard jackets. Secure with outward clinch expanding staples or pressure sensitive adhesive system on standard factory-applied jacket and butt strips or both.
   2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive.
   3. Do not insulate unions and flanges at equipment, but bevel and seal ends of insulation at such locations.
D. Inserts and Shields:
   1. Piping 1-1/2 Inches Diameter and Smaller: Install galvanized steel shield between pipe hanger and insulation.
   2. Piping 2 Inches Diameter and Larger: Install insert between support shield and piping and under finish jacket.
      a. Insert Configuration: Minimum 6 inches long, of thickness and contour matching adjoining insulation; may be factory fabricated.
      b. Insert Material: Compression resistant insulating material suitable for planned temperature range and service.
   3. Piping Supported by Roller Type Pipe Hangers: Install galvanized steel shield between roller and inserts.
E. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces: Finish with aluminum jacket and fitting covers.
F. Heat Traced Piping Interior to Building: Insulate fittings, joints, and valves with insulation of like material, thickness, and finish as adjoining pipe. Size large enough to enclose pipe and heat tracer.

G. Heat Traced Piping Exterior to Building: Insulate fittings, joints, and valves with insulation of like material, thickness, and finish as adjoining pipe. Size insulation large enough to enclose pipe and heat tracer. Cover with aluminum jacket with seams located at 3 or 9 o'clock position on side of horizontal piping with overlap facing down to shed water.

H. Prepare pipe insulation for finish painting. Refer to Division 09.

3.3 SCHEDULES

A. Water Supply Services Piping Insulation Schedule:
   1. Domestic Hot Water Supply and Recirculation:
      a. Type: P-1.
      b. Thickness: 1.0 inch.
   2. Domestic Cold Water:
      a. Type: P-1.
      b. Thickness: 0.5-inch.

END OF SECTION

SECTION 22 11 00 - FACILITY WATER DISTRIBUTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Domestic water piping, above grade.
   2. Unions and flanges.
   3. Valves.
   4. Relief valves.
   5. Strainers.
   6. Backflow preventers.
   7. Water hammer arrestors.
   8. Thermostatic mixing valves.

B. Related Requirements:
   1. Division 01 Specification Sections apply to Work of this Section.
   2. Section 07 84 13 "Penetration Firestopping" for product requirements for firestopping for placement by this Section.
   3. Section 22 05 29 "Hangers and Supports for Plumbing Piping and Equipment" for product requirements for pipe hangers and supports for placement by this Section.
   4. Section 22 07 00 "Plumbing Insulation" for product and execution requirements for pipe insulation.

1.2 REFERENCES

A. American National Standards Institute:
   1. ANSI Z21.22 - Relief Valves for Hot Water Supply Systems.

B. American Society of Mechanical Engineers:
   1. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
   2. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
   3. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes.
   4. ASME B31.9 - Building Services Piping.
   5. ASME B40.1 - Gauges - Pressure Indicating Dial Type - Elastic Element.
   6. ASME Section VIII - Boiler and Pressure Vessel Code - Pressure Vessels.
   7. ASME Section IX - Boiler and Pressure Vessel Code - Welding and Brazing Qualifications.

C. American Society of Sanitary Engineering:
   1. ASSE 1010 - Performance Requirements for Water Hammer Arresters.
   2. ASSE 1012 - Performance Requirements for Backflow Preventer with Intermediate Atmospheric Vent.
   3. ASSE 1013 - Performance Requirements for Reduced Pressure Principle Backflow Preventers and Reduced Pressure Fire Protection Principle Backflow Preventers.

4. ASSE 5013 - Performance Requirements for Reduced Pressure Principle Backflow Preventers (RP) and Reduced Pressure Fire Protection Principle Backflow Preventers (RFP).
5. ASSE 5015 - Performance Requirements for Testing Double Check Backflow Prevention Assemblies (DC) and Double Check Fire Protection Backflow Prevention Assemblies (RPDF).

D. ASTM International:
1. ASTM A395 - Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures.
2. ASTM A536 - Standard Specification for Ductile Iron Castings.
3. ASTM B32 - Standard Specification for Solder Metal.
4. ASTM B42 - Standard Specification for Seamless Copper Pipe, Standard Sizes.
5. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
6. ASTM B584 - Standard Specification for Copper Alloy Sand Castings for General Applications.
7. ASTM E1 - Standard Specification for ASTM Thermometers.
8. ASTM E77 - Standard Test Method for Inspection and Verification of Thermometers.
9. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers.
10. ASTM F1476 - Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications.

E. American Welding Society:
1. AWS A5.8 - Specification for Filler Metals for Brazing and Braze Welding.

F. American Water Works Association:

G. Manufacturers Standardization Society of the Valve and Fittings Industry:
1. MSS SP 58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.
2. MSS SP 67 - Butterfly Valves.
3. MSS SP 69 - Pipe Hangers and Supports - Selection and Application.
4. MSS SP 71 - Cast Iron Swing Check Valves, Flanged and Threaded Ends.
5. MSS SP 80 - Bronze Gate, Globe, Angle and Check Valves.
6. MSS SP 85 - Cast Iron Globe & Angle Valves, Flanged and Threaded.
7. MSS SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices.
8. MSS SP 110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

H. National Electrical Manufacturers Association:
1. NEMA 250 - Enclosures for Electrical Equipment (1,000 Volts Maximum).

I. Plumbing and Drainage Institute:
1. PDI WH201 - Water Hammer Arrester Standard.

J. Underwriters Laboratories Inc.:
1. UL 393 - Indicating Pressure Gauges for Fire-Protection Service.
2. UL 404 - Gauges, Indicating Pressure, for Compressed Gas Service.

1.3 SUBMITTALS

A. Division 01 and Section 23 05 00 "General Mechanical Requirements" for submittal procedures.
B. Product Data:
   1. Piping: Submit data on pipe materials, fittings, and accessories. Submit manufacturer's catalog information.
   2. Valves: Submit manufacturers catalog information with valve data and ratings for each service.
   3. Domestic Water Specialties: Submit manufacturers catalog information, component sizes, rough-in requirements, service sizes, and finishes.
C. Manufacturer's Installation Instructions: Submit installation instructions for pumps, valves and accessories.

1.4 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of valves and equipment.
B. Operation and Maintenance Data: Submit spare parts list, exploded assembly views and recommended maintenance intervals.

1.5 QUALITY ASSURANCE

A. For drinking water service, provide valves complying with NSF 61.
B. Perform Work in accordance with state and local standards.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum 3 years' experience.
B. Installer: Company specializing in performing Work of this Section with minimum 3 years' experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Accept valves and equipment on site in shipping containers with labeling in place. Inspect for damage.
B. Provide temporary protective coating on cast iron and steel valves.
C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

1.8 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.9 WARRANTY

A. Section 23 05 00 "General Mechanical Requirements."

1.10 EXTRA MATERIALS

A. Furnish 2 packing kits for each size valve, 2 loose keys for outside hose bibs and hose end vacuum breakers for hose bibs, and 2 pump seals for each pump model.

PART 2 - PRODUCTS

2.1 DOMESTIC WATER PIPING, ABOVE GRADE

A. Copper Tubing: ASTM B88, Type L drawn.
   1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
   2. ASTM B32 permits up to 0.1 percent lead content in solders not classified as containing lead.
   3. Joints: ASTM B32, Alloy Grade Sb5 tin-antimony, or Alloy Grade Sn95 tin-silver, lead free solder AWS A5.8 Classification BCuP-3 or BCuP-4 silver braze.

2.2 UNIONS AND FLANGES

A. Unions for Pipe 2 Inches and Smaller:
   1. Copper Piping: Class 150, bronze unions with soldered or brazed joints.
   2. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.
B. Flanges for Pipe 2-1/2 Inches and Larger:
   1. Copper Piping: Class 150, slip-on bronze flanges.
   2. Gaskets: 1/16-inch-thick preformed neoprene gaskets.

2.3 BALL VALVES

A. Manufacturers:
   1. Nibco Inc.
   2. Apollo Flow Controls.
B. Substitutions: Division 01 and Section 23 05 00 "General Mechanical Requirements" for substituted products.
C. Two Inches and Smaller: MSS SP 110, 600 psiWOG, 2-piece bronze body, chrome plated brass ball, full port, Teflon seats, blow-out proof stem, solder or threaded ends with union, and lever handle.

2.4 BUTTERFLY VALVES

A. Manufacturers:
   1. NIBCO INC.
B. Substitutions: Division 01 and Section 23 05 00 "General Mechanical Requirements" for Substituted products.
C. 2-1/2 inches and Larger: MSS SP 67, Class 200.
   1. Body: Cast or ductile iron, wafer or lug ends, stainless steel stem, extended neck.

2. Disc: Aluminum bronze.
3. Seat: Resilient replaceable EPDM.
4. Handle and Operator: Ten-position lever handle.

2.5 CHECK VALVES

A. Horizontal Swing Check Valves:
   1. Manufacturers:
      a. Nibco inc.
   2. Substitutions: Division 01 and Section 23 05 00 "General Mechanical Requirements" for substituted products.
   3. Two Inches and Smaller: MSS SP 80, Class 125, bronze body and cap, bronze seat, Buna-N disc, solder or threaded ends.
   4. 2-1/2 Inches and Larger: MSS SP 71, Class 125, cast iron body, bolted cap, bronze or cast iron disc, renewable disc seal and seat, flanged ends.

2.6 RELIEF VALVES

A. Pressure Relief:
   1. Bronze body, Teflon seat, steel stem and springs, automatic, direct pressure actuated at maximum 60 psi, UL listed for fuel oil, capacities ASME certified and labeled.

B. Temperature and Pressure Relief:
   1. ANSI Z21.22 certified, bronze body, Teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, temperature relief maximum 210 degrees F, capacity ASME certified and labeled.

2.7 STRAINERS

A. Manufacturers:
   1. Watts.
   2. Zurn Industries, LLC.

B. Substitutions: Division 01 and Section 23 05 00 "General Mechanical Requirements" for substituted products.

C. Two Inches and Smaller: Threaded brass body for 175 psi CWPY pattern with 1/32-inch stainless steel perforated screen.

D. 2-1/2 to 4 Inches: Class 125, flanged iron body, Y pattern with 1/16-inch stainless steel perforated screen.

E. Five Inches and Larger: Class 125, flanged iron body, basket pattern with 1/8-inch stainless steel perforated screen.

2.8 BACKFLOW PREVENTERS

A. Manufacturers:
   1. WATTS.
   2. Zurn Industries, LLC.

B. Substitutions: Division 01 and Section 23 05 00 "General Mechanical Requirements" for substituted products.

C. Reduced Pressure Backflow Preventers:
   1. Comply with ASSE 1013.
   2. Bronze body, with bronze internal parts and stainless steel springs.
   3. Two independently operating, spring loaded check valves; diaphragm type differential pressure relief valve located between check valves; third check valve opening under back pressure in case of diaphragm failure; non-threaded vent outlet; assembled with 2 gate valves, strainer, and 4 test cocks.

D. Double Check Valve Assemblies: Comply with ASSE 1015 or AWWA C510; Bronze body with corrosion-resistant internal parts and stainless steel springs; 2 independently operating check valves with intermediate atmospheric vent.

2.9 WATER HAMMER ARRESTORS

A. ASSE 1010; stainless steel or copper construction, piston type sized in accordance with PDI WH-201.
B. Pre-charged suitable for operation in temperature range 34 to 250 degrees F and maximum 150 psiworking pressure.

2.10 THERMOSTATIC MIXING VALVES

A. Valve: Chrome-plated cast brass body, stainless steel or copper alloy bellows, integral temperature adjustment. Conform to ASSE 1070 to temper water to maximum 110 degrees F.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify excavations are to required grade, dry, and not over-excavated.

3.2 PREPARATION

A. Ream pipe and tube ends. Remove burrs.
B. Remove scale and dirt, on inside and outside, before assembly.

3.3 INSTALLATION - THERMOMETERS AND GAUGES

A. Install 1 pressure gauge for each pump, locate taps before strainers and on suction and discharge of pump; pipe to gauge.
B. Install gauge taps in piping.
C. Install pressure gauges with pulsation dampers. Provide ball valve to isolate each gauge.
D. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2 inches for installation of thermometer sockets. Allow clearance from insulation.
E. Provide instruments with scale ranges selected according to service with largest appropriate scale.

F. Install gauges and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.
G. Adjust gauges and thermometers to final angle, clean windows and lenses, and calibrate to zero.

3.4 INSTALLATION - ABOVE GROUND PIPING

A. Install non-conducting dielectric connections wherever jointing dissimilar metals.
B. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.
C. Install piping to maintain headroom without interfering with use of space or taking more space than necessary.
D. Group piping whenever practical at common elevations.
E. Slope piping and arrange systems to drain at low points.
F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
G. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 22 07 00 "Plumbing Insulation."
H. Provide access where valves and fittings are not accessible.
I. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply 1 coat of zinc rich primer to welding.
J. Provide support for utility meters in accordance with requirements of utility companies.
K. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting. Refer to Division 09.
L. Install domestic water piping in accordance with ASME B31.9.
M. Sleeve pipes passing through partitions, walls and floors. Refer to Section 22 05 29 "Hangers and Supports for Plumbing Piping and Equipment."
N. Install unions downstream of valves and at equipment or apparatus connections.
O. Install valves with stems upright or horizontal, not inverted.
P. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.
Q. Install ball or butterfly valves for shut-off and to isolate equipment, part of systems, or vertical risers.
R. Install ball or butterfly valves for throttling, bypass, or manual flow control services.
S. Provide lug end butterfly valves adjacent to equipment when functioning to isolate equipment.
T. Provide spring loaded check valves on discharge of water pumps.
U. Install potable water protection devices on plumbing lines where contamination of domestic water may occur; on boiler feed water lines, janitor rooms, fire sprinkler systems, premise isolation, irrigation systems, flush valves, interior and exterior hose bibs.
V. Pipe relief from valves, back-flow preventers and drains to nearest floor drain.
W. Select testing procedure applicable to type of backflow preventers included in Project.
X. Test backflow preventers in accordance with ASSE.
Y. Install water hammer arrestors complete with accessible isolation valve on hot and cold water supply piping as shown on Drawings.

3.5 FIELD QUALITY CONTROL

A. Test domestic water piping system in accordance with applicable code.

3.6 CLEANING

A. Prior to starting Work, verify system is complete, flushed and clean.
B. Verify pH of between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).
C. Inject disinfectant, free chlorine in liquid, powder and tablet or gas form, throughout system to obtain residual from 50 to 80 mg/L.
D. Bleed water from outlets to obtain distribution and test for disinfectant residual at minimum 15 percent of outlets.
E. Maintain disinfectant in system for 24 hours.
F. When final disinfectant residual tests less than 25 mg/L, repeat treatment.
G. Flush disinfectant from system until residual concentration is equal to incoming water or 1.0 mg/L.
H. Take samples no sooner than 24 hours after flushing, from 10 percent of outlets and from water entry, and analyze in accordance with AWWA C651.

END OF SECTION

SECTION 22 13 00 - FACILITY SANITARY SEWERAGE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Sanitary sewer piping above grade.

B. Related Sections:
   1. Division 01 Specification Sections apply to Work of this Section.
   2. Section 03 30 00 "Cast-In-Place Concrete" for execution requirements for placement of concrete specified by this Section.
   3. Section 07 84 13 "Penetration Firestopping" for product requirements for firestopping for placement by this Section.
   4. Section 08 31 13 "Access Doors and Frames" for product requirements for access doors for placement by this Section.
   5. Section 09 91 23 "Interior Painting" for product and execution requirements for painting specified by this Section.
   6. Section 22 05 29 "Hangers and Supports for Plumbing Piping and Equipment" for product requirements for pipe hangers and supports and firestopping for placement by this Section.
   7. Section 22 05 53 "Identification for Plumbing Piping and Equipment" for product requirements for pipe identification for placement by this Section.
   8. Section 22 07 00 "Plumbing Insulation" for product and execution requirements for pipe insulation.

1.2 REFERENCES

A. American Society of Mechanical Engineers:
   1. ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings.
   2. ASME B16.3 - Malleable Iron Threaded Fittings.
   3. ASME B16.4 - Gray Iron Threaded Fittings.
   4. ASME B16.23 - Cast Copper Alloy Solder Joint Drainage Fittings (DWV).
   5. ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV.
   6. ASME B31.9 - Building Services Piping.

B. ASTM International:
   1. ASTM A47 - Standard Specification for Ferritic Malleable Iron Castings.
   2. ASTM A53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
   3. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings.
   4. ASTM A234 - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
   5. ASTM A395 - Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures.
   6. ASTM A536 - Standard Specification for Ductile Iron Castings.
   7. ASTM B32 - Standard Specification for Solder Metal.

8. ASTM B42 - Standard Specification for Seamless Copper Pipe, Standard Sizes.
9. ASTM B43 - Standard Specification for Seamless Red Brass Pipe, Standard Sizes.
10. ASTM B75 - Standard Specification for Seamless Copper Tube.
11. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
12. ASTM B251 - Standard Specification for General Requirements for Wrought Seamless Copper and Copper-Alloy Tube.
13. ASTM B302 - Standard Specification for Threadless Copper Pipe, Standard Sizes.
14. ASTM B306 - Standard Specification for Copper Drainage Tube (DWV).
15. ASTM C14 - Standard Specification for Concrete Sewer, Storm Drain, and Culvert Pipe.
16. ASTM C76 - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
17. ASTM C443 - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.
18. ASTM C478 - Standard Specification for Precast Reinforced Concrete Manhole Sections.
19. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
20. ASTM C1053 - Standard Specification for Borosilicate Glass Pipe and Fittings for Drain, Waste, and Vent (DWV) Applications.
21. ASTM D2235 - Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.
22. ASTM D2241 - Standard Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter.
23. ASTM D2661 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe and Fittings.
24. ASTM D2751 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings.
25. ASTM D2996 - Standard Specification for Filament-Wound Fiberglass (Glass-Fiber-Reinforced Thermosetting Resin) Pipe.
26. ASTM D2997 - Standard Specification for Centrifugally Cast Fiberglass (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe.
27. ASTM D3262 - Standard Specification for "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Sewer Pipe.
28. ASTM D3517 - Standard Specification for "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pressure Pipe.
29. ASTM D3754 - Standard Specification for "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Sewer and Industrial Pressure Pipe.
30. ASTM D3840 - Standard Specification for "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe Fittings for Nonpressure Applications.
31. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
32. ASTM F628 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe with a Cellular Core.

33. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers.
34. ASTM F1476 - Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications.

C. Cast Iron Soil Pipe Institute:
1. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.
2. CISPI 310 - Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.

D. Manufacturers Standardization Society of the Valve and Fittings Industry:
1. MSS SP 58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.
2. MSS SP 69 - Pipe Hangers and Supports - Selection and Application.
3. MSS SP 70 - Cast Iron Gate Valves, Flanged and Threaded Ends.
4. MSS SP 71 - Cast Iron Swing Check Valves, Flanged and Threaded Ends.
5. MSS SP 80 - Bronze Gate, Globe, Angle and Check Valves.
6. MSS SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices.
7. MSS SP 110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

E. Plumbing and Drainage Institute:
1. PDI G101 - Standard - Testing and Rating Procedure for Grease Interceptors.

1.3 SUBMITTALS

A. Division 01 and Section 23 05 00 "General Mechanical Requirements" for submittal procedures.

B. Product Data:
1. Piping: Submit data on pipe materials, fittings, and accessories. Submit manufacturers catalog information.
2. Valves: Submit manufacturers catalog information with valve data and ratings for each service.
3. Hangers and Supports: Submit manufacturers catalog information including load capacity.
4. Sanitary Drainage Specialties: Submit manufacturers catalog information, component sizes, rough-in requirements, service sizes, and finishes.
5. Pumps: Submit pump type, capacity, certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable. Include electrical characteristics and connection requirements.

C. Manufacturer's Installation Instructions: Submit installation instructions for material and equipment.

1.4 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of equipment and clean-outs.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with state and local standards.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum 3 years' experience.
B. Installer: Company specializing in performing Work of this Section with minimum 3 years' experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

1.8 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.9 WARRANTY

A. Refer to section 23 05 00 “General Mechanical Requirements” for product warranties.

PART 2 - PRODUCTS

2.1 SANITARY SEWER PIPING, ABOVE GRADE

A. Cast Iron Pipe: ASTM A74, service weight.
   1. Fittings: Cast iron, ASTM A74.
   2. Joints: ASTM C564, rubber gasket joint devices or lead and oakum.
B. Cast Iron Pipe: CISPI 301, hub-less, service weight.
   1. Fittings: Cast iron, CISPI 301.
   2. Joints: CISPI 310, neoprene gaskets and stainless steel clamp-and-shield assemblies.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify excavations are to required grade, dry, and not over-excavated.

3.2 PREPARATION

A. Ream pipe and tube ends. Remove burrs.
B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.
D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

3.3 INSTALLATION - HANGERS AND SUPPORTS

A. Inserts:
   1. Provide inserts for placement in concrete forms.

3.4 INSTALLATION - ABOVE GROUND PIPING

A. Establish invert elevations, slope drainage as required by local code.
B. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Provide clearances at cleanout for snaking drainage system.
C. Encase exterior cleanouts in concrete flush with grade.
D. Install floor cleanouts at elevation to accommodate finished floor.
E. Provide non-conducting dielectric connections wherever jointing dissimilar metals.
F. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.
G. Install piping to maintain headroom. Do not spread piping, conserve space.
H. Group piping whenever practical at common elevations.
I. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
J. Provide clearance in hangers and from structure and other equipment for installation of insulation.
K. Install piping penetrating roofed areas to maintain integrity of roof assembly.
L. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
M. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting. Refer to Section 09 91 23 "Interior Painting."
N. Install bell and spigot pipe with bell end upstream.
O. Sleeve pipes passing through partitions, walls and floors.
P. Install firestopping at fire rated construction perimeters and openings containing penetrating sleeves and piping. Refer to Section 07 84 13 "Penetration Firestopping."
Q. Support cast iron drainage piping at every joint.

3.5 FIELD QUALITY CONTROL

A. Test sanitary waste and vent piping system in accordance with applicable code.
B. The sanitary sewer system will be smoke tested by a third-party independent contractor hired by General Contractor. Any joints found deficient will be corrected by Plumbing Contractor and the smoke test will be repeated. Two tests will be performed.
   1. Piping will be tested before walls, ceilings, and fixtures are installed.
   2. Piping will be tested after the fixtures are installed.

END OF SECTION

SECTION 22 40 00 - PLUMBING FIXTURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Water closets.
   2. Urinals.
   3. Lavatories.
   4. Sinks.
   5. Floor cleanouts.
   6. Showers.

B. Related Requirements:
   1. Division 01 Specification Sections apply to Work of this Section.

1.2 REFERENCES

A. American National Standards Institute:
   1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
   2. ANSI Z358.1 - Emergency Eyewash and Shower Equipment.

B. Air-Conditioning and Refrigeration Institute:
   1. ARI 1010 - Self-Contained, Mechanically Refrigerated Drinking-Water Coolers.

C. American Society of Mechanical Engineers:
   1. ASME A112.6.1 - Floor-Affixed Supports for Off-the-Floor Plumbing Fixtures for Public Use.
   2. ASME A112.18.1 - Plumbing Fixture Fittings.
   3. ASME A112.19.1M - Enameled Cast Iron Plumbing Fixtures.
   4. ASME A112.19.2M - Vitreous China Plumbing Fixtures.
   5. ASME A112.19.4 - Porcelain Enameled Formed Steel Plumbing Fixtures.
   6. ASME A112.19.5 - Trim for Water-Closet Bowls, Tanks and Urinals.

1.3 SUBMITTALS

A. Only request submittals needed to verify compliance with Project requirements.
B. Division 01 Section 23 05 00 "General Mechanical Requirements" for submittal procedures.
C. Product Data: Submit catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.
D. Manufacturer's Installation Instructions: Submit installation methods and procedures.
E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

A. Division 01 Section 23 05 00 "General Mechanical Requirements" for closeout procedures.
B. Operation and Maintenance Data: Submit fixture, trim, exploded view, and replacement parts lists.

1.5 QUALITY ASSURANCE

A. Perform Work according to state and local codes.
B. Provide products requiring electrical connections listed and classified by UL as suitable for purpose specified and indicated.
C. Provide plumbing fixture fittings according to ASME A112.18.1 that prevent backflow from fixture into water distribution system.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum 3 years' experience.
B. Installer: Company specializing in performing Work of this Section with minimum 3 years' experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Division 01 Section 23 05 00 "General Mechanical Requirements" for product storage and handling requirements.
B. Accept fixtures on site in factory packaging. Inspect for damage.
C. Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

1.8 WARRANTY

A. Division 01 Section 23 05 00 "General Mechanical Requirements" for product warranties and product bonds.

PART 2 - PRODUCTS

2.1 FIXTURES

A. Refer to Plumbing Fixture Schedule for make, model number, and type.
B. Manufacturers:
    1. Fixtures:
        a. American Standard.
        b. Sloan.
        c. Kohler.
        d. Bradley Corp.
        e. Zurn Industries.
        f. Symmons.

g. Woodford.
h. Stern Williams.
i. Halsey Taylor.
j. Murdock.

2. Stainless Steel Fixtures:
   a. Just mfg.
   b. Elkay.
   c. Acorn.
   d. Bradley Corp.
   e. Advance Tabco.
3. Commercial Brass:
   a. Moen.
   b. Kohler.
   c. T & S Brass.
   d. Chicago Faucets.
   e. Sloan.
4. Drainage Products:
   a. Watts.
   b. Wade.
   c. Josam.
   d. Sioux Chief.
   e. J.R. Smith.
   f. Zurn.
   g. Proset Trap guard.
   h. Green drain.
5. Mixing Valves:
   a. Armstrong.
   b. Bradley Corp.
   c. Leonard.
   d. Powers.
   e. Watts.

C. Substitutions: Division 01 and Section 23 05 00 "General Mechanical Requirements" for substitutions.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify walls and floor finishes are prepared and ready for installation of fixtures.
B. Verify electric power is available and of correct characteristics.
C. Confirm millwork is constructed with adequate provision for installation of counter top lavatories and sinks.

3.2 PREPARATION

A. Rough-in fixture piping connections according to minimum sizes indicated on the Plumbing fixture schedule for particular fixtures.

3.3 INSTALLATION

A. Install Work according to State and local codes.
B. Install each fixture with trap, easily removable for servicing and cleaning.
C. Provide chrome-plated rigid or flexible supplies to fixtures with quarter turn stops, reducers, and escutcheons.
D. Install components level and plumb.
E. Install and secure fixtures in place with wall supports or carriers and bolts.
F. Seal fixtures to wall and floor surfaces with sealant as specified, color to match fixture.
G. Solidly attach water closets to floor with lag screws. Lead flashing is not intended hold fixture in place.
H. For TAS or ADA accessible water closets, install flush valve with handle to wide side of stall.
I. For any plumbing fixture with an exposed p-trap provide a chrome plated cast brass p-trap with a cleanout plug, chrome plated outlet, and chrome plated cast brass escutcheon with set screw. Also provide a manufactured insulation kit made from molded closed cell vinyl that is anti-microbial and seamless. Each kit shall cover the tailpiece, p-trap, wall bend, both water supply stops, and both water risers.

3.4 INTERFACE WITH OTHER PRODUCTS

A. Review millwork Shop Drawings. Confirm location and size of fixtures and openings before rough in and installation.

3.5 ADJUSTING

A. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

3.6 CLEANING

A. Clean plumbing fixtures and equipment.

3.7 PROTECTION OF INSTALLED CONSTRUCTION

A. Do not permit use of fixtures before final acceptance.

END OF SECTION

SECTION 23 05 00 - GENERAL MECHANICAL REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Work covered by this Division consists of furnishing labor, equipment, supplies, and materials and in performing Work necessary for the installation of complete and operating mechanical systems as required by these Specifications and/or shown in the Drawings, subject to the terms and conditions of the Contract. The Work also includes completion of mechanical and electrical details not indicated that are necessary for the successful operation of systems described in the Drawings or required by these Specifications; including the furnishing materials for the filling the systems to make them operable, including water, refrigerant, oil, grease, and other lubrication. If requested, prove satisfactory operation of equipment and controls to Architect.

B. Work Not Included: Certain labor, material, and equipment may be furnished and/or installed under other Divisions of these Specifications. Coordinate with other trades and arrange his Work to make the part fit together. The following items are to be accomplished under other Divisions of these Specifications:
   1. Temporary Heat: Refer to paragraph in this Section.
   2. Temporary Water and Toilet: Refer to General Conditions.
   3. Roof Curbs: Refer to paragraph in this Section.
   4. Electrical Equipment and Wiring: Refer to paragraph in this Section.
   5. Concrete: Refer to paragraph in this Section.

C. Equipment Furnished by Owner: Rough-in services to locations as required by Architectural and Mechanical Drawings and equipment Shop Drawings. Provide service valves on pipes except waste and vent pipes. Making final connections to equipment is included in this Contract.

D. Related Requirements:
   1. Division 01 Specification Sections apply to Work of this Section.

1.2 BIDDING

A. Provide new mechanical equipment unless specified otherwise in the Specifications or in the Drawings.

B. Base Bids or proposals only on the equipment and materials as scheduled in the Drawings and as specified or on approved equivalent equipment and materials. Contractors who assume equivalence of products and who base their proposal on this assumption do so at their own risk.

C. Listing of approved alternative manufacturers does not indicate that all products of a particular manufacturer are acceptable alternatives to scheduled items. Fixtures and devices are required to be submitted according to the prescribed procedures. In addition, some items that have an important visual affect, such as electric water coolers, may be required to receive Owner’s or Architect's approval.

1.3 EXISTING UTILITIES

A. Drawings indicate the locations, type, and sizes of various utilities within the site where known. Known utilities are indicated as accurately as possible based on site surveys. If utilities are discovered during construction that are not shown in the Drawings and interfere with Work, obtain instructions from Architect prior to proceeding with Work. If required, a Change Order will address relocation or remodeling necessary. Contractor assumes responsibility for protection of utilities, shown or not, and for repair required by this construction.
B. Verify location, size, elevation, pressure, and any other pertinent data of the existing utilities. Additional costs incurred due to failure to verify such data and to coordinate associated work with respective utility providers will be borne by Contractor and not be Owner.
C. Include costs associated with providing utilities including, but not limited to, connection fees, boring under roads, etc., in proposal price, whether such costs are incurred by Contractor or charged by the utility company.
D. Submission of a Proposal by Contractor will be considered an acknowledgment by Contractor of their compliance with this Section.

1.4 CODES, PERMITS, AND FEES

A. Comply with local, state, and national codes and pay for applicable costs, fees, permits, licenses, and inspections for this Project.

1.5 TEMPORARY HEAT

A. General Contractor will furnish temporary heat. Use of the permanent heating system will not be allowed without written authorization from Architect and Owner. In case the permanent heating system is used for temporary heat, the General Contractor will pay all the costs until acceptance by Owner. Warranties for equipment will not start until the date of Substantial Completion.

1.6 DRAWINGS

A. Contract Drawings are diagrammatic only and are not intended to be scaled for dimensions. Obtain dimensions from Architectural Drawings, certified equipment drawings, and from site conditions before fabricating and Work. Verify and coordinate space requirements and equipment locations with other trades. It is Contractors' responsibility to install the systems complete in the space provided at no additional cost to Owner.
B. It is intended that equipment or material, that is usually furnished as part of equipment specified and is necessary for operation, is furnished as part of the Contract without additional cost, whether shown or described.
C. Conceal piping in finished areas of the building except where otherwise noted in the Drawings.
D. Install equipment in accordance with manufacturer's recommendations unless approval is given in writing by Architect for deviation.

1.7 REQUIREMENTS OF REGULATORY AGENCIES

A. Provide mechanical Work in accordance with local and State codes, ordinances, and regulations governing the specified Work involved. Furnish, without extra charge, additional material and labor when and where required to comply with these Rules and Regulations, whether the Work is mentioned in the Specifications or shown in the Drawings or not. When the Specifications or Drawings indicate describe materials or construction of better quality or larger sizes than required by the above-mentioned Rules and Regulations, the provisions of these Specifications and accompanying Drawings will take precedence.

1.8 QUALIFICATIONS

A. Provide mechanics that are capable journeymen, skilled in the work assigned to them with licensing required by the inspecting authority. Welders must have been certified within the past 3 years to perform required welding.

1.9 WARRANTY

A. Warrant workmanship, material, and equipment and replace defective material, equipment, or systems, at no additional cost to Owner, for 1 year after the Date of Substantial Completion as defined in General Conditions.
B. Provide warranty durations over 1 year as described above (that covers equipment installed on this Project) to Owner in the Operation and Maintenance Manual, along with the start and end of warranty dates.
C. Refer to General Conditions for additional information regarding specific warranty requirements.

1.10 PROJECT RECORD DOCUMENTS

A. Prior to final payment, provide Architect with set of Drawings and Specifications corrected up to date as job progresses. These documents will reflect the As-Built conditions. Refer to General Conditions for additional information.

1.11 SUBMITTALS

A. The intent of this Section is to give general submittal information; refer to specific submittal information in the subsequent Mechanical Sections and Section 01 33 00 "Submittal Procedures."
B. Sale of Electronic Revit or CADD Files:
   1. Refer to specification Section 01 33 00 "Submittal Procedures" or call the Parkhill office issuing this Project and request the pricing for electronic files.
C. Within 10 days after award of the Contract, and before orders are placed, submit specific information on equipment list and principal materials specified. Indicate and provide names of manufacturers, catalog and model numbers, cut sheets, and such other supplementary information as necessary for evaluation.
D. Requirements for Each Submittal:
   1. Bear a dated stamp or specific written indication that Contractor has reviewed and approved all submittal prior to submission to Architect.

2. Have all information deleted by Contractor that pertains to the means and methods of construction or to fabrication by Contractor that pertains to the means and methods of construction or to fabrication, assembly, installation, or erection (approval by Architect will not extend to these areas unless specifically noted by Architect).
3. Be clearly and specifically marked as to which specific piece of equipment is being submitted, by use of a permanent marker, stamp, etc., so as to distinguish it from other pieces of equipment that may occur on the same page.
4. Be clearly marked as to which available options are being submitted that are associated with a piece of equipment.
5. Be complete with respect to quantities, dimensions, specific performance, materials, and similar data to enable Architect to review the proposed equipment.

E. Omission by Contractor of any of the above requirements or submittals will subject submittal to rejection without review.

F. Submittals received by Architect not requested will be returned without review.

G. Installation Instructions: For certain products or systems as identified in subsequent Specifications Sections or in the Drawings, provide manufacturer's installation instructions with submittals. When requested, the installation instructions are considered part of the submittal and their omission may result in rejection of the submittal.

1. Where more than one identical device is scheduled, only one set of installation instructions need be submitted; Example: if seven 5-ton split systems air conditions are scheduled, only one 5-ton unit installation instruction needs to be submitted. Similarly, if one set of installation instructions is identified by the manufacturer and the instructions are applicable to more than one type or size of devices, e.g., if one set of air conditioner instructions applies to 3-, 4-, or 5-ton units, then only 1 instruction set is required for these devices.

1.12 SUBSTITUTED PRODUCTS

A. Material or equipment specified by manufacturer's name is being used as a basis of standard, unless otherwise noted. Architect will be the sole judge on the equivalence of substituted equipment and materials.

B. It is Contractor's responsibility to verify that submitted equipment will fit in space available. Contractor's submittal for requesting approval of the substitution will include a written statement of whether or not such acceptance would require any subsequent or associated changes to the Drawings or Specifications. Completely describe necessary changes in an Request for Information (RFI). Refer to Section 01 30 00 "Administrative Requirements" and 01 60 00 "Product Requirements."

C. Contractor will be responsible for the costs of Project modifications due to substitution of materials or equipment for what was specified or scheduled. The cost will be complete, including the costs necessary to accommodate modifications effecting other trades.

D. Architect may request detailed Shop Drawing or plan layouts of mechanical rooms or systems of the substituted equipment.

1.13 SAFETY

A. General: Contractor will be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the Work, and Contractor will comply with all laws governing safety, specifically state and federal "Occupational Safety and Health Standards" and the "Safety and Health Regulations for Construction."

B. According to OSHA, a hazardous chemical is any chemical that is a physical hazard or a health hazard. This may include items such as paints, solvents, adhesives, sealants, cleaners, etc. If a Contractor produces, uses, or stores hazardous chemicals at the workplace, then Contractor will develop, implement, and maintain a hazard communication program in compliance with the latest OSHA requirements. Provide required methods of training, information, handling, ventilation, labeling, storing, disposal, and removal of hazardous chemicals.
   1. In projects with multiple tenants in which the building is partially occupied during all or part of the Project, Contractor will inform the Building Manager or Owner, according to OSHA guidelines, of any hazardous chemicals being produced, stored, or used in the building so that other tenants may be notified.

1.14 LABELING

A. Each device where an independent testing authority has established a standard will have affixed a label indicating its compliance and listing.

1.15 SITE VISIT REPORTS

A. During the course of the Project, Architect will make site visits to observe Work in progress and will subsequently prepare a written site visit report, that will be sent to Contractor and to other parties as necessary. Prepare a written response addressing items requiring clarifications or explanation within 7 calendar days of receiving the site visit report. Include in response the following information.
   1. Date of site visit by Architect.
   2. Date of receipt of the site visit report.
   3. Name and title of the preparer of the response.
   4. An item number referenced to the site report.
   5. A brief 3- or 4-word description of the item.
   6. Contractor or Subcontractor affected.
   7. The proposed course of action.
   8. An expected time of completion of the action.

1.16 CUTTING AND PATCHING

A. Do not cut, drill, or alter joists, beams, girders, columns, slabs, or other structural elements without first obtaining written permission and instructions from Architect.

B. Where it is necessary to cut through non-structural elements of walls, floors, or ceilings to permit the installation of Work under this Contract, or to repair defects that may appear during warranty duration, provide cutting with as little damage as possible to the construction being cut or to adjacent construction.

C. After the necessary Work has been completed, damage will be repaired by the respective Contractor, and pay all costs of such cutting, repairs, and patching. Patching or sealing of cuts, penetrations, and other alterations necessary, including final appearance of same, will be accomplished to the approval of Architect.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Materials will be new, free from defects, and of specified quality, unless specifically noted otherwise. Manufacturer names mentioned in the Specifications or in the Drawings are to establish a standard of quality, performance, and construction.
B. Contractor will be responsible for transportation of his material to and from the job site and for the storage and protection of his materials and Work until the date of Substantial Completion. At the end of each day of Work, each Contractor is responsible for covering or protecting their Work and/or materials that may be susceptible to damage even if damage is the result of unforeseen weather events. Failure to do so will be sufficient cause for rejection of items in question, and any such items will be replaced by Contractor at no additional cost to Owner.
C. Verify that all pieces of equipment will fit through available openings in the building and that all equipment can be installed without modification to the building structure.

2.2 EQUIPMENT SCHEDULE

A. Equipment specified in the equipment schedules on the Drawings will be new and furnished complete with all accessories normally supplied with the catalog item listed and all other accessories necessary for a complete and operational installation.
B. Indicated equipment will require start-up by factory-trained personnel. Equipment so noted will require factory-approved service personnel who will provide service, including parts and labor, during the warranty period of equipment.

2.3 EQUIPMENT RATINGS

A. Equipment capacities as scheduled in the Drawings are at Project Site altitude. Capacities of submitted equipment must be corrected for Project Site altitude unless otherwise noted.

2.4 WORKMANSHIP

A. Provide workmanship and construction according to the best practices of the trade. Conceal Piping, ducting, and conduit unless otherwise noted, and installed square to the building lines. Work not meeting this requirement will be replaced or rebuilt without extra expense to Owner.

2.5 V-BELT DRIVES

A. Provide V-belt drives of fabric and rubber construction approved by the manufacturer. Match multiple belts, adjusted to drive the apparatus properly, and to prevent slippage and undue wear in starting motor nameplate rating.

2.6 BELT GUARDS

A. Provide for each V-belt drive a painted steel belt guard, constructed around a steel angle frame, securely bolted to the floor or apparatus. Completely enclose drives and pulleys to comply with safety requirements. Provide hinged access doors not less than 6 by 6 inches for access to motors and fan shafts for test purposes.

2.7 ELECTRICAL WIRING AND CONTROL EQUIPMENT

A. Provide disconnects, motor starters, relays, wiring, etc., that comply with requirements of this Section.
B. Mechanical Contractor must refer to the electrical control equipment and wiring shown on the Electrical Drawings. Any changes or additions required by specified or substituted equipment furnished will be the complete responsibility of Contractor furnishing the equipment.
C. Verify electrical equipment characteristics (voltage, etc.) by Mechanical Contractor prior to ordering. It is imperative that voltage and phase characteristics are verified with the Electrical Drawings.
D. Provide motors that comply with current applicable IEEE, ASA, and NEMA standards. Provide general-purpose motors that are open drip-proof machines for installation indoors and/or in protected locations.
    1. Provide totally enclosed fan cooled (TEFC) motors used in areas of exposure to weather or other environmental contamination.
    2. Provide rated explosion-proof motors when located in hazardous atmospheres.
    3. Type II weather-protected motors may be used instead of TEFC motors on roof fan units and similar equipment.
    4. Provide shields for motors mounted in direct sun to prevent direct radiation from the sun when the sun is 45 degrees F or greater above the horizon.
E. Unless indicated otherwise, provide motors that are NEMA Design B with a service factor of 1.15 with 40 degrees C rise and total temperature rise of 65 degrees C ambient and when powered from the system voltage feeding the motor.
    1. Provide TEFC motors that have a service factor of 1.00 with total temperature rise of 65 degrees C in the above conditions.
    2. Provide single-phase motors that are NEMA Type N split-phase induction motors with built-in thermal protectors. Single-phase motors connected to loads requiring high starting torque will be capacitor-start induction motors.
F. Provide motors that are copper wound, high power factor rated. Electric motors will be an energy-efficient type as defined in the latest edition of ANSI/NEMA Document MG 1: Motors and Generators. Provide motor efficiency information if requested by Architect.

G. If there is not a separate "Controls Contractor" for this Project, Mechanical Contractor is responsible for providing and installing necessary control wiring. Wiring and conduit are to be provided and installed as indicated in Division 26 Specifications.

2.8 EQUIPMENT AND PIPING SUPPORTS

A. Supporting systems for piping, equipment, and materials supported by the building structure will be submitted to Architect for approval prior to purchase and installation.

B. Roof Supports: Provide and install roof supports for uninsulated piping routed on the roof.
   1. For single pipes up to 5 inches in size, such as gas pipes, provide MAPA, MS-4RA or MS-5RA roof supports, that consist of a 1-piece combination roof deck base, adjustable height pipe supports, and hard cast rubber roller with nylon bushings. Provide walk pad under pipe support as recommended by the pipe support manufacturer. Anchor pad and support to roof as recommended by support manufacturer.
   2. Manufacturer's installation recommendations may vary depending on roof types. Installer is responsible for verifying the roof type and adhering to the applicable installation instructions.
   3. Space roof supports as recommended by the manufacturer.

2.9 ROOF PENETRATIONS

A. Piping: Provide penetrations with factory-made assemblies designed specifically for the purpose. The use of pitch pans or pitch pockets is not allowed. Provide a factory-made penetration assembly as follows:
   1. For pipes and conduits up to 3 inches in diameter that can or are intended to be turned to horizontal after passing through the roof (e.g., small electrical conduit, gas piping, refrigerant lines, water pipes, etc.) provide a device consisting of a curb assembly with a welded 18-gauge galvanized steel shell and base, 1-1/2 inches thick 3 pcf rigid insulation, 0.50-inch aluminum or 20-gauge galvanized cap with minimum 3-inch overhang and 1-inch rigid insulation, and 2 by 6-inch treated wood nailer; Custom Curb Model CPC, ThyCurb Model RP-2 with TC-1, 2, or 3 curb, or approved equivalent.

B. Ductwork without Equipment: Provide penetrations with a factory-made insulated roof curb. Fabricate curb of welded 18-guage galvanized steel shell and base plate, lined with 1-1/2-inch 3 pcf rigid insulation, a minimum 2- by 2-inch treated wood nailer, and be reinforced with 1- by 1-inch by 1-foot-8-inch steel angel on sides 24 inches and larger; Custom Curb, Inc., ThyCurb, Roof Products and Systems, Pate, or approved equivalent.

C. Ductwork with Equipment: Provide roof-mounted equipment such as exhaust or supply fans, relief or intake hoods, packaged rooftop air conditioners, air handlers, etc., with an insulated roof curb designed to mate with the equipment and include a weatherproof enclosure. If a pre-insulated curb is not available, an uninsulated curb is acceptable if Contractor provides and installs field insulation per manufacturer's instructions. Deliver roof curbs to Roofing Contractor for installation.

D. General:
   1. Coordinate roof flashing assemblies and roof curbs with other work through Roofing Contractor to ensure that flashing, canting, insulation type and location is correct and appropriate for the specified roof construction type.
   2. Select and provide roof curb so that the top of the curb will be level after installation. Provide tapered curb as required to match roof slope. The curb will provide a minimum clearance of 10 inches between the top of the finished roof surface and the top of the wood nailer, continuous around the curb perimeter.
   3. Curb Fabrication: Unless otherwise noted, provide welded 18-gauge galvanized steel shell and base, mitered 3-inch cant, variable step to match roof insulation, 1-1/2-inch-thick insulation, and factory-installed treated wood nailer. Provide tapered curbs to match roof slope.
   4. Roof penetration location indicated on the Drawings is approximate. Refer to the Architectural and Structural Drawings for the structural openings. Refer to "Cutting and Patching" paragraph in this Section for more information.
   5. Provide other options for roof curbs as scheduled in the Drawings.

2.10 ACCESSIBILITY

A. Access Panels: Provide access panels where necessary for possible future replacement, adjustment, or maintenance of operating devices such as machinery, valves, dampers, switches, relays, etc., or to other critical non-operating devices such as pull boxes, inspection parts, gauges, etc. Access panels will be provided and installed by Contractor, whether or not shown in the Drawings, and approved by Architect of type, color and application.
   1. Where access panels are installed in fire rated construction, provide panels that are UL rated to maintain rating of the construction penetrated.

B. Access to Equipment:
   1. Pipes, tubing, conduit, etc., including but not limited to draining piping, electrical conduit, wiring not in conduit, and pneumatic control tubing will be installed in such a way so as allow convenient and serviceable removal, operation, use, or maintenance of equipment, access panels or doors, pathways (especially in attics or crawlspaces), observation ports, measurement, balancing devices, or junction boxes.
   2. If access for these purposes is prevented or made unreasonably difficult in the opinion of Architect, make modifications or repairs at no additional cost. Modifications or repairs will be considered neither complete nor adequate until Architect is satisfied that access for the above purpose is achieved.

2.11 PROTECTION OF PENETRATION

A. Penetrations of fire or smoke barriers will be sealed, sleeves (if any), insulation (if any), and vibration isolation (if any) that maintain the fire or smoke resistance rating of the barrier in accordance with the latest edition of NFPA 101 Life Safety Code. Refer to Section 07 84 13 "Penetration Firestopping" for penetration requirements.

B. Verify locations and type of partition penetrations from the Drawings. Provide Sealing material and methods per UL requirements.

2.12 BEDDING COURSE

A. Bedding Course: A naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.

PART 3 - EXECUTION

3.1 STORAGE

A. Provide for proper storage of all materials and equipment and assume responsibility for losses due to any cause. Storage will be within the contract limits of the building site or in a bonded warehouse. Cover, store, and protect equipment and materials from inclement or detrimental conditions. Items that have become damaged, rusted, or rendered unusable will not be permitted to be installed.
B. Provide temporary storage facilities suitable for equipment stored at the job site. Provide rainproof and lockable storage as required. Materials or equipment stored on site that is not in a lockable rainproof storage facility will be stored above ground or above slab. Take necessary precautions to prevent entry of and/or damage from dirt, trash, water, or vermin. Equipment not properly stored and protected will be, at the discretion of Architect, replaced at no additional cost to Owner. Do not store equipment or material on roofs unless specifically allowed in by Architect.

3.2 INSTALLATION AND ARRANGEMENT

A. Install Work to permit removal (without damage to other parts) of coils, heat exchanger bundles, boiler tubes, fan shafts and wheels, filters, belt guards, sheaves, and drives, and all other parts that might require periodic replacement or maintenance. Arrange pipes, ducts, and equipment to permit ready access to valves, traps, starters, motors, control components, and to clear opens of doors and of access panels.
B. Offsets, transitions, and changes in direction in pipes and ducts will be made as required to maintain proper headroom and pitch of sloping pipes whether indicated in the Drawings or not. Furnish and install all traps, air vents, sanitary vents, etc., as required to affect these offsets, transitions, and changes in direction.
C. Duct transitions and offsets required to connect ductwork to equipment will be made as required whether or not indicated in the Drawings.

3.3 PROTECTION OF WORK AND PROPERTY

A. Protect existing facilities, whether or not such facility is to be removed or relocated or remain as installed. Move or remove facilities so as not to cause interruption to the Work or Owner's Operation.

B. Cover and protect pipe and duct openings with caps or plugs during installation. Cover and protect fixtures against damage. At final completion, clean and deliver Work in an unblemished condition or refinished and repainted at the discretion of Architect.

3.4 CONCEALED AND EXPOSED WORK

A. "Concealed" is intended to mean within such spaces as pipe chases, pipe trenches, above plaster ceilings, in walls and buried pipe is inaccessible when building is completed. "Exposed" is intended to be within equipment rooms, unfinished spaces, above "pushup" ceilings, accessible pipe tunnels, etc., where pipe is accessible.

3.5 CONCRETE

A. Mechanical Contractor will coordinate requirements for concrete supporting or necessary mechanical equipment. All concrete will be furnished under the Architectural Divisions of these Specifications.

3.6 FIELD MEASUREMENTS

A. Verify the dimensions and conditions governing Work at the Project Site and examine adjoining work on which Work is dependent, for Project efficiency. Report Project conditions that require correction to Architect.

3.7 LUBRICATION

A. Provide oil and grease for the operation of equipment until acceptance. Repair or replace damaged bearings operated prior to Date of Substantial Completion. Protect bearings and shafts during installation and thoroughly lubricate the steel shafts to prevent corrosion.

3.8 MANUFACTURER'S DIRECTION

A. Install equipment in accordance with directions and recommendations provided by the manufacturer. Where manufacturer’s instructions conflict with the Drawings and Specifications, report conflicts to Architect, who will determine changes deemed necessary and desirable.

3.9 FLUSHING, CLEANING, AND STERILIZING

A. Before final connections are made in the piping systems, blow-out piping with air and completely wash-out with cleaning compounds. Flush the systems for complete removal of foreign and deleterious materials. Furnish temporary connections, valves, etc., required for this purpose.
B. After flushing, sterilize domestic water systems with an approved chlorinating agent to provide a dosage of not less than 50 ppm. After a minimum contact period of 8 hours, flush the system with clean water until the residual chlorine is no greater than the municipal water supply.

3.10 TESTS

A. Test storm, vent, and waste lines with either a 5 psi air test or a standing water test of 10 feet of head pressure. Do not test plastic pipe with air. Hold test for a minimum of 1 hour, or as required by local code.
B. Test new domestic cold, hot, and recirculating hot water service lines as follows:
   1. Test hydrostatically at not less than the working pressure of the system or by an air test of 50 psig. Do not test plastic pipe with air. Hold test for a minimum of 1 hour, or as required by local code. Use potable water for the hydrostatic test.
C. Test fire protection system at 200 psig. Hold test for a minimum of 2 hours, or as required by local code.
D. Test all heating and chilled water piping before connecting to the units at 100 psig hydrostatic pressure. Test to be held for a minimum of 2 hours.
E. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
F. Tests will be witnessed and approved by Architect and the local Authority Having Jurisdiction (AHJ) before covering or insulating. Demonstrate satisfactory operation of blowers, pumps, and other equipment with moving parts to Architect. Equipment without movable parts will have pressure or other tests performed by Contractor to demonstrate satisfactory operation.
G. Furnish instruments, pumps, blowers, and equipment required for the testing.
H. Provide test result reports for inclusion on the Operations and Maintenance Manuals and submit one copy to Architect.

3.11 PAINTING

A. Thoroughly clean, primed (if not factory primed), and finish coat surfaces of equipment and material not provided with a factory finish coat with a high-quality alkyd industrial enamel of a color selected by Architect or Owner.

3.12 SPECIAL OPENINGS

A. Schedule delivery of large equipment requiring special openings for installation before enclosing of area. Where this is not possible, written notice of required openings that must be provided will be listed by size and location and submitted to General Contractor prior to enclosing the areas involved. Work required to construct openings and the associated cost of enclosing them will be done at no additional cost to Owner.

3.13 PLACING IN OPERATION

A. Ducts, pipes, equipment, controls, etc., will be cleaned of foreign debris and other deleterious material.
B. Prior to Date of Substantial Completion, thoroughly clean or replace strainers, lubricate bearings, and clean-out and prime drains. Clean filters permanent filters. Replace throwaway-type filters with new filters.
C. Place systems in operation.

D. Verify that controls are set to meet specified operating conditions.
   1. Example: Boiler operating control set at 180 degrees F. Limit control set at 200 degrees F.
E. Verify that parts of equipment are operable and that sequences of controls are properly set.
F. Adjust seating through the first year as required by Architect.

3.14 BALANCING, TESTING, AND ADJUSTING THE MECHANICAL SYSTEMS

A. Include in proposal the cost of testing, adjusting, and balancing (TAB). Refer to the TAB Specification (Section 23 05 93 "Testing, Adjusting, and Balancing of HVAC"). Coordinate with TAB Contractor to correct deficiencies noted by the TAB Contractor during TAB testing.

3.15 OPERATION AND MAINTENANCE INSTRUCTIONS

A. Prepare operating and maintenance manuals and deliver O&M manuals to Architect for approval. Index manuals with dividers for each Section. Delivery and approval of required documents is a condition for final acceptance and payment. Refer to Section 01 70 00 "Execution and Closeout Requirements."
B. Each manual will contain, but not limited to, the following general sections:
   1. Certificates of acceptance from the inspecting authorities.
   2. Waiver of liens.
   3. Warranties with starting dates and end dates for each piece of equipment and/or for each system (warranties will begin on the date of Substantial Completion and acceptance by Owner).
   4. Names, telephone, and fax numbers, and addresses of all subcontractors, vendors, manufacturer's representatives, and warranty providers.
   5. Certification letters from each Contractor that each system furnished and installed by that Contractor and/or subcontractors is started up, balanced, adjusted, and checked for proper operation in accordance with the intent of the Contract Documents.
   6. Spare parts lists for each piece of equipment.
   7. Lubrication charts showing types of lubrication and application methods and frequencies.
   8. Filter cleaning or replacement schedule (on Contractor's letterhead stationery).
   9. Preventative maintenance schedule for checking all items such as belt drives, safety controls, oil and refrigerant charges, and seasonal change over recommendations. Cleaning of all strainers, traps, coils, tower pans, tubes, sprays, etc. (on Contractor's letterhead stationery).
   10. Normal operating instructions including a sequence of operations (on Contractor's letterhead stationery).
   11. Instructions as to procedures to be followed for emergency situations, such as alarms or safety items being tripped (on Contractor's letterhead stationery).

12. Instruction on who to call for service during guarantee period (on Contractor's letterhead stationery).
13. As-Built Drawings.
14. Copy of approved Shop Drawing submittals including nameplate date, design parameters, name, telephone and fax numbers, address of vendor, manufacturer's representative, and warranty provider.

C. Final payment approval will not be granted until tests, balancing, and operating instruction portions have been completed.

3.16 INSTRUCTIONS TO OWNER

A. Instruct Owner's operating personnel in the operations and maintenance of mechanical systems and equipment. Provide a minimum of 8 hours of training. Furnish special servicing tools required for maintenance.

B. Conduct a demonstration of the installation upon completion and final acceptance of the Work. Provide a minimum 8-hour demonstration. Prior to the demonstration, ensure that Work has been completed, tested, balanced, and placed in proper operation. Provide qualified personnel to be present at demonstrations to operate systems and prove the proper performance of equipment. Coordinate demonstration schedule with Architect and Owner.

END OF SECTION

SECTION 23 05 00.20 - BASIC MECHANICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. The following basic mechanical materials and methods to complement other Division 23 Sections.
      a. Piping materials and installation instructions common to most piping systems.
      b. Concrete equipment base construction requirements.
      c. Equipment nameplate data requirements.
      d. Labeling and identifying mechanical systems and equipment is specified in Section 23 05 53 "Identification for HVAC Piping and Equipment."
      e. Nonshrink grout for equipment installations.
      f. Field-fabricated metal and wood equipment supports.
      g. Installation requirements common to equipment specification Sections.
      h. Cutting and patching.
      i. Touch-up painting and finishing.
   2. Pipe and pipe fitting materials are specified in piping system Sections.

B. Related Requirements:
   1. Division 01 Specification Sections apply to Work of this Section.

1.2 DEFINITIONS

A. Pipe, pipe fittings, and piping include tube, tube fittings, and tubing.

B. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below the roof, spaces above ceilings, unexcavated spaces, crawl spaces, and tunnels.

C. Exposed Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

D. Exposed Exterior Installations: Exposed to view outdoors, or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

E. Concealed Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and duct shafts.

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

1.3 SUBMITTALS

A. General: Submit the following according to the Conditions of the Contract and Division 01 and Section 23 05 00 "General Mechanical Requirements."

B. Product data for following piping specialties:
   1. Mechanical sleeve seals.
   2. Dielectric Fittings.
   3. Access Doors.

1.4 QUALITY ASSURANCE

A. Qualify welding processes and operators for piping according to ASME "Boiler and Pressure Vessel Code," Section IX, "Welding and Brazing Qualifications."
   1. Comply with provisions of ASME B31 Series "Code for Pressure Piping."
   2. Certify that each welder has passed AWS qualification tests for the welding processes involved and that certification is current.
B. ASME A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.
C. Equipment Selection: Equipment of greater or larger power, dimensions, capacities, and ratings may be furnished provided such proposed equipment is approved in writing and connecting mechanical and electrical services, circuit breakers, conduit, motors, bases, and equipment spaces are increased. No additional costs will be approved for these increases if larger equipment is approved. If minimum energy ratings or efficiencies of the equipment are specified, the equipment must meet the design requirements and commissioning requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied endcaps. Maintain endcaps through shipping, storage, and handling to prevent pipe-end damage and prevent entrance of dirt, debris, and moisture.
B. Protect stored pipes and tubes from moisture and dirt. Elevate above grade. When stored inside, do not exceed structural capacity of the floor.
C. Protect flanges, fittings, and piping specialties from moisture and dirt.
D. Protect stored plastic pipes from direct sunlight. Support to prevent sagging and bending.

1.6 SEQUENCING AND SCHEDULING

A. Coordinate mechanical equipment installation with other building components.
B. Arrange for chases, slots, and openings in building structure during progress of construction to allow for mechanical installations.
C. Coordinate the installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
D. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Coordinate installation of large equipment requiring positioning before closing in the building.
E. Coordinate connection of electrical services.
F. 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.

G. Coordinate requirements for access panels and doors where mechanical items requiring access are concealed behind finished surfaces. Access panels and doors are specified in this Section and Division 08.
H. Coordinate installation of identifying devices after completing covering and painting where devices are applied to surfaces. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 PIPE AND PIPE FITTINGS

A. Refer to individual piping system Specification Sections for pipe and fitting materials and joining methods.
B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.2 JOINING MATERIALS

A. Refer to individual piping system Specification Sections in Division 23 for special joining materials not listed below.
B. Pipe Flange Gasket Materials: Suitable for the chemical and thermal conditions of the piping system contents.
   1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness, except where thickness or specific material is indicated.
      a. Full-Face Type: For flat-face, Class 125 cast-iron and cast-bronze flanges.
      b. Narrow-Face Type: For raised-face, Class 250 cast-iron and steel flanges.
   2. ASME B16.20 for grooved, ring-joint, steel flanges.
   3. AWWA C110, rubber, flat face, 1/8-inch thick, except where other thickness is indicated; and full-face or ring type, except where type is indicated.
C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, except where other material is indicated.
D. Plastic Pipe Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, except where other type or material is indicated.
E. Solder Filler Metal: ASTM B32.
   1. Alloy Sn95 or Alloy Sn94: Tin (approximately 95 percent) and silver (approximately 5 percent), having 0.10 percent lead content.
F. Brazing Filler Metals: AWS A5.8.
   1. BCuP Series: Copper-phosphorus alloys.
   2. BAg1: Silver alloy.
G. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
H. Solvent Cements: Manufacturer's standard solvents complying with the following:
   1. Chlorinated Poly (Vinyl Chloride) (CPVC): ASTM F493.
I. Plastic Pipe Seals: ASTM F477, elastomeric gasket.
J. Flanged, Ductile-Iron Pipe Gasket, Bolts, and Nuts: AWWA C110, rubber gasket, carbon steel bolts, and nuts.

K. Couplings: Iron body sleeve assembly, fabricated to match outside diameters of plain-end pressure pipes.
   1. Sleeve: ASTM A126, Class B, gray iron.
   2. Followers: ASTM A47, Grade 32510, or ASTM A536 ductile iron.
   3. Gaskets: Rubber.
   4. Bolts and Nuts: AWWA C111.
   5. Finish: Enamel paint.

2.3 PIPING SPECIALTIES

A. Escutcheons: Manufactured wall, ceiling, and floor plates; deep-pattern type where required to conceal protruding fittings and sleeves.
   1. Inside Diameter: Closely fit around pipe, tube, and insulation.
   2. Outside Diameter: Completely cover opening.
   3. Cast Brass: One-piece, with setscrew.
      a. Finish: Rough brass.
      b. Finish: Polished chrome plate.
   4. Cast Brass: Split casting, with concealed hinge and setscrew.
      a. Finish: Rough brass.
      b. Finish: Polished chrome plate.
   5. Stamped Steel: One-piece, with setscrew and chrome-plated finish.
   6. Stamped Steel: One-piece, with spring clips and chrome-plated finish.
   7. Stamped Steel: Split plate, with concealed hinge, setscrew, and chrome-plated finish.
   8. Stamped Steel: Split plate, with concealed hinge, spring clips, and chrome-plated finish.
   9. Stamped Steel: Split plate, with exposed-rivet hinge, setscrew, and chrome-plated finish.
   10. Stamped Steel: Split plate, with exposed-rivet hinge, spring clips, and chrome-plated finish.
   11. Cast-Iron Floor Plate: One-piece casting.

B. Dielectric Fittings: Assembly or fitting having insulating material isolating joined dissimilar metals to prevent galvanic action and stop corrosion.
   1. Description: Combination of copper alloy and ferrous; threaded, solder, plain, and weld neck end types and matching piping system materials.
   2. Insulating Material: Suitable for system fluid, pressure, and temperature.
   3. Dielectric Unions: Factory-fabricated, union assembly for 250-psig minimum working pressure at a 180 degrees F temperature.
   4. Dielectric Flanges: Factory-fabricated, companion-flange assembly for 150- or 300-psig minimum pressure to suit system pressures.
   5. Dielectric-Flange Insulation Kits: Field-assembled, companion-flange assembly, full-face or ring type. Components include neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
      a. Provide separate companion flanges and steel bolts and nuts for 150- or 300-psig minimum working pressure to suit system pressures.
   6. Dielectric Couplings: Galvanized-steel coupling, having inert and noncorrosive, thermoplastic lining, with threaded ends and 300-psig minimum working pressure at 225 degrees F temperature.

7. Dielectric Nipples: Electroplated steel nipple, having inert and noncorrosive thermoplastic lining, with combination of plain, threaded, or grooved end types and 300-psig working pressure at 225 degrees F temperature.

C. Mechanical Sleeve Seals: Modular, watertight mechanical type. Components include interlocking synthetic rubber links shaped to continuously fill annular space between pipe and sleeve. Connecting bolts and pressure plates cause rubber-sealing elements to expand when tightened.

D. Sleeves: The following materials are for wall, floor, slab, and roof penetrations:
   1. Steel Sheet Metal: 24-gauge or heavier galvanized sheet metal, round tube closed with welded longitudinal joint.
   2. Steel Pipe: ASTM A53, Type E, Grade A, Schedule 40, galvanized, plain ends.
   3. Cast-Iron: Cast or fabricated wall pipe equivalent to ductile-iron pressure pipe, having plain ends and integral water stop, except where other features are specified.
   4. Wall Penetration Systems: Wall sleeve assembly, consisting of housing, gaskets, and pipe sleeve, with 1 mechanical-joint end conforming to AWWA C110 and 1 plain pipe-sleeve end.
      a. Penetrating Pipe Deflection: Five percent without leakage.
      b. Housing: Ductile-iron casting having waterstop and anchor ring, with ductile-iron gland, steel studs and nuts, and rubber gasket conforming to AWWA C111, of housing and gasket size as required to fit penetrating pipe.
      c. Pipe Sleeve: AWWA C151, ductile-iron pipe.
      d. Housing-to-Sleeve Gasket: Rubber or neoprene push-on type of manufacturer's design.
   5. Cast-Iron Sleeve Fittings: Commercially made sleeve having an integral clamping flange, with clamping ring, bolts, and nuts for membrane flashing.
      a. Underdeck Clamp: Clamping ring with setscrews.

2.4 GROUT

A. Nonshrink, Nonmetallic Grout: ASTM C1107, Grade B.
   1. Characteristics: Post-hardening, volume-adjusting, dry, hydraulic-cement grout, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
   2. Design Mix: 5,000-psi, 28-day compressive strength.
   3. Packaging: Premixed and factory packaged.

2.5 ACCESS DOORS

A. Flush-mounted steel access doors with 16-gauge frame and 14-gauge panel. Prime coat finish. Concealed spring hinges, screwdriver cam-lock. Provide doors in fire-rated construction that are UL listed and labeled. Doors to be Milcor or approved equivalent.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

A. General: Install piping as described below, except where system Sections specify otherwise. Individual piping system Specification Sections in Divisions 21, 22, and 23 specify piping installation requirements unique to the piping system.
B. General Locations and Arrangements: Drawings (plans, schematics, and diagrams) indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated, except where deviations to layout are approved on Coordination Drawings.
C. Install piping at indicated slope.
D. Install components having pressure rating equal to or greater than system operating pressure.
E. Install piping in concealed interior and exterior locations, except in equipment rooms and service areas.
F. Install piping free of sags and bends.
G. Install exposed interior and exterior piping at right angles or parallel to building walls. Diagonal runs are prohibited, except where indicated.
H. Install piping tight to slabs, beams, joists, columns, walls, and other building elements. Allow sufficient space above removable ceiling panels to allow for ceiling panel removal.
I. Install piping to allow application of insulation plus 1-inch clearance around insulation.
J. Locate groups of pipes parallel to each other, spaced to permit valve servicing.
K. Install fittings for changes in direction and branch connections.
L. Install couplings according to manufacturer's printed instructions.
M. Install pipe escutcheons for pipe penetrations of concrete and masonry walls, wallboard partitions, and suspended ceilings according to the following:
    1. Chrome-Plated Piping: Cast-brass, one-piece, with setscrew, and polished chrome-plated finish. Use split-casting escutcheons, where required, for existing piping.
    2. Uninsulated Piping Wall Escutcheons: Cast-brass or stamped-steel, with setscrew.
    3. Uninsulated Piping Floor Plates in Utility Areas: Cast-iron floor plates.
    4. Insulated Piping: Cast-brass or stamped-steel, with concealed hinge, spring clips, and chrome-plated finish.
    5. Piping in Utility Areas: Cast-brass or stamped-steel, with setscrew or spring clips.
N. Sleeves are required for core-drilled holes.
O. Install sleeves for pipes passing through concrete and masonry walls, concrete floor, roof slabs, and where indicated.

P. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, concrete floor, and roof slabs, and where indicated.
   1. Cut sleeves to length for mounting flush with both surfaces.
      a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 4 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring where specified.
   2. Build sleeves into new walls and slabs as work progresses.
   3. Install large enough sleeves to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
      a. Steel Pipe Sleeves: For pipes smaller than 6 inches.
      b. Steel Sheet-Metal Sleeves: For pipes 6 inches and larger that penetrate gypsum board partitions.
      c. Cast-Iron Sleeve Fittings: For floors having membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 4 inches above finished floor level. Flashing is specified in Division 07.
         1) Seal space outside of sleeve fittings with nonshrink, nonmetallic grout.
   4. Except for below-grade wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using elastomeric joint sealants specified in Division 07.

Q. Above Grade, Exterior Wall, and Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Size sleeve for 1-inch annular clear space between pipe and sleeve for installation of mechanical seals.
   1. Install steel pipe for sleeves smaller than 6 inches.
   2. Install cast-iron wall pipes for sleeves 6 inches and larger.
   3. Assemble and install mechanical seals according to manufacturer's printed instructions.

R. Below Grade, Exterior Wall, and Pipe Penetrations: Install cast-iron wall pipes for sleeves. Seal pipe penetrations using mechanical sleeve seals. Size sleeve for 1-inch annular clear space between pipe and sleeve for installation of mechanical seals.
   1. Below Grade, Exterior Wall, and Pipe Penetrations: Install ductile-iron wall penetration system sleeves according to manufacturer's printed installation instructions.

S. Fire Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestopping sealant material. Firestopping materials are specified in Division 07.

T. Verify final equipment locations for roughing in.

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

V. Piping Joint Construction: Join pipe and fittings as follows and as specifically required in individual piping system Sections.
   1. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
   2. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
   3. Soldered Joints: Construct joints according to AWS "Soldering Manual," in "The Soldering of Pipe and Tube" chapter.

4. Brazed Joints: Construct joints according to AWS "Brazing Manual" in the "Pipe and Tube" chapter.
5. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full inside diameter. Join pipe fittings and valves as follows:
    a. 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.
    b. Apply appropriate tape or thread compound to external pipe threads (except where dry seal threading is specified).
    c. Align threads at point of assembly.
    d. Tighten joint with wrench. Apply wrench to valve end into which pipe is being threaded.
    e. Damaged Threads: Do not use pipe or pipe fittings having threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
6. Welded Joints: Construct joints according to AWS D10.12 "Recommended Practices and Procedures for Welding Low Carbon Steel Pipe" using qualified processes and welding operators according to the "Quality Assurance" Article.
7. Flanged Joints: Align flange surfaces parallel. Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly using torque wrench.
8. Plastic Pipe and Fitting Solvent-Cement Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join pipe and fittings according to the following standards:
    a. Comply with ASTM F402 for safe handling of solvent-cement and primers.
    b. Chlorinated Poly (Vinyl Chloride) (CPVC): ASTM D2846 and ASTM F493.

W. Piping Connections: Except as otherwise indicated, make piping connections as specified below.
1. Install unions in piping 2 inches and smaller adjacent to each valve and at final connection to each piece of equipment having a 2-inch or smaller threaded pipe connection.
2. Install flanges in piping 2-1/2 inches and larger adjacent to flanged valves and at final connection to each piece of equipment having flanged pipe connection.
3. Dry Piping Systems (Gas): Install dielectric unions and flanges to connect piping materials of dissimilar metals.
4. Wet Piping Systems (Water): Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.2 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to provide the maximum possible headroom where mounting heights are not indicated.
B. Install equipment according to approved submittal data. Portions of the Work are shown only in diagrammatic form. Refer conflicts to Architect.
C. Install equipment level and plumb, parallel, and perpendicular to other building systems and components in exposed interior spaces, except where otherwise indicated.
D. Install mechanical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. Connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location.
E. Install equipment giving right-of-way to piping systems installed at a required slope.

3.3 ACCESS DOORS

A. Furnish an access door for each pipe chase for each floor. This includes both toilet plumbing chases and pipe riser chases. Access doors assembly to be size 16 by 16 inches. Access doors are not shown on floor plans. Access door locations shall be field verified.
B. Also, furnish access doors in all non-removable ceilings and in partitions and walls where necessary access to plumbing cleanouts, shock absorbers, fire dampers, manual dampers, valves, and other mechanical devices requiring access. Size these as required for access with minimum size of 12 by 12 inches.
C. Any access doors furnished for installation in fire-rated surfaces or assembly shall carry an approved fire rating for that use.
D. Any access doors furnished for installation in glued-on acoustical surfaces or assembly shall have recessed doors to allow installation of tiles.
E. Provide all access doors to General Contractor for them to construct into the building.

3.4 PAINTING AND FINISHING

A. Refer to Division 09 for field painting requirements.
B. Damage and Touch-Up: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.5 CONCRETE BASES

A. Construct concrete equipment bases of dimensions indicated, but not less than 4 inches larger than supported unit in both directions. Follow supported equipment manufacturer's setting templates for anchor bolt and tie locations. Use 3,000-psi, 28-day compressive strength concrete and reinforcement use fibrillated or monofilament polypropylene fibers engineered and designed for use in concrete, complying with ASTM C1116, Type III, 1/2-inch to 1-1/2 inches long. Uniformly disperse in concrete mix at manufacturer’s recommended rate, but not less than 1.5 lb./cu. yd.

3.6 ERECTION OF METAL SUPPORTS AND ANCHORAGE

A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.
B. Field Welding: Comply with AWS D1.1 "Structural Welding Code - Steel."

3.7 ERECTION OF WOOD SUPPORTS AND ANCHORAGE

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorage to support and anchor mechanical materials and equipment.
B. Select fastener sizes 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 wood members.
C. Attach to substrates as required to support applied loads.

3.8 CUTTING AND PATCHING

A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces necessary for mechanical installations. Perform cutting by skilled mechanics of the trades involved.
B. Repair cut surfaces to match adjacent surfaces.

3.9 GROUTING

A. Install nonmetallic, nonshrink grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors. Mix grout according to manufacturer's printed instructions.
B. Clean surfaces that will come into contact with grout.
C. Provide forms for placement of grout, as required.
D. Avoid air entrapment when placing grout.
E. Place grout to completely fill equipment bases.
F. Place grout on concrete bases to provide a smooth bearing surface for equipment.
G. Place grout around anchors.
H. Cure placed grout according to manufacturer's printed instructions.

3.10 DEMOLITION

A. Disconnect, demolish, and remove work specified under Divisions 21, 22, and 23 and as indicated.
B. Where pipe, ductwork, insulation, or equipment to remain is damaged or disturbed, remove damaged portions and install new products of equal capacity and quality.
C. Accessible Work: Remove indicated exposed pipe and ductwork in its entirety.

D. Abandoned Work: Cut and remove buried pipe abandoned in place, 2 inches beyond the face of adjacent construction. Cap and patch surface to match existing finish.
E. Removal: Remove indicated equipment from the Project Site.
F. Temporary Disconnection: Remove, store, clean, reinstall, reconnect, and make operational equipment indicated for relocation.

END OF SECTION

SECTION 23 05 29 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Pipe hangers and supports.
   2. Hanger rods.
   3. Formed steel channel.
   4. Equipment bases and supports.

B. Related Requirements:
   1. Division 01 Specification Sections apply to Work of this Section.
   2. Section 03 10 00 "Concrete Forming and Accessories" Placement of inserts in concrete forms as required by this Section.
   3. Section 03 30 00 "Cast-in-Place Concrete" for placement of concrete housekeeping pads as required by this Section.
   4. Section 07 84 13 "Penetration Firestopping" for firestopping for placement by this Section.
   5. Section 07 92 00 "Joint Sealants" for sealant materials for placement by this Section.
   6. Section 09 91 23 "Interior Painting" for painting as required by this Section.
   7. Section 22 07 00 "Plumbing Insulation" for piping and accessory insulation as required by this Section.

1.2 REFERENCE STANDARDS

A. American Welding Society:
   1. AWS D1.1 - Structural Welding Code - Steel.

B. ASME International:
   1. ASME B31.1 - Power Piping.
   2. ASME B31.5 - Refrigeration Piping and Heat Transfer Components.
   3. ASME B31.9 - Building Services Piping.

C. ASTM International:
   1. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
   2. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems.
   3. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems.
   4. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers.

D. FM Global:
   1. FM - Approval Guide.

E. Manufacturers Standardization Society of the Valve and Fittings Industry:
   1. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation.

F. UL:
   1. UL - Fire-resistance-rated Systems and Products.
   2. UL 263 - Fire Tests of Building Construction and Materials.
   3. UL 1479 - Fire Tests of Through-Penetration Firestops.
   4. UL 2079 - Tests for Fire Resistance of Building Joint Systems.

1.3 SUBMITTALS

A. Refer to Division 01 and Section 23 05 00 "General Mechanical Requirements."
B. Product Data:
   1. Hangers and Supports: Submit manufacturer's catalog information, including load capacity.
C. Manufacturer Instructions:
   1. Hangers and Supports: Submit special procedures and assembly of components.

1.4 QUALITY ASSURANCE

A. Welding of Hanger and Support Attachments to Building Structure: Comply with AWS D1.1.
B. Perform Work according to State and local standards.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum 3 years' experience.
B. Installer: Company specializing in performing Work of this Section with minimum 3 years' experience.
C. Welders: AWS qualified within previous 12 months for employed weld types.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Inspection: Accept materials on site in manufacturer's original packaging and inspect for damage.
B. Store materials according to manufacturer instructions.
C. Protection:
   1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
   2. Provide additional protection according to manufacturer instructions.

1.7 EXISTING CONDITIONS

A. Field Measurements:
   1. Verify field measurements prior to fabrication.

1.8 WARRANTY

A. Refer to Division 01 and Section 23 05 00 "General Mechanical Requirements."

PART 2 - PRODUCTS

2.1 PIPE HANGERS AND SUPPORTS

A. Hydronic Piping:
1. Comply with ASME B31.9. ASTM F708, or MSS SP-58.
2. Hangers for Pipe Sizes 1/2-Inch to 1-1/2 Inches:
   a. Material: Carbon steel.
   b. Type: Adjustable swivel and split ring.
3. Hangers for Cold Pipe, Sizes 2 Inches and Larger:
   a. Material: Carbon steel.
   b. Type: Adjustable; clevis.
4. Hangers for Hot Pipe, Sizes 2 to 4 Inches:
   a. Material: Carbon steel.
   b. Type: Adjustable; clevis.
5. Hangers for Hot Pipe, Sizes 6 Inches and Larger:
   a. Type: Double hanger.
   b. Yoke: Adjustable; steel.
   c. Roll: Cast iron.
6. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
7. Multiple or Trapeze Hangers for Hot Pipe, Sizes 6 Inches and Larger:
   a. Steel channels with welded spacers and hanger rods.
   b. Roll: Cast iron.
8. Wall Support for Pipe Sizes 3 Inches and Smaller: Cast-iron hooks.
9. Wall Support for Pipe Sizes 4 Inches and Larger: Welded steel bracket and wrought steel clamp.
10. Wall Support for Hot Pipe Sizes 6 Inches and Larger:
    a. Welded steel bracket and wrought steel clamp.
    b. Yoke: Adjustable; steel.
    c. Roll: Cast iron.
11. Vertical Support: Steel riser clamp.
12. Floor Support for Cold Pipe:
    a. Pipe Saddle: Cast iron; adjustable.
    b. Support: Concrete pier or steel column.
    c. Furnish lock nut, nipple, and floor flange.
13. Floor Support for Hot Pipe, Sizes 4 Inches and Smaller:
    a. Pipe Saddle: Cast iron; adjustable.
    b. Support: Concrete pier or steel column.
    c. Furnish lock nut, nipple, and floor flange.
14. Floor Support for Hot Pipe, Sizes 6 Inches and Larger:
    a. Roll and Stand: Cast iron; adjustable.
    b. Screws: Steel.
    c. Support: Concrete pier or steel column.
15. Copper Pipe Support: Copper-plated carbon-steel ring.

B. Accessories:
1. Hanger Rods: Mild steel continuously threaded.

2.2 FORMED STEEL CHANNEL

A. Manufacturers:
   1. B-line
   2. Unistrut
   3. Substitutions: Refer to Division 01 and Section 23 05 00 "General Mechanical Requirements."
B. Description:
   1. Material: Galvanized 12-gauge steel.
   2. Thickness: 12 gauge.
   3. Hole Spacing: 1-1/2 inches o.c.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that openings are ready to receive sleeves.
B. Verify that openings are ready to receive firestopping.

3.2 INSTALLATION

A. Pipe Hangers and Supports:
   1. Comply with ASME B31.1, B31.5, or B31.9.
   2. Comply with ASTM F708, or MSS SP-58.
   3. Support horizontal piping as scheduled.
   4. Minimum Hanger Spacing: 1/2-inch between finished covering and adjacent Work.
   5. Place hangers within 12 inches of each horizontal elbow.
   6. Minimum Vertical Hanger Adjustment: 1-1/2 inches.
   7. Support vertical piping at every floor.
   8. If piping is installed in parallel and at same elevation, provide multiple-pipe or trapeze hangers.
   9. Support riser piping independently of connected horizontal piping.
   10. Provide copper-plated hangers and supports for copper piping.
   11. Design hangers for pipe movement without disengagement of supported pipe.
   12. Painting and Coating:
      a. Prime coat exposed steel hangers and supports.
      b. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
   13. Insulation:
      a. Provide clearance in hangers and from structure and other equipment for installation of insulation.
B. Equipment Bases and Supports:
   1. Provide housekeeping pads of concrete as specified in Section 03 30 00 "Cast-in-Place Concrete."
   2. Minimum Size: Four inches thick and extending 6 inches beyond supported equipment.

3. Use templates furnished with equipment to install equipment anchor bolts and accessories.
4. Supports: Brace and fasten with flanges bolted to structure.

3.3 FIELD QUALITY CONTROL

A. Inspect installed firestopping for compliance with Specifications and submitted schedule.

3.4 CLEANING

A. Clean adjacent surfaces of firestopping materials.

3.5 PROTECTION

A. Protect adjacent surfaces from damage by material installation.

3.6 SCHEDULES

A. Hydronic Piping Hanger Spacing:

PIPE MATERIAL	MAXIMUM HANGER SPACING, FEET	HANGER ROD DIAMETER, INCHES
Copper tube, 1-1/4 inches and smaller	6	1/2
Copper tube, 1-1/2 inches and larger	10	1/2
Steel, 3 inches and smaller	12	1/2
Steel, 4 inches and larger	12	5/8

END OF SECTION

SECTION 23 05 53 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Nameplates.
   2. Tags.
   3. Stencils.
   4. Pipe Markers.
   5. Ceiling Tacks.
   6. Labels.

B. Related Requirements:
   1. Division 01 Specification Sections apply to Work of this Section.
   2. Section 09 91 23 "Interior Painting" for execution requirements for painting specified by this Section.

1.2 REFERENCES

A. American Society of Mechanical Engineers:
   1. ASME A13.1 - Scheme for the Identification of Piping Systems.

1.3 SUBMITTALS

A. Product Data: Submit manufacturers catalog literature for each product required.

B. Shop Drawings: Submit list of wording, symbols, letter size, and color coding for mechanical identification and valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

C. Manufacturer's installation instructions: Indicate installation instructions, special procedures, and installation.

1.4 QUALITY ASSURANCE

A. Conform to ASME A13.1 for color scheme for identification of piping systems and accessories.

B. Maintain 1 copy of each document on site.

1.5 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Seton Identification Products.
B. Brimar Industries.
C. Substitutions: Refer to Section 23 05 00 "General Mechanical Requirements."

2.2 NAMEPLATES

A. Product Description: Laminated 3-layer plastic with engraved black letters on light contrasting background color.

2.3 TAGS

A. Metal Tags:
   1. Brass with stamped letters; tag size minimum 1-1/2 inches diameter with finished edges.
B. Information Tags:
   1. Clear plastic with printed "Danger," "Caution," or "Warning" and message; size 3-1/4 by 5-5/8 inches with grommet and self-locking nylon ties.
C. Tag Chart: Typewritten letter size list of applied tags and location in anodized aluminum frame.

2.4 STENCILS

A. Stencils: With clean-cut symbols and letters of following size:
   1. Up to 2 inches Outside Diameter of Insulation or Pipe: 1/2-inch-high letters.
   2. 2-1/2 to 6 inches Outside Diameter of Insulation or Pipe: 1-inch-high letters.
   3. Over 6 inches Outside Diameter of Insulation or Pipe: 1-3/4 inches high letters.
   4. Ductwork and Equipment: 1-3/4-inch-high letters.
B. Stencil Paint: As specified in Division 09, semi-gloss enamel, colors, and lettering size conforming to ASME A13.1.

2.5 PIPE MARKERS

A. Color and Lettering: Conform to ASME A13.1.
   1. Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering. Larger sizes may have maximum sheet size with spring fastener.
B. Plastic Tape Pipe Markers
   1. Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.
C. Plastic Underground Pipe Markers
   1. Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mils thick, manufactured for direct burial service.

2.6 CEILING TACKS

A. Description: Steel with 3/4-inch-diameter color-coded head.
B. Color code as follows:
   1. HVAC Equipment: Yellow
   2. Fire Damper/Smoke Damper: Red
   3. Plumbing valves: Green.
   4. Heating/Cooling Valves: Blue

2.7 LABELS

A. Description: Aluminum size 1.9- by 0.75-inch, adhesive-backed, with printed identification.

PART 3 - EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.
B. Prepare surfaces per Division 09 for stencil painting.

3.2 INSTALLATION

A. Apply stencil painting per Division 09.
B. Install identifying devices after completion of coverings and painting.
C. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive.
D. Install labels with sufficient adhesive for permanent adhesion and seal with clear lacquer. For unfinished canvas covering, apply paint primer before applying labels.
E. Install tags using corrosion resistant chain. Number tags consecutively by location.
F. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.
G. Identify air handling units, pumps, heat transfer equipment, tanks, and water treatment devices with plastic nameplates. Identify in-line pumps and other small devices with tags.
H. Identify control panels and major control components outside panels with plastic nameplates.
I. Identify valves in main and branch piping with tags.
J. Identify air terminal units and radiator valves with numbered tags.
K. Tag automatic controls, instruments, and relays. Key to control schematic.
L. Identify piping, concealed, or exposed, with plastic pipe markers, plastic tape pipe markers, or stenciled painting. Use tags on piping 3/4-inch diameter and smaller. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and tee, at each side of penetration of structure or enclosure, and at each obstruction.
M. For exposed natural gas lines other than steel pipe, attach yellow pipe labels with "GAS" in black lettering, at maximum 5 foot spacing.

N. Identify ductwork with plastic nameplates or stenciled painting. Identify with air handling unit identification number and area served. Locate identification at air handling unit, at each side of penetration of structure or enclosure, and at each obstruction.

O. Provide ceiling tacks to locate valves or dampers above T-bar type panel ceilings. Locate in corner of panel closest to equipment.

END OF SECTION

SECTION 23 05 93 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Testing, adjusting, and balancing of air systems.
   2. Testing, adjusting, and balancing of hydronic systems.
   3. Measurement of final operating condition of HVAC systems.
B. Related Requirements:
   1. Division 01 Specification Sections apply to Work of this Section.

1.2 REFERENCES

A. Associated Air Balance Council:
   1. AABC MN-1 - National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems.
B. American Society of Heating, Refrigerating and Air-Conditioning Engineers:
   1. ASHRAE 111 - Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning and Refrigeration Systems.
C. Natural Environmental Balancing Bureau:
   1. NEBB - Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems.
D. Testing Adjusting and Balancing Bureau:
   1. TABB - International Standards for Environmental Systems Balance.

1.3 SUBMITTALS

A. Division 01 and Section 23 05 00 "General Mechanical Requirements."
B. Prior to commencing Work, submit proof of latest calibration date of each instrument.
C. Test Reports: Indicate data on AABC MN-1 National Standards for Total System Balance forms or NEBB Report forms.
D. Field Reports: Indicate deficiencies preventing proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
E. Prior to removing the air handling unit, a TAB is to be taken to confirm the oustide air that is currently being supplied to the existing air handling unit. This is to confirm that the outside air CFM is 3,750 CFM as the existing Drawings indicate. Once this CFM has been taken and recorded, then remove existing air handling unit, AC-C and inform Engineer of Record of existing outside air CFM. Outside air shall be set to 2,750 CFM or should the TAB from the original outside air of the existing unit be larger, up to 3,750 CFM. This is to maintain current building pressure and will still meet minimum ventilation requirements.

F. Prior to commencing Work, submit report forms or outlines indicating adjusting, balancing, and equipment data required. Include detailed procedures, agenda, sample report forms and copy of AABC National Project Performance Guaranty or NEBB Certificate of Conformance Certification.
G. Submit draft copies of report for review before final acceptance of Project.
H. Furnish reports in pdf electronic format, complete with table of contents page and indexing tabs, with cover identification at front and side. Include set of reduced drawings with air outlets and equipment identified to correspond with data sheets and indicating thermostat locations.

1.4 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of balancing valves and rough setting.
B. Operation and Maintenance Data: Furnish final copy of testing, adjusting, and balancing report inclusion in operating and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with State and local.
B. Perform Work in accordance with AABC MN-1 National Standards for Field Measurement and Instrumentation, Total System Balance or NEBB Procedural Standards for Testing, Balancing and Adjusting of Environmental Systems.
C. Prior to commencing Work, calibrate each instrument to be used.

1.6 QUALIFICATIONS

A. Agency: Company specializing in testing, adjusting, and balancing of systems specified in this Section with minimum 3 years' experience.
B. Perform Work under supervision of AABC Certified Test and Balance Engineer or NEBB Certified Testing, Balancing, and Adjusting Supervisor registered Professional Engineer experienced in performance of this Work and licensed in State of Texas.

1.7 SEQUENCING

A. Sequence balancing between completion of systems tested and date of Substantial Completion.

1.8 SCHEDULING

A. Schedule and provide assistance in final adjustment.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify systems are complete and operable before commencing work. Verify the following:
   1. Systems are started and operating in safe and normal condition.
   2. HVAC control systems are installed complete and operable.
   3. Proper thermal overload protection is in place for electrical equipment.
   4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
   5. Duct systems are clean of debris.
   6. Fans are rotating correctly.
   7. Fire and volume dampers are in place and open.
   8. Air coil fins are cleaned and combed.
   9. Access doors are closed, and duct end caps are in place.
   10. Air outlets are installed and connected.
   11. Duct system leakage is minimized.
   12. Hydronic systems are flushed, filled, and vented.
   13. Pumps are rotating correctly.
   14. Proper strainer baskets are clean and in place or in normal position.
   15. Service and balancing valves are open.

3.2 PREPARATION

A. Furnish instruments required for testing, adjusting, and balancing operations.
B. Make instruments available to Architect to facilitate spot checks during testing.

3.3 INSTALLATION TOLERANCES

A. Air Handling Systems: Adjust to within plus or minus 10 percent of design.
B. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.
C. Hydronic Systems: Adjust to within plus or minus 10 percent of design.

3.4 ADJUSTING

A. Verify recorded data represents actual measured or observed conditions.
B. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.
C. After adjustment, take measurements to verify balance has not been disrupted. If disrupted, verify correcting adjustments have been made.
D. Report defects and deficiencies noted during performance of services, preventing system balance.

E. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.
F. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by Owner.
G. Check and adjust systems approximately 6 months after final acceptance and submit report.

3.5 AIR SYSTEM PROCEDURE

A. Adjust air handling and distribution systems to obtain required or design supply, return, and exhaust air quantities at site altitude.
B. Make air flow rate measurements in main ducts by Pitot tube traverse of entire cross-sectional area of duct.
C. Measure air quantities at air inlets and outlets.
D. Use volume control devices to regulate air quantities only to extent adjustments do not create objectionable air motion or sound levels. Effect volume control by using volume dampers located in ducts.
E. Vary total system air quantities by adjustment of fan speeds. Provide sheave drive changes to vary fan speed. Vary branch air quantities by damper regulation.
F. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.
G. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across fan. Make allowances for 50 percent loading of filters.
H. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.
I. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.
J. At modulating damper locations, take measurements and balance at extreme conditions.
K. For variable air volume system powered units set volume controller to airflow setting indicated. Confirm connections properly made and confirm proper operation for automatic variable-air-volume temperature control.

3.6 WATER SYSTEM PROCEDURE

A. Adjust water systems, after air balancing, to obtain design quantities.
B. Use calibrated Venturi tubes, orifices, or other metered fittings and pressure gauges to determine flow rates for system balance. Where flow-metering devices are not installed, base flow balance on temperature difference across various heat transfer elements in system.
C. Confirm air bleeds indicate system is full of water.
D. Adjust systems to obtain specified pressure drops and flows through heat transfer elements before thermal testing. Perform balancing by measurement of temperature differential in conjunction with air balancing.
E. Perform system balance with automatic control valves fully open triple duty valves fully open, and pump VFDs at 100 percent speed.
F. Confirm pump rotation and differential pressure at full flow.

G. Perform adjustment of water distribution systems by the following measures:
   1. Reduce total system flow rate first by reducing speed of VFD.
   2. Use balancing cocks, valves, and fittings.

H. Do not use service or shut-off valves for balancing unless designed for balancing and shut-off functions. Where available pump capacity is less than total flow requirements or individual system parts, simulate full flow in one part by temporary restriction of flow to other parts.

3.7 SCHEDULES

A. Equipment Requiring Testing, Adjusting, and Balancing:
   1. Air Handling Units.
   2. Air Terminal Units.
   3. Air Inlets and Outlets.
   4. Fan Coil Units.
   5. Exhaust Fans.

B. Report Forms:
   1. Title Page:
      a. Name of Testing, Adjusting, and Balancing Agency.
      b. Address of Testing, Adjusting, and Balancing Agency.
      c. Telephone and facsimile numbers of Testing, Adjusting, and Balancing Agency.
      d. Project name.
      e. Project location.
      f. Project Architect.
      g. Project Engineer.
      h. Project Contractor.
      i. Project altitude.
      j. Report date.
   2. Summary Comments:
      a. Design versus final performance.
      b. Notable characteristics of system.
      c. Description of systems operation sequence.
      d. Summary of outdoor and exhaust flows to indicate building pressurization.
      e. Nomenclature used throughout report.
      f. Test conditions.
   3. Instrument List:
      a. Instrument.
      b. Manufacturer.
      c. Model number.
      d. Serial number.
      e. Range.
      f. Calibration date.
   4. Electric Motors:
      a. Manufacturer.
      b. Model/Frame.
      c. HP/BHP and kW.
      d. Phase, voltage, amperage; nameplate, actual, no load.

e. RPM.
f. Service factor.
g. Starter size, rating, heater elements.
h. Sheave Make/Size/Bore.

5. V-Belt Drive:
   a. Identification/location.
   b. Required driven RPM.
   c. Driven sheave, diameter, and RPM.
   d. Belt, size, and quantity.
   e. Motor sheave diameter and RPM.
   f. Center-to-center distance, maximum, minimum, and actual.
6. Cooling Coil Data:
   a. Identification/number.
   b. Location.
   c. Service.
   d. Manufacturer.
   e. Air flow, design and actual.
   f. Entering air DB temperature, design and actual.
   g. Entering air WB temperature, design and actual.
   h. Leaving air DB temperature, design and actual.
   i. Leaving air WB temperature, design and actual.
   j. Water flow, design and actual.
   k. Water pressure drop, design and actual.
   l. Entering water temperature, design and actual.
   m. Leaving water temperature, design and actual.
   n. Saturated suction temperature, design and actual.
   o. Air pressure drop, design and actual.
7. Heating Coil Data:
   a. Identification/number.
   b. Location.
   c. Service.
   d. Manufacturer.
   e. Airflow, design and actual.
   f. Water flow, design and actual.
   g. Water pressure drop, design and actual.
   h. Entering water temperature, design and actual.
   i. Leaving water temperature, design and actual.
   j. Entering air temperature, design and actual.
   k. Leaving air temperature, design and actual.
   l. Air pressure drop, design and actual.
8. Air Moving Equipment:
   a. Location.
   b. Manufacturer.
   c. Model number.
   d. Serial number.
   e. Arrangement/class/discharge.
   f. Air flow, specified and actual.
   g. Return air flow, specified and actual.
   h. Outside air flow, specified and actual.

i. Total static pressure (total external), specified and actual.
j. Inlet pressure.
k. Discharge pressure.
l. Sheave make/size/bore.
m. Number of belts/make/size.
n. Fan RPM.

9. Return Air/Outside Air Data:
   a. Identification/location.
   b. Design airflow.
   c. Actual air flow.
   d. Design return airflow.
   e. Actual return airflow.
   f. Design outside airflow.
   g. Actual outside airflow.
   h. Return air temperature.
   i. Outside air temperature.
   j. Required mixed air temperature.
   k. Actual mixed air temperature.
   l. Design outside/return air ratio.
   m. Actual outside/return air ratio.
10. Duct Traverse:
   a. System zone/branch.
   b. Duct size.
   c. Area.
   d. Design velocity.
   e. Design air flow.
   f. Test velocity.
   g. Test air flow.
   h. Duct static pressure.
   i. Air temperature.
   j. Air correction factor.
11. Duct Leak Test:
   a. Description of ductwork under test.
   b. Duct design operating pressure.
   c. Duct design test static pressure.
   d. Duct capacity, air flow.
   e. Maximum allowable leakage duct capacity times leak factor.
   f. Test apparatus.
      1) Blower.
      2) Orifice, tube size.
      3) Orifice size.
      4) Calibrated.
   g. Test static pressure.
   h. Test orifice differential pressure.
   i. Leakage.
12. Air Monitoring Station Data:
   a. Identification/location.
   b. System.
   c. Size.

d. Area.
e. Design velocity.
f. Design air flow.
g. Test velocity.
h. Test air flow.

13. Flow Measuring Station:
    a. Identification/number.
    b. Location.
    c. Size.
    d. Manufacturer.
    e. Model number.
    f. Serial number.
    g. Design flow rate.
    h. Design pressure drop.
    i. Actual/final pressure drop.
    j. Actual/final flow rate.
    k. Station calibrated setting.
14. Terminal Unit Data:
    a. Manufacturer.
    b. Type, constant, variable, single, dual duct.
    c. Identification/number.
    d. Location.
    e. Model number.
    f. Size.
    g. Minimum static pressure.
    h. Minimum design air flow.
    i. Maximum design air flow.
    j. Maximum actual air flow.
    k. Inlet static pressure.
15. Air Distribution Test Sheet:
    a. Air terminal number.
    b. Room number/location.
    c. Terminal type.
    d. Terminal size.
    e. Area factor.
    f. Design velocity.
    g. Design air flow.
    h. Test (final) velocity.
    i. Test (final) air flow.
    j. Percent of design air flow.

END OF SECTION

SECTION 23 07 00 - HVAC INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. HVAC piping insulation, jackets, and accessories.
2. HVAC ductwork insulation, jackets, and accessories.

B. Related Requirements:
1. Division 01 Specification Sections apply to Work of this Section.

1.2 REFERENCES

A. ASTM International:
1. ASTM A240 - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
2. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless-Steel Sheet, Strip, Plate, and Flat Bar.
3. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
4. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement.
5. ASTM C449 - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement.
6. ASTM C450 - Standard Practice for Fabrication of Thermal Insulating Fitting Covers for NPS Piping, and Vessel Lagging.
7. ASTM C533 - Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation.
8. ASTM C534 - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
9. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation.
10. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
11. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.
12. ASTM C585 - Standard Practice for Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS System).
13. ASTM C591 - Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation.
14. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
15. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
16. ASTM C921 - Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.

17. ASTM C1071 - Standard Specification for Thermal and Acoustical Insulation (Glass Fiber, Duct Lining Material).
18. ASTM C1136 - Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.
19. ASTM C1290 - Standard Specification for Flexible Fibrous Glass Blanket Insulation Used to Externally Insulate HVAC Ducts.
20. ASTM D4637 - Standard Specification for EPDM Sheet Used in Single-Ply Roof Membrane.
21. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.
22. ASTM E162 - Standard Test Method for Surface Flammability of Materials Using a Radiant Heat Energy Source.

B. Sheet Metal and Air Conditioning Contractors Association:
   1. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

C. Underwriters Laboratories Inc.:
   1. UL 1978 - Standard for Safety for Grease Ducts.

1.3 SUBMITTALS

A. Division 01 and Section 23 05 00 "General Mechanical Requirements" for submittal procedures.
B. Product Data: Submit product description, thermal characteristics and list of materials and thickness for each service, and location.
C. Manufacturer's Installation Instructions: Submit manufacturers published literature indicating proper installation procedures.

1.4 QUALITY ASSURANCE

A. Pipe insulation manufactured in accordance with ASTM C585 for inner and outer diameters.
B. Factory fabricated fitting covers manufactured in accordance with ASTM C450.
C. Duct and pipe insulation, Coverings, and Linings: Maximum 25/50 flame spread/smoke developed index, when tested in accordance with ASTM E84, using specimen procedures and mounting procedures of ASTM E2231.
D. Perform Work in accordance with state and local codes.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum 3 years' experience.
B. Applicator: Company specializing in performing Work of this Section with minimum 3 years' experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Division 01 and Section 23 05 00 "General Mechanical Requirements" for product storage and handling requirements.

B. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.
C. Protect insulation from weather and construction traffic, dirt, water, chemical, and damage, by storing in original wrapping.

1.7 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.8 WARRANTY

A. Division 01 and Section 23 05 00 "General Mechanical Requirements" for product warranties and product bonds.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Glass Fiber and Mineral Fiber Insulation:
   1. Manufacturers:
      a. Johns Manville.
      b. Knauf Insulation.
      c. Manson Insulation Inc.
      d. Owens Corning.
      e. Substitutions: Division 01 and Section 23 05 00 "General Mechanical Requirements" for substituted products.

2.2 PIPE INSULATION

A. Type P-1: ASTM C547, molded glass fiber pipe insulation.
   1. Thermal Conductivity: 0.23 at 75 degrees F.
   2. Operating Temperature Range: 0 to 850 degrees F.
   3. Vapor Barrier Jacket: ASTM C1136, Type I, factory-applied reinforced foil kraft with self-sealing adhesive joints.
   4. Jacket Temperature Limit: minus 20 to 150 degrees F.

2.3 PIPE INSULATION JACKETS

A. Vapor Retarder Jacket:
   1. ASTM C921, white Kraft paper with glass fiber yarn, bonded to aluminized film.
   2. Water Vapor Permeance: ASTM E96; 0.02 perms.
B. Aluminum Pipe Jacket:
   1. ASTM B209.
   2. Thickness: 0.020-inch-thick sheet.
   3. Finish: Embossed.

4. Joining: Longitudinal slip joints and 2-inch laps.
5. Fittings: 0.016-inch-thick die shaped fitting covers with factory attached protective liner.
6. Metal Jacket Bands: 3/8-inch wide; 0.015-inch-thick aluminum.

C. Stainless Steel Pipe Jacket:
1. ASTM A240 OR ASTM 666 Type 304 stainless steel.
2. Thickness: 0.020-inch thick.
3. Finish: Corrugated.
4. Metal Jacket Bands: 3/8-inch wide; 0.020-inch-thick stainless steel.

2.4 PIPE INSULATION ACCESSORIES

A. Vapor Retarder Lap Adhesive: Compatible with insulation.
B. Covering Adhesive Mastic: Compatible with insulation.
C. Piping 1-1/2-Inch Diameter and Smaller: Galvanized steel insulation protection shield. MSS SP-69, Type 40. Length: Based on pipe size and insulation thickness.
D. Piping 2-Inch Diameter and Larger: Wood insulation saddle, hard maple. Inserts length: not less than 6 inches long, matching thickness and contour of adjoining insulation.
E. Closed Cell Elastomeric Insulation Pipe Hanger: Polyurethane insert with aluminum single piece construction with self-adhesive closure. Thickness to match pipe insulation.
F. Insulating Cement: ASTM C195; hydraulic setting on mineral wool.
G. Adhesives: Compatible with insulation.

2.5 DUCTWORK INSULATION

A. Type D-1: ASTM C1290, Type II, flexible glass fiber, commercial grade with factory applied reinforced aluminum foil jacket meeting ASTM C1136, Type II.
1. Thermal Conductivity: 0.25 at 75 degrees F.
2. Maximum Operating Temperature: 250 degrees F.
3. Density: 1.0 pound per cubic foot.

B. Type D-2: ASTM C612, Type IA or IB, rigid glass fiber, with factory applied all service facing or reinforced aluminim foil facing meeting ASTM C1136, Type II.
1. Thermal Conductivity: 0.24 at 75 degrees F.
2. Density: 3.0 pound per cubic foot.

C. Type D-3: Johns Manville Linacoustic RC, ASTM C1071, Type I, flexible glass fiber duct liner with coated air side.
1. Thermal Conductivity: 0.16 at 75 degrees F.
2. Liner shall meet ASTM C1338, ASTM G21 and ASTM G22 for Fungi and Bacteria resistance.
3. Maximum Operating Temperature: 250 degrees F.
4. Maximum Air Velocity: 6,000 feet per minute.

2.6 DUCTWORK INSULATION JACKETS

A. Aluminum Duct Jacket:
1. ASTM B209.
2. Thickness: 0.025-inch-thick sheet.
3. Finish: Embossed.

4. Joining: Longitudinal slip joints and 2-inch laps.
5. Fittings: 0.016-inch-thick die shaped fitting covers with factory-attached protective liner.
6. Metal Jacket Bands: 3/8-inch wide; 0.015-inch-thick aluminum.

2.7 DUCTWORK INSULATION ACCESSORIES

A. Vapor Retarder Tape:
   1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber-based adhesive.
B. Vapor Retarder Lap Adhesive: Compatible with insulation.
C. Adhesive: Waterproof, ASTM E162 fire-retardant type.
D. Liner Fasteners: Galvanized steel, impact applied with press-on head.
E. Tie Wire: 0.048-inch stainless steel with twisted ends on maximum 12-inch centers.
F. Lagging Adhesive: Fire retardant type with maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.
G. Impale Anchors: Galvanized steel, 12-gauge self-adhesive pad.
H. Adhesives: Compatible with insulation.
I. Membrane Adhesives: As recommended by membrane manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify piping equipment and ductwork has been tested before applying insulation materials.
B. Verify surfaces are clean and dry, with foreign material removed.

3.2 INSTALLATION - PIPING SYSTEMS

A. Piping Exposed to View in Finished Spaces: Locate insulation and cover seams in least visible locations.
B. Continue insulation through penetrations of building assemblies or portions of assemblies having fire resistance rating of 1 hour or less. Provide intumescent firestopping when continuing insulation through assembly. Finish at supports, protrusions, and interruptions. Refer to Section 07 84 13 "Penetration Firestopping" for penetrations of assemblies with fire resistance rating greater than 1 hour.
C. Piping Systems Conveying Fluids Below Ambient Temperature:
   1. Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, and expansion joints.

2. Furnish factory-applied or field-applied vapor retarder jackets. Secure factory-applied jackets with pressure sensitive adhesive self-sealing longitudinal laps and butt strips. Secure field-applied jackets with outward clinch expanding staples and seal staple penetrations with vapor retarder mastic.
3. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor retarder adhesive.

D. Glass Fiber Board Insulation:
1. Apply insulation close to equipment by grooving, scoring, and beveling insulation. Fasten insulation to equipment with studs, pins, clips, adhesive, wires, or bands.
2. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor retarder cement.
3. Cover wire mesh or bands with cement to a thickness to remove surface irregularities.

E. Hot Piping Systems Less Than 140 Degrees F:
1. Furnish factory-applied or field-applied standard jackets. Secure with outward clinch expanding staples or pressure sensitive adhesive system on standard factory-applied jacket and butt strips or both.
2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive.
3. Do not insulate unions and flanges at equipment, but bevel and seal end of insulation at such locations.

F. Hot Piping Systems Greater Than 140 Degrees F:
1. Furnish factory-applied or field-applied standard jackets. Secure with outward clinch expanding staples or pressure sensitive adhesive system on standard factory-applied jacket and butt strips or both.
2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive.
3. Insulate flanges and unions at equipment.

G. Inserts and Shields:
1. Piping 1-1/2 Inches Diameter and Smaller: Install galvanized steel shield between pipe hanger and insulation.
2. Piping 2 Inches Diameter and Larger: Install insert between support shield and piping and under finish jacket.
   a. Insert Configuration: Minimum 6 inches long, of thickness and contour matching adjoining insulation; may be factory fabricated.
   b. Insert Material: Compression resistant insulating material suitable for planned temperature range and service.
3. Piping Supported by Roller Type Pipe Hangers: Install galvanized steel shield between roller and inserts.

H. Insulation Terminating Points:
1. Coil Branch Piping 1 Inch and Smaller: Terminate hot water piping at union upstream of the coil control valve.
2. Chilled Water Coil Branch Piping: Insulate chilled water piping and associated components up to coil connection.

I. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces (10 feet): Finish with aluminum jacket and fitting covers.

J. Piping Exterior to Building: Provide vapor retarder jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor retarder cement. Cover with aluminum jacket with seams located at 3 or 9 o'clock position on side of horizontal piping with overlap facing down to shed water or on bottom side of horizontal piping.

K. Buried Piping: Insulate only where insulation manufacturer recommends insulation product may be installed in trench, tunnel or direct buried. Install factory fabricated assembly with inner all-purpose service jacket with self-sealing lap, and asphalt impregnated open mesh glass fabric, with 1 mil thick aluminum foil sandwiched between 3 layers of bituminous compound; outer surface faced with polyester film.

L. Prepare pipe insulation for finish painting. Refer to Division 09.

3.3 INSTALLATION - DUCTWORK SYSTEMS

A. Duct dimensions indicated on Drawings are finished inside dimensions.

B. Insulated ductwork conveying air below ambient temperature:
   1. Provide insulation with vapor retarder jackets.
   2. Finish with tape and vapor retarder jacket.
   3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
   4. Insulate entire system including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.

C. Insulated ductwork conveying air above ambient temperature:
   1. Provide with or without standard vapor retarder jacket.
   2. Insulate fittings and joints. Where service access is required, bevel and seal ends of insulation.

D. External Glass Fiber Duct Insulation:
   1. Secure insulation with vapor retarder with wires and seal jacket joints with vapor retarder adhesive or tape to match jacket.
   2. Secure insulation without vapor retarder with staples, tape, or wires.
   3. Install without sag on underside of ductwork. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift ductwork off trapeze hangers and insert spacers.
   4. Seal vapor retarder penetrations by mechanical fasteners with vapor retarder adhesive.
   5. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.

E. Duct and Plenum Liner:
   1. Adhere insulation with adhesive for 100 percent coverage.
   2. Secure insulation with mechanical liner fasteners. Comply with SMACNA Standards for spacing.
   3. Seal and smooth joints. Seal and coat transverse joints.
   4. Seal liner surface penetrations with adhesive.
   5. Cut insulation for tight overlapped corner joints. Support top pieces of liner at edges with side pieces.

F. Prepare duct insulation for finish painting. Refer to Division 09.

3.4 SCHEDULES

A. Cooling Services Piping Insulation Schedule:
   1. Chilled Water Supply and Return , 40 to 60 Degrees F:
      a. Type: P-1.
      b. Thickness:
         1) Pipe Size 1-1/4 Inches and Smaller: 0.5-inch
         2) Pipe Size 1-1/2 Inches and Larger: 1.0 inch

B. Heating Services Piping Insulation Schedule:
   1. Heating Water Supply and Return:
      a. Type: P-1.
      b. Thickness:
         1) Pipe Size 1-1/2 Inches and Smaller: 1.5-inch.
         2) Pipe Size 2 Inches and Larger: 2.0-inch.

C. Ductwork Insulation Schedule:
   1. Return Ducts - Internally Insulated:
      a. Type: D-3.
      b. Thickness: As required to meet R-6.
   2. Supply Ducts - Externally Insulated, Installed Thickness:
      a. Type: D-1 or D-2.
      b. Thickness: As required to meet R-6.
   3. Exhaust Ducts:
      a. Type: None.
   4. Transfer Air Ducts - Internally Insulated:
      a. Type: D-3.
      b. Thickness: As required to meet R-6.

END OF SECTION

SECTION 23 23 00 - REFRIGERANT PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Refrigerant piping.
   2. Unions, flanges, and couplings.
   3. Valves.
   4. Refrigerant strainers.

B. Related Requirements:
   1. Division 01 Specification Sections apply to Work of this Section.

1.2 REFERENCES

A. Air-Conditioning and Refrigeration Institute:
   1. ARI 495 - Refrigerant Liquid Receivers.
   2. ARI 710 - Liquid-Line Driers.
   3. ARI 730 - Flow-Capacity Rating and Application of Suction-Line Filters and Filter Dryers.
   4. ARI 750 - Thermostatic Refrigerant Expansion Valves.
   5. ARI 760 - Solenoid Valves for Use with Volatile Refrigerants.

B. American Society of Heating, Refrigerating and Air-Conditioning Engineers:
   1. ASHRAE 15 - Safety Code for Mechanical Refrigeration.

C. American Society of Mechanical Engineers:
   1. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
   2. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes.
   3. ASME B31.5 - Refrigeration Piping.
   4. ASME Section VIII - Boiler and Pressure Vessel Code - Pressure Vessels.

D. ASTM International:
   1. ASTM A53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
   2. ASTM A234 - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
   3. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
   4. ASTM B280 - Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.
   5. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers.
   6. ASTM B749 - Standard Specification for Lead and Lead Alloy Strip, Sheet, and Plate Products.

E. American Welding Society:
   1. AWS A5.8 - Specification for Filler Metals for Brazing and Braze Welding.
   2. AWS D1.1 - Structural Welding Code - Steel.

F. Manufacturers Standardization Society of the Valve and Fittings Industry:
   1. MSS SP 58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.
   2. MSS SP 69 - Pipe Hangers and Supports - Selection and Application.
   3. MSS SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices.

G. Underwriters Laboratories Inc.:
   1. UL 429 - Electrically Operated Valves.

1.3 SYSTEM DESCRIPTION

A. Where more than one piping system material is specified, provide compatible system components and joints. Use non-conducting dielectric connections when joining dissimilar metals in systems.

B. Provide flanges, unions, or couplings at locations requiring servicing. Use unions, flanges, or couplings downstream of valves and at equipment connections. Do not use direct welded or threaded connections to valves or equipment.

C. Provide pipe hangers and supports in accordance with ASME B31.5, ASTM F708, MSS SP 58, MSS SP 69, and MSS SP 89.

1.4 SUBMITTALS

A. Division 01 and Section 23 05 00 "General Mechanical Requirements" for submittal procedures.

B. Product Data:
   1. Piping: Submit data on pipe materials, fittings, and accessories.
   2. Valves: Submit manufacturer's catalog information with valve data and ratings for each service.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with ASME B31.5 code for installation of refrigerant piping systems.

B. Perform Work in accordance with AWS D1.1 for welding hanger and support attachments to building structure.

C. Perform Work in accordance with state and local standards.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum 3 years; experience.

B. Fabricator or Installer: Company specializing in performing Work of this Section with minimum 3 years' experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Dehydrate and charge refrigeration components including piping and receivers, seal prior to shipment. Maintain seal until connected into system.

B. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Do not install underground piping when bedding is wet or frozen.

1.9 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.10 WARRANTY

A. Division 01 and Section 23 05 00 "General Mechanical Requirements."

PART 2 - PRODUCTS

2.1 REFRIGERANT PIPING

A. Copper Tubing: ASTM B280, drawn.
   1. Fittings: ASME B16.22 wrought copper.
   2. Joints: Braze, AWS A5.8 BCuP silver/phosphorus/copper alloy with melting range 1,190 to 1,480 degrees F.

2.2 UNIONS, FLANGES, AND COUPLINGS

A. Two Inches and Smaller:
   1. Copper Pipe: Bronze, soldered joints.
B. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

2.3 VALVES

A. Ball Valves:
   1. Two-piece bolted forged brass body with Teflon ball seals and copper tube extensions, brass bonnet and seal cap, chrome plated ball, stem with neoprene ring stem seals, soldered ends.
   2. Maximum working pressure: 500 psig.
   3. Maximum working temperature: 325 degrees F.
B. Service Valves:
   1. Forged brass body with copper stubs, brass caps, removable valve core, integral ball check valve, flared or solder ends.
   2. Maximum working pressure: 500 psig.

C. Refrigerant Check Valves:
   1. Straight Through Type:
      a. Spring, neoprene seat.
      b. Maximum working pressure: 500 psig.
      c. Maximum working temperature: 250 degrees F.

2.4 REFRIGERANT STRAINERS

A. Straight Line or Angle Line Type:
   1. Brass or steel shell, steel cap and flange, and replaceable cartridge, with screen of stainless steel wire or monel reinforced with brass.
   2. Maximum working pressure: 430 psig.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify excavations are to required grade, dry, and not over-excavated.

3.2 PREPARATION

A. Ream pipe and tube ends. Remove burrs.
B. Remove scale and dirt on inside and outside before assembly.
C. Prepare piping connections to equipment with flanges or unions.
D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

3.3 INSTALLATION - INSERTS

A. Provide inserts for placement in concrete forms.
B. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
C. Provide hooked rod to concrete reinforcement section for inserts carrying pipe 4 inches and larger.
D. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
E. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut recessed into and grouted flush with slab.

3.4 INSTALLATION - ABOVE GROUND PIPING SYSTEMS

A. Route piping parallel to building structure and maintain gradient.
B. Install piping to conserve building space, and not interfere with use of space.
C. Group piping whenever practical at common elevations.
D. Sleeve pipe passing through partitions, walls and floors. Refer to Section 23 05 00 "General Mechanical Requirements."

E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
F. Provide access where valves and fittings are not exposed.
G. Arrange refrigerant piping to return oil to compressor. Provide traps and loops in piping, and provide double risers as required. Slope horizontal piping 0.40 percent in direction of flow.
H. Flood refrigerant piping system with nitrogen when brazing.
I. Install valves with stems upright or horizontal, not inverted.
J. Insulate piping; refer to Section 23 07 00 "HVAC Insulation."
K. Fully charge completed system with refrigerant after testing.
L. Follow ASHRAE 15 procedures for charging and purging of systems and for disposal of refrigerant.
M. Install refrigerant piping in accordance with ASME B31.5.

3.5 FIELD QUALITY CONTROL

A. Test refrigeration system in accordance with ASME B31.5.
B. Pressure test refrigeration system with dry nitrogen to 200 psig.
C. Repair leaks.
D. Retest until no leaks are detected.

3.6 SCHEDULES

A. Copper Tube Hanger Spacing:
    1. Pipe Size 1/2-Inch:
        a. Maximum Hanger Spacing: 5 feet.
        b. Hanger Rod Diameter: 3/8-inch.
    2. Pipe Size 3/4-Inch:
        a. Maximum Hanger Spacing: 5 feet.
        b. Hanger Rod Diameter: 3/8-inch.
    3. Pipe Size 1 Inch:
        a. Maximum Hanger Spacing: 6 feet.
        b. Hanger Rod Diameter: 3/8-inch.
    4. Pipe Size 1-1/4 Inches:
        a. Maximum Hanger Spacing: 7 feet.
        b. Hanger Rod Diameter: 3/8-inch
    5. Pipe Size 1-1/2 Inches:
        a. Maximum Hanger Spacing: 8 feet.
        b. Hanger Rod Diameter: 3/8-inch.
    6. Pipe Size 2 Inches:
        a. Maximum Hanger Spacing: 8 feet.
        b. Hanger Rod Diameter: 3/8-inch.

7. Pipe Size 2-1/2 Inches:
   a. Maximum Hanger Spacing: 9 feet.
   b. Hanger Rod Diameter: 1/2-inch.
8. Pipe Size 3 Inches:
   a. Maximum Hanger Spacing: 10 feet.
   b. Hanger Rod Diameter: 1/2-inch.
9. Pipe Size 4 Inches:
   a. Maximum Hanger Spacing: 10 feet.
   b. Hanger Rod Diameter: 1/2-inch.

END OF SECTION

SECTION 23 31 00 - HVAC DUCTS AND CASINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Duct materials.
   2. Insulated flexible ducts.
   3. Single-wall, spiral round ducts.
   4. Single-wall, spiral flat oval ducts.
   5. Transverse duct connection system.
   6. Casings.
   7. Ductwork fabrication.
   8. Duct cleaning.

B. Related Requirements:
   1. Division 01 Specification Sections apply to Work of this Section.

1.2 REFERENCE STANDARDS

A. American Society of Heating, Refrigerating and Air-Conditioning Engineers:
   1. ASHRAE Handbook - Fundamentals.

B. American Welding Society:
   1. AWS D1.1 - Structural Welding Code - Steel.
   2. AWS D1.2 - Structural Welding Code - Aluminum.
   3. AWS D9.1 - Sheet Metal Welding Code.

C. ASTM International:
   1. ASTM A36 - Standard Specification for Carbon Structural Steel.
   2. ASTM A90 - Standard Test Method for Weight Mass of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings.
   3. ASTM A240 - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
   4. ASTM A568 - Standard Specification for Steel, Sheet, Carbon, Structural, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements for.
   5. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
   6. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
   7. ASTM A1008 - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.
   8. ASTM A1011 - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.

9. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
10. ASTM C14 - Standard Specification for Nonreinforced Concrete Sewer, Storm Drain, and Culvert Pipe.
11. ASTM C443 - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.
12. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

D. International Code Council:
1. International Energy Conservation Code (IECC).
2. International Mechanical Code (IMC).

E. NFPA:
1. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems.
2. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.
3. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.

F. Sheet Metal and Air Conditioning Contractors' National Association:
1. SMACNA 016 - HVAC Air Duct Leakage Test Manual.
2. SMACNA 1767 - Kitchen Ventilation Systems and Food Service Equipment Guidelines.
3. SMACNA 1884 - Fibrous Glass Duct Construction Standards.
4. SMACNA 1966 - HVAC Duct Construction Standards - Metal and Flexible.

G. UL:
1. UL 181 - Factory-Made Air Ducts and Air Connectors.
2. UL 181A - Closure Systems for Use With Rigid Air Ducts.
3. UL 1978 - Grease Ducts.

1.3 SUBMITTALS

A. Section 01 33 00 "Submittal Procedures" for requirements for submittals.
B. Product Data: Submit manufacturer information for duct materials.

1.4 CLOSEOUT SUBMITTALS

A. Division 01 and Section 23 05 00 "General Mechanical Requirements."

1.5 QUALITY ASSURANCE

A. Perform Work according to SMACNA 1884 and 1966.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum 3 years ' experience.
B. Installer: Company specializing in performing Work of this Section with minimum 3 years' experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Inspection: Accept materials on-site in manufacturer's original packaging and inspect for damage.
B. Store materials according to manufacturer instructions.
C. Protection:
    1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
    2. Provide additional protection according to manufacturer instructions.

1.8 AMBIENT CONDITIONS

A. Minimum Conditions: Do not install duct sealant when temperatures are less than those recommended by sealant manufacturer.
B. Subsequent Conditions: Maintain temperatures during and after installation of duct sealant.

1.9 EXISTING CONDITIONS

A. Field Measurements:
    1. Verify field measurements prior to fabrication.
    2. Indicate field measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 DUCTS

A. Performance and Design Criteria:
    1. Variation of duct configuration or sizes other than those of equivalent or lower loss coefficient is not permitted except by written permission of Engineer.
    2. Size round ducts installed in place of rectangular ducts according to ASHRAE Handbook - Fundamentals.
    3. Galvanized-Steel Ducts:
    4. Material: ASTM A653 galvanized-steel sheet.
    5. Quality: Lock forming.
    6. Finish: G90 zinc coating according to ASTM A90.
B. Fasteners: Rivets, bolts, or sheet metal screws.
C. Hanger Rod:
    1. Material: Galvanized steel.
    2. Comply with ASTM A36.
    3. Type: Threaded continuously.

2.2 INSULATED FLEXIBLE DUCTS

A. Description:
    1. Two-ply vinyl film supported by helical-wound spring steel wire.
    2. Insulation: Fiberglass.

3. Vapor Barrier Film: Polyethylene (PE) or Aluminized.
4. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
5. Maximum Velocity: 4,000 fpm.
6. Temperature Range: Minus 10 to plus 160 degrees F.
7. Thermal Resistance: R-6 or greater.

2.3 SINGLE-WALL, SPIRAL ROUND DUCTS

A. Description:
1. UL 181, Class 1, round spiral lockseam duct.
2. Material: Galvanized steel.

B. Minimum Duct Wall Thicknesses:
1. Diameter 2 to 14 Inches: 26-gauge.
2. Diameter 16 to 26 Inches: 24-guage.

C. Minimum Fittings Wall Thicknesses:
1. Diameter 2 to 14 Inches: 24-gauge.
2. Diameter 16 to 26 Inches: 22-gauge.

2.4 SINGLE-WALL, SPIRAL FLAT OVAL DUCTS

A. Description:
1. Machine made from round spiral lockseam duct.
2. Material: Galvanized steel.
3. Pressure Rating: 10-inch wg.

B. Joints:
1. Type: Fully welded or bolted flange.
2. Gasket Material: As recommended by manufacturer.

C. Minimum Duct Wall Thicknesses:
1. Major Axis Dimension 7 to 24 Inches: 24-gauge.
2. Major Axis Dimension 25 to 48 Inches: 22-gauge.
3. Major Axis Dimension 50 to 70 Inches: 20-gauge.

D. Minimum Fittings Wall Thicknesses:
1. Major Axis Dimension 7 to 36 Inches: 20-gauge.
2. Major Axis Dimension 37 to 60 Inches: 18-gauge.

2.5 TRANSVERSE DUCT CONNECTION SYSTEM

A. Description:
1. Interlocking angle and duct edge connection system with sealant, gasket, cleats, and corner clips.
2. Rigidity Class Connection: SMACNA.

2.6 CASINGS

A. Fabricate casings according to SMACNA 1966 and construct for indicated operating pressures.

B. Doors:
   1. Reinforce access door frames with steel angles tied to horizontal and vertical plenum supporting angles.
   2. Furnish hinged access doors where indicated or required for access to equipment for cleaning and inspection.

C. Acoustic Casings:
   1. Fabricate acoustic casings with reinforcing turned inward.
   2. Furnish 16-gauge back facing and 22-gauge perforated front facing, with 3/32-inch-diameter holes at 5/32-inch o.c.
   3. Construct panels 3 inches thick and packed with 4.5-pcf minimum glass-fiber media, on 16-gauge inverted channels.

2.7 FABRICATION

A. Rectangular Ducts:
   1. According to SMACNA 1966.
   2. Provide duct material, gauges, reinforcing, and sealing for indicated operating pressures.

B. Round Ducts:
   1. According to SMACNA 1966 and as indicated on Drawings.
   2. Seams: Longitudinal.
   3. Provide duct material, gauges, reinforcing, and sealing for indicated operating pressures.

C. Tees, Bends, and Elbows:
   1. Minimum Radius:
      a. 1-1/2 times centerline duct width.
      b. If not possible or if rectangular elbows are used, provide single thickness airfoil turning vanes.
   2. If acoustical lining is indicated, furnish turning vanes of perforated metal with glass-fiber insulation.

D. Divergence:
   1. Increase duct sizes gradually, not exceeding 15 degrees of divergence wherever possible.
   2. Upstream of Equipment: Maximum 30 degrees.
   3. Downstream of Equipment: Maximum 45 degrees.

E. Welding:
   1. Continuously Welded Round and Oval Duct Fittings: Two gauges heavier than duct gauges according to SMACNA 1966.
   2. Cemented Slip Joints:
      a. Minimum 4 inches.
      b. Brazed or electric welded.
   3. Prime coat welded joints.

F. Takeoffs:
   1. Provide standard 45-degree lateral wye takeoffs.
   2. If not possible due to space limitations, provide 90-degree conical tee connections.

G. Sealing:
1. Seal joints between duct sections and duct seams with welds, gaskets, mastic adhesives, mastic plus embedded fabric systems, or tape.
2. Sealants, Mastics, and Tapes: Comply with UL 181A and provide products bearing appropriate UL 181A markings.

2.8 ACCESSORIES

A. Hangers and Supports:
1. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.
2. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
3. Strap and Rod Sizes:
a. Comply with SMACNA 1966.
b. Trapeze and Riser Supports:
c. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
d. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
e. Supports for Aluminum Ducts: Aluminum or galvanized steel, coated with zinc chromate.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify sizes of equipment connections before fabricating transitions.

3.2 PREPARATION

A. Obtain manufacturer's inspection and acceptance of fabrication and installation at beginning of installation.
B. Install temporary closures of metal or taped PE on open ductwork to prevent construction dust from entering ductwork system.

3.3 INSTALLATION

A. Install and seal ducts according to SMACNA 1966.
B. Glass-Fiber-Reinforced Ducts: Comply with SMACNA 1884.
C. Insulated Flexible Duct Fittings:
1. Join each flexible duct section to main trunk duct through sheet metal fittings.
2. Material: Galvanized steel.
3. Equip fittings with factory-installed volume damper having positive locking regulator.
4. Provide insulation guard with fittings installed in lined ductwork.
D. Use crimp joints with or without bead or beaded sleeve couplings for joining round duct sizes 8 inches and smaller.

E. Hanger and Supports:
   1. Fabricate and support ducts according to SMACNA 1966.
   2. Threaded Rods: Provide double nuts and lock washers.
   3. Building Attachments:
      a. Provide concrete inserts or structural-steel fasteners appropriate for construction materials to which hangers are attached.
      b. If possible, install concrete inserts before placing concrete.
      c. Powder-Actuated Concrete Fasteners:
         1) Use only for slabs more than 4 inches thick.
         2) Install after concrete is placed and completely cured.
         3) Do not use powder-actuated concrete fasteners for seismic restraints.
   4. Hanger Spacing:
      a. Comply with SMACNA 1966.
      b. Install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.
      c. Extend strap supports down both sides of ducts and turn under bottom at least 1 inch.
      d. Secure hanger to sides and bottom of ducts with sheet metal screws.
   5. Hangers Exposed to View: Provide threaded rod and angle or channel supports.
   6. Vertical Ducts:
      a. Support with steel angles or channel secured to sides of duct with welds, bolts, sheet metal screws, or blind rivets.
      b. Support at each floor and at maximum intervals of 16 feet.
   7. Upper Attachments:
      a. Attach to structures.
      b. Selection and Sizing: Provide pull-out, tension, and shear capacities as required for supported loads and building materials.
   8. Penetrations:
      a. Avoid penetrations of ducts with hanger rods.
      b. If unavoidable, provide airtight rubber grommets at penetrations.

F. Connect flexible ducts to metal ducts with adhesive plus sheet metal screws.

G. Plenum Doors:
   1. Location: 6 to 12 inches above floor.
   2. Arrange door swing such that fan static pressure holds door in closed position.

H. Casings:
   1. Floor Mounting:
      a. Install on 4-inch-high concrete curbs.
      b. At floor, rivet panels to angles 8 inches o.c.
      c. If floors are acoustically insulated, provide liner of 18-gauge galvanized expanded metal mesh, supported 12 inches o.c. and turned up 12 inches at sides with sheet metal shields.

I. Exhaust Outlet Locations:
   1. Minimum Distance from Property Lines: Three feet.
   2. Minimum Distance from Building Openings: Three feet.
   3. Minimum Distance from Outside Air Intakes: Ten feet.

J. Interface with Other Work:
1. Install openings in ductwork as required to accommodate thermometers and controllers.
2. Install pitot tube openings for testing of systems, complete with metal can with spring device or screw to prevent air leakage.
3. If openings are provided in insulated ductwork, install insulation material inside metal ring.
4. Connect diffusers or light troffer boots to low-pressure ducts directly or with 5-foot maximum length of flexible duct held in place with strap or clamp.
5. Connect air terminal units and/or air outlets and inlets to supply ducts directly or with 5-foot maximum length of flexible duct; do not use flexible duct to change direction.

3.4 FIELD QUALITY CONTROL

A. Testing:
1. Medium Pressure Ductwork (Variable-Air Supply Upstream of VAV Boxes):
a. Pressure test 100 percent of ductwork after duct cleaning but before duct insulation is applied or ductwork is concealed.
b. Comply with SMACNA 016.
c. Maximum Allowable Leakage: According to IECC.

3.5 CLEANING

A. Clean duct system and force air at high velocity through duct to remove accumulated dust.
B. To obtain sufficient airflow, clean one half of system completely before proceeding to other half.
C. Protect sensitive equipment with temporary filters or bypass during cleaning.

3.6 ATTACHMENTS

A. Ductwork Material Schedule:
1. Supply: Steel.
2. Return: Steel.
3. General Exhaust: Steel.
B. Ductwork Pressure Class Schedule:
1. Constant Volume Supply: 1-inch wg, regardless of velocity.
2. Variable-Air-Volume Supply - Downstream of VAV Boxes: 1-inch wg, regardless of velocity.
3. Variable-Air-Volume Supply - Upstream of VAV Boxes: 2-inch wg.
4. Return: 1/2-inch wg.
5. General Exhaust: 1/2-inch wg.

END OF SECTION

SECTION 23 33 00 - AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Back-draft dampers.
   2. Combination fire-and-smoke dampers.
   3. Duct access doors.
   4. Volume control dampers.
   5. Flexible duct connections.
   6. Duct test holes.

B. Related Requirements:
   1. Division 01 Specification Sections apply to Work of this Section.

1.2 REFERENCES

A. Air Movement and Control Association International, Inc.:
   1. AMCA 500 - Test Methods for Louvers, Dampers, and Shutters.

B. ASTM International:
   1. ASTM E1 - Standard Specification for ASTM Thermometers.

C. National Fire Protection Association:
   1. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems.
   2. NFPA 92A - Recommended Practice for Smoke-Control Systems.

D. Sheet Metal and Air Conditioning Contractors:
   1. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

E. Underwriters Laboratories Inc.:
   1. UL 555 - Standard for Safety for Fire Dampers.
   2. UL 555C - Standard for Safety for Ceiling Dampers.
   3. UL 555S - Standard for Safety for Smoke Dampers.

1.3 SUBMITTALS

A. Division 01 and Section 23 05 00 "General Mechanical Requirements" for submittal procedures.

B. Product Data: Submit data for shop fabricated assemblies and hardware used.

C. Product Data: Submit for the following. Include where applicable electrical characteristics and connection requirements.
   1. Fire dampers including locations and ratings.
   2. Smoke dampers including locations and ratings.
   3. Backdraft dampers.
   4. Flexible duct connections.
   5. Volume control dampers.
   6. Duct access doors.
   7. Duct test holes.

D. Product Data: For fire dampers, smoke dampers. or combination fire and smoke dampers submit the following:
   1. Include UL ratings, dynamic ratings, leakage, pressure drop and maximum pressure data.
   2. Indicate materials, construction, dimensions, and installation details.
   3. Damper pressure drop ratings based on tests and procedures performed in accordance with AMCA 500.

E. Manufacturer's Installation Instructions: Submit for Fire and Combination Smoke and Fire Dampers.

1.4 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of access doors and test holes.
B. Operation and Maintenance Data: Submit for Combination Smoke and Fire Dampers.

1.5 QUALITY ASSURANCE

A. Dampers tested, rated and labeled in accordance with the latest UL requirements.
B. Damper pressure drop ratings based on tests and procedures performed in accordance with AMCA 500.
C. Perform Work in accordance with State and local standard.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum 3 years' experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect dampers from damage to operating linkages and blades.
B. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly indicating manufacturer and material.
C. Storage: Store materials in a dry area indoor, protected from damage.
D. Handling: Handle and lift dampers in accordance with manufacturer's instructions. Protect materials and finishes during handling and installation to prevent damage.

1.8 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.9 COORDINATION

A. Coordinate Work where appropriate with building control Work.

1.10 WARRANTY

A. Section 23 05 00 "General Mechanical Requirements" for product warranties.

PART 2 - PRODUCTS

2.1 BACK-DRAFT DAMPERS

A. Product Description: Multi-Blade, back-draft dampers: Parallel-action, gravity-balanced, Galvanized 16-gauge-thick steel, or extruded aluminum. Blades, maximum 6-inch width, center pivoted, with felt or flexible vinyl sealed edges. Blades linked together in rattle-free manner with 90-degree stop, steel ball bearings, and plated steel pivot pin. Furnish dampers with adjustment device to permit setting for varying differential static pressure.

2.2 COMBINATION FIRE AND SMOKE DAMPERS

A. In this article, list manufacturers acceptable for this Project.
B. Manufacturers:
   1. Greenheck Fan Corporation.
   2. Nailor Industries Inc.
   3. Ruskin Company.
   4. Substitutions: Refer to Section 23 05 00 General Mechanical Requirements.
C. Fabricate in accordance with NFPA 90A, UL 555, and UL 555S.
D. Multiple-Blade Dampers: Fabricate with 16 gauge galvanized steel frame and blades. Furnish oil-impregnated bronze or stainless-steel sleeve bearings and plated steel axles, stainless steel jamb seals, 1/8- by 1/2-inch plated steel concealed linkage, stainless steel closure spring, blade stops, and lock, and 1/2-inch actuator shaft.
E. Operators: UL-listed and labeled spring return electric type suitable for 120 volts, single phase, 60 Hz. non-stall motor. Locate damper operator on exterior of duct and link to damper operating shaft.
F. Normally Closed Smoke Responsive Fire Dampers: Curtain type, opening by gravity upon actuation of Electro thermal link, flexible stainless-steel blade edge seals to produce constant sealing pressure.
G. Electro Thermal Link: Fusible link melting at 165 degrees F; 120 volts, single phase, 60 Hz; UL listed and labeled

2.3 DUCT ACCESS DOORS

A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated on Drawings.
B. Fabrication: Rigid and close fitting of galvanized steel with sealing gaskets and quick fastening locking devices. For insulated ductwork, furnish minimum 1-inch thick insulation with sheet metal cover.
   1. Less than 12 inches square, secure with sash locks.
   2. Up to 18 inches Square: Furnish 2 hinges and 2 sash locks.
   3. Up to 24 by 48 inches: Three hinges and 2 compression latches.
   4. Larger Sizes: Furnish additional hinge.
   5. Access panels with sheet metal screw fasteners are not acceptable.

2.4 VOLUME CONTROL DAMPERS

A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated on Drawings.
B. Multi-Blade Damper: Fabricate of opposed blade pattern with maximum blade sizes 8- by 72-inch. Assemble center and edge crimped blades in prime coated or galvanized frame channel with suitable hardware.
C. End Bearings: Except in round ductwork 12 inches and smaller, furnish end bearings. On multiple blade dampers, furnish oil-impregnated nylon or sintered bronze bearings. Furnish closed end bearings on ducts having pressure classification over 2 inches wg.
D. Quadrants:
    1. Furnish locking, indicating quadrant regulators on single and multi-blade dampers.
    2. On insulated ducts mount quadrant regulators on standoff mounting brackets, bases, or adapters.
    3. Where rod lengths exceed 30 inches furnish regulator at both ends.

2.5 FLEXIBLE DUCT CONNECTIONS

A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.
B. Connector: Fabric crimped into metal edging strip.
    1. Fabric: UL listed fire-retardant neoprene coated woven glass fiber fabric conforming to NFPA 90A, minimum density 30 oz per sq yd.
    2. Net Fabric Width: Approximately 6 inches wide.
    3. Metal: Three inches wide, 24 gauge thick galvanized steel.

2.6 DUCT TEST HOLES

A. Permanent Test Holes: Factory fabricated, air tight flanged fittings with screw cap. Furnish extended neck fittings to clear insulation.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify rated walls are ready for fire damper installation.
B. Verify ducts and equipment installation are ready for accessories.
C. Check location of air outlets and inlets and make necessary adjustments in position to conform to architectural features, symmetry, and lighting arrangement.

3.2 INSTALLATION.

A. Install in accordance with NFPA 90A, and follow SMACNA HVAC Duct Construction Standards - Metal and Flexible. Refer to Section 23 31 00 "HVAC Ducts and Casings" for duct construction and pressure class.
B. Install Work in accordance with State and local standards.

C. Install back-draft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated on Drawings.

D. Access Doors: Install access doors at the following locations and as indicated on Drawings.
   1. Before and after each duct mounted filter.
   2. Before and after each duct mounted coil.
   3. Before and after each duct mounted fan.
   4. Before and after each automatic control damper.
   5. Before and after each fire damper, smoke damper, or combination fire and smoke damper.
   6. Downstream of each VAV box.
   7. Install at locations for cleaning kitchen exhaust ductwork in accordance with NFPA 96.

E. Access Door Sizes: Install minimum 8- by 8-inch size for hand access, 18- by 18-inch size for shoulder access, and as indicated on Drawings. Review locations prior to fabrication.
   1. Mark access doors for fire and smoke dampers on outside surface, with minimum 1/2-inch-high letters reading: FIRE/SMOKE DAMPER, SMOKE DAMPER, OR FIRE DAMPER.

F. Install temporary duct test holes and required for testing and balancing purposes. Cut or drill in ducts. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.

G. Install permanent duct test holes as required for testing and balancing purposes.

H. Install fire dampers, combination fire and smoke dampers, and smoke dampers at locations as indicated on Drawings. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.
   1. Install smoke dampers and combination smoke and fire dampers in accordance with NFPA 92A.
   2. Install dampers square and free from racking with blades running horizontally.
   3. Do not compress or stretch damper frame into duct or opening.
   4. Handle damper using sleeve or frame. Do not lift damper using blades, actuator, or jack shaft.
   5. Install bracing for multiple section assemblies to support assembly weight and to hold against system pressure. Install bracing as needed.

3.3 DEMONSTRATION

A. Demonstrate re-setting of fire dampers to Owner's representative.

END OF SECTION

SECTION 23 34 00 - HVAC FANS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Centrifugal square inline fans.
B. Related Requirements:
   1. Division 01 Specification Sections apply to Work of this Section.

1.2 REFERENCES

A. American Bearing Manufacturers Association:
   1. ABMA 9 - Load Ratings and Fatigue Life for Ball Bearings.
   2. ABMA 11 - Load Ratings and Fatigue Life for Roller Bearings.
B. Air Movement and Control Association International, Inc.:
   1. AMCA 99 - Standards Handbook.
   2. AMCA 204 - Balance Quality and Vibration Levels for Fans.
   3. AMCA 210 - Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.
   4. AMCA 300 - Reverberant Room Method for Sound Testing of Fans.
   5. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data.
C. American Refrigeration Institute:
   1. ARI 1060 - Air-to-Air Energy Recovery Ventilation Equipment Certification Equipment Program.
D. ASTM International:
   1. ASTM E1996 - Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Windborne Debris in Hurricanes.
E. National Electrical Manufacturers Association:
   1. NEMA MG 1 - Motors and Generators.
   2. NEMA 250 - Enclosures for Electrical Equipment (1,000 Volts Maximum).
F. Underwriters Laboratories Inc.:
   1. UL 705 - Power Ventilators.

1.3 SUBMITTALS

A. Division 01 and Section 23 05 00 "General Mechanical Requirements."
B. Product Data: Submit data on each type of fan and include accessories, fan curves with specified operating point plotted, power, RPM, sound power levels for both fan inlet and outlet at rated capacity, electrical characteristics and connection requirements.
C. Manufacturer's Installation Instructions: Submit fan manufacturer instructions.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: Submit instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

1.5 QUALITY ASSURANCE

A. Performance Ratings: Conform to AMCA 210 and bear AMCA Certified Rating Seal.
B. Sound Ratings: AMCA 301, tested to AMCA 300 ,and bear AMCA Certified Sound Rating Seal.
C. UL Compliance: UL listed and labeled, designed, manufactured, and tested per UL 705.
D. Balance Quality: Conform to AMCA 204.
E. Perform Work per state and local standards.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum 3 years' experience.
B. Installer: Company specializing in performing Work of this Section with minimum 3 years' experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect motors, shafts, and bearings from weather and construction dust.

1.8 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.9 EXTRA MATERIALS

A. Furnish 2 sets of belts for each fan.

PART 2 - PRODUCTS

2.1 CENTRIFUGAL SQUARE INLINE FANS

A. Manufacturers:
1. Acme Engineering & Manufacturing Corp.
2. Greenheck Fan Corporation.
3. Loren Cook Company.
4. PennBarry.
5. Substitutions: Refer to Section 23 05 00 "General Mechanical Requirements."

B. General Description:
   1. Base fan performance at standard conditions (density 0.075 lb./ft^3).
   2. Normal operating temperature up to 130 degrees F.
   3. Applications Include: Intake, exhaust, return, or make-up air systems.
   4. Each fan will bear a permanently affixed manufacturer's engraved metal nameplate containing the model number and individual serial number.

C. Wheel:
   1. Non-overloading, backward inclined centrifugal wheel.
   2. Constructed of aluminum.
   3. Statically and dynamically balanced in accordance with AMCA Standard 204-05.
   4. The wheel cone and fan inlet will be matched and will have precise running tolerances for maximum performance and operating efficiency.
   5. Single thickness blades are securely riveted or welded to a heavy gauge back plate and wheel cone.

D. Electronically Commutated Motor:
   1. Motor Enclosure: Open drip proof.
   2. Motor to be a DC Electronic Commutation Type Motor (ECM) specifically designed for fan applications. AC induction type motors are not acceptable. Examples of unacceptable motors are: Shaded Pole, Permanent Split Capacitor (PSC), Split Phase, Capacitor Start and 3 phase induction type motors.
   3. Motors are permanently lubricated, heavy duty ball bearing type to match with the fan load and pre-wired to the specific voltage and phase.
   4. Internal motor circuitry to convert AC power supplied to the fan to DC power to operate the motor.
   5. Motor will be speed controllable down to 20 percent full speed (80 percent turndown). Speed will be controlled by either a potentiometer dial mounted at the motor or by a 0-10 VDC signal.
   6. Motor will be a minimum of 85 percent efficient at all speeds.

E. Housing/Cabinet Construction:
   1. Square design constructed of heavy gauge galvanized steel and will include square duct mounting collars.
   2. Housing and bearing supports will be constructed of heavy gauge bolted and welded steel construction to prevent vibration and to rigidly support the shaft and bearing assembly.
   3. Galvanized Construction material.

F. Housing Supports and Drive Frame:
   1. Housing supports are constructed of structural steel with formed flanges.
   2. Drive frame is welded steel which supports the motor.

G. Disconnect Switches:
   1. NEMA Rated: NEMA 1; indoor application no water. Factory standard.
   2. Positive electrical shut-off.
   3. Wired from fan motor to junction box.

H. Duct Collars:

I. Access Panel: Two-sided access panels permit easy access to all internal components.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify roof curbs are installed and dimensions are as instructed by manufacturer.

3.2 INSTALLATION

A. Secure roof fans with cadmium plated steel lag screws to roof curb.
B. Suspended Fans: Install flexible connections specified in Section 23 33 00 "Air Duct Accessories" between fan and ductwork. Ensure metal bands of connectors are parallel with minimum 1-inch flex between ductwork and fan while running.
C. Install backdraft dampers on inlet to roof exhaust fans.
D. Provide backdraft dampers on outlet from cabinet and ceiling fans and as indicated on Drawings.
E. Install safety screen where inlet or outlet is exposed.
F. Pipe scroll drains to nearest floor drain.
G. Install backdraft dampers on discharge of exhaust fans**.**
H. Provide sheaves required for final air balance.

3.3 CLEANING

A. Vacuum clean coils and inside of fan cabinet.

3.4 DEMONSTRATION

A. Demonstrate fan operation and maintenance procedures.

3.5 PROTECTION OF FINISHED WORK

A. Do not operate fans until ductwork is clean, filters in place, bearings lubricated, and fan has been test run under observation.

END OF SECTION

SECTION 23 37 00 - AIR OUTLETS AND INLETS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Diffusers.
   2. Registers
   3. Grilles.
B. Related Requirements:
   1. Division 01 Specification Sections apply to Work of this Section.

1.2 REFERENCES

A. Air Movement and Control Association International, Inc.:
   1. AMCA 500 - Test Methods for Louvers, Dampers, and Shutters.
B. American Society of Heating, Refrigerating, and Air-Conditioning Engineers:
   1. ASHRAE 70 - Method of Testing for Rating the Performance of Air Outlets and Inlets.
C. Sheet Metal and Air Conditioning Contractors:
   1. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

1.3 SUBMITTALS

A. Division 01 and Section 23 05 00 "General Mechanical Requirements" for submittal procedures.
B. Product Data: Submit sizes, finish, and type of mounting. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.
C. Test Reports: Rating of air outlet and inlet performance.
D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 70 00 "Execution and Closeout Requirements" for closeout procedures.
B. Project Record Documents: Record actual locations of air outlets and inlets.

1.5 QUALITY ASSURANCE

A. Test and rate diffuser, register, and grille performance in accordance with ASHRAE 70.
B. Test and rate louver performance in accordance with AMCA 500.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum 3 years' documented experience.

1.7 WARRANTY

A. Section 01 70 00 "Execution and Closeout Requirements" for product warranties and product bonds.

PART 2 - PRODUCTS

2.1 DIFFUSERS, GRILLES, AND REGISTERS

A. Refer to Drawings for Air Distribution Schedules.
B. Manufacturers:
   1. Nailor Industries Inc.
   2. Price Industries.
   3. Titus.
   4. Substitutions: Section 23 05 00 "General Mechanical Requirements."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify inlet and outlet locations.
B. Verify ceiling or wall systems are ready for installation.

3.2 INSTALLATION

A. Install diffusers to ductwork with airtight connection.
B. Install balancing dampers on duct take-off to diffusers, grilles, and registers, whether or not dampers are furnished as part of diffuser, grille, and register assembly.
C. Paint visible portion of ductwork behind air outlets and inlets matte black.
D. Do not locate air registers, diffusers or grilles in floors of toilet or bathing rooms.

3.3 INTERFACE WITH OTHER PRODUCTS

A. Check location of outlets and inlets and make necessary adjustments in position to conform to architectural features, symmetry, and lighting arrangement.

3.4 SCHEDULES

A. Refer to Drawings for all Schedules.

END OF SECTION

SECTION 23 81 26 - SPLIT-SYSTEM AIR-CONDITIONERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Air handling unit.
   2. Condensing unit.

B. Related Requirements:
   1. Division 01 Specification Sections apply to Work of this Section.
   2. Section 03 30 00 "Cast-in-Place Concrete" for execution requirements for concrete foundations specified by this Section.
   3. Section 23 23 00 "Refrigerant Piping" for execution requirements for connection to refrigerant piping specified by this Section.
   4. Section 23 33 00 "Air Duct Accessories" for flexible connections.

1.2 REFERENCES

A. Air-Conditioning and Refrigeration Institute:
   1. ARI 210/240 - Unitary Air-Conditioning and Air-Source Heat Pump Equipment.
   2. ARI 270 - Sound Rating of Outdoor Unitary Equipment.
   3. ARI 340/360 - Commercial and Industrial Unitary Air-Conditioning and Heat Pump Equipment.
   4. ARI 365 - Commercial and Industrial Unitary Air-Conditioning Condensing Units.

B. American Society of Heating, Refrigerating and Air-Conditioning Engineers:
   1. ASHRAE 52.1 - Gravimetric and Dust-Spot Procedures for Testing Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter.
   2. ASHRAE 90.1 - Energy Standard for Buildings Except Low-Rise Residential Buildings.

C. ASTM International:
   1. ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus.

D. National Electrical Manufacturers Association:
   1. NEMA MG 1 - Motors and Generators.

E. NFPA:
   1. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems.

1.3 SUBMITTALS

A. Section 23 05 00 "General Mechanical Requirements" for submittal procedures.
B. Product Data: Submit data indicating:
   1. Cooling and heating capacities.
   2. Dimensions.
   3. Weights.
   4. Rough-in connections and connection requirements.
   5. Duct connections.
   6. Electrical requirements with electrical characteristics and connection requirements.
   7. Controls.
   8. Accessories.
C. Manufacturer's Installation Instructions: Submit assembly, support details, connection requirements, and include start-up instructions.

1.4 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of controls installed remotely from units.
B. Operation and Maintenance Data: Submit manufacturer's descriptive literature, operating instructions, installation instructions, and maintenance and repair data.

1.5 QUALITY ASSURANCE

A. Cooling Capacity: Rate in accordance with ARI 210/240.
B. Sound Rating: Measure in accordance with ARI 270.
C. Insulation and adhesives: Meet requirements of NFPA 90A.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum 3 years' experience.
B. Installer: Company specializing in performing Work of this Section with minimum 3 years' experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Accept units and components on site in factory protective containers, with factory shipping skids and lifting lugs. Inspect for damage.
B. Comply with manufacturer's installation instruction for rigging, unloading and transporting units.
C. Protect units from weather and construction traffic by storing in dry, roofed location.

1.8 WARRANTY

A. Furnish 5-year manufacturer's warranty for compressors.

PART 2 - PRODUCTS

2.1 SPLIT SYSTEM AIR CONDITIONING UNITS

A. Manufacturers:
   1. Carrier Corporation.
   2. Trane.
   3. Lennox Industries, Inc.; Lennox International.
B. Substitutions: Refer to Section 23 05 00 "General Mechanical Requirements."
C. Product Description: Split system consisting of air handling unit and condensing unit including cabinet, evaporator fan, refrigerant cooling coil, compressor, refrigeration circuit, condenser, electric heating coil, air filters, controls, air handling unit accessories, condensing unit accessories, and refrigeration specialties.

2.2 AIR HANDLING UNIT

A. Configuration: As indicated on Drawings.
B. Cabinet:
   1. Panels: Constructed of galvanized steel with baked enamel finish. Access Panels: Located on both sides of unit. Furnish with duct collars on inlets and outlets.
   2. Insulation: Factory applied to each surface to insulate entire cabinet. 1/2-inch-thick aluminum-foil-faced glass fiber with edges protected from erosion.
C. Evaporator Fan: Forward curved centrifugal type, resiliently mounted with adjustable belt drive and ECM motor. Motor permanently lubricated with built-in thermal overload protection.
D. Evaporator Coil: Constructed of copper tubes expanded onto aluminum fins. Factory leak tested under water. Removable, PVC construction, double-sloped drain pan with piping connections on both sides.
E. Refrigeration System: Single refrigeration circuits controlled by factory-installed thermal expansion valve.
F. Electric Heating Coil: Helical nickel-chrome resistance wire coil heating elements with refractory ceramic support bushings easily accessible with automatic reset thermal cut-out, built-in contactors, galvanized steel frame, and load fuses.
G. Air Filters: Two-inch-thick pleated filter.

2.3 CONDENSING UNIT

A. General: Factory assembled and tested air-cooled condensing units, consisting of casing, compressors, condensers, coils, condenser fans and motors, and unit controls.
B. Unit Casings: Exposed casing surfaces constructed of galvanized steel with manufacturer's standard baked enamel finish. Designed for outdoor installation and complete with weather protection for components and controls, and complete with removable panels for required access to compressors, controls, condenser fans, motors, and drives.
C. Compressor: Single refrigeration circuit reciprocating type compressors, resiliently mounted, with positive lubrication, and internal motor overload protection.
D. Condenser Coil: Constructed of copper tubing mechanically bonded to aluminum fins, factory leak and pressure tested.
E. Controls: Furnish operating and safety controls including high and low pressure cutouts. Control transformer. Furnish magnetic contactors for compressor and condenser fan motors.
F. Condenser Fans and Drives: Direct drive propeller fans statically and dynamically balanced. Wired to operate with compressor. Permanently lubricated ball bearing type motors with built-in thermal overload protection.
G. Condensing Unit Accessories: Furnish the following accessories:
    1. Controls to provide low ambient cooling to 40 degrees F.
    2. Time delay relay.
    3. Anti-short cycle timer.
    4. Vibration isolators.
    5. Condenser Coil Guard: Condenser fan openings furnished with factory louvered hail guards.

2.4 CONTROLS

A. Thermostat: Seven-day WIFI programmable electronic space thermostat with automatic changeover and heating setback and cooling setup capability. Furnish system selector switch.

2.5 ELECTRICAL CHARACTERISTICS AND COMPONENTS

A. Electrical Characteristics: In accordance with Division 26.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify concrete pad for condensing unit is ready for unit installation.

3.2 INSTALLATION - AIR HANDLING UNIT

A. Install air handling units on vibration isolators.
B. Install floor-mounted units on concrete housekeeping pads at least 3-1/2 inches high and 6 inches wider than unit.
C. Connect air handling units to supply and return ductwork with flexible connections.
D. Install condensate piping with trap and route from drain pan to location as shown on Drawings.
E. Install components furnished loose for field mounting.

3.3 INSTALLATION - CONDENSING UNIT

A. Install condensing units on vibration isolators.
B. Install units on concrete foundations.
C. Install refrigerant piping from unit to condensing unit. Install refrigerant specialties.
D. Evacuate refrigerant piping and install initial charge of refrigerant.
E. Install electrical devices furnished loose for field mounting.
F. Install control wiring between air handling unit, condensing unit, and field installed accessories.
G. Install Work in accordance with state and local standards.

3.4 CLEANING

A. Vacuum clean coils and inside of unit cabinet.
B. Install temporary filters during construction period. Replace with permanent filters at Substantial Completion.

3.5 DEMONSTRATION

A. Demonstrate air handling unit operation and maintenance.
B. Demonstrate starting, maintenance, and operation of condensing unit including low ambient temperature operation.

3.6 PROTECTION OF FINISHED WORK

A. Do not operate air handling units until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

END OF SECTION

SECTION 26 05 00 - BASIC ELECTRICAL METHODS

PART 1 - GENERAL

1.1 SUMMARY

A. Related Requirements:
1. Division 01 Specification Sections apply to Work of this Section.

1.2 REQUIREMENTS OF REGULATORY AGENCIES AND STANDARDS

A. Regulatory Agencies: Installation, materials, equipment and workmanship shall conform to the applicable provisions of the following:
B. National Electrical Code (NEC).
C. National Electrical Safety Code (NESC).
D. Terms and conditions of the electrical utility and other authorities having lawful jurisdiction pertaining to the work required.
E. All temperature control wiring and associated conduit and boxes, shall be provided under other Sections of the Specifications. All power and control wiring, not identified under Divisions 22 and 23, shall be provided under Division 26.
F. The work covered by Division 26 of the Specifications includes the furnishing of all materials, labor, transportation, tools, permits, and fees for the complete installation of all electrical work required in the Contract Drawings.
G. In the event that additional or special construction is required, Contractor is responsible for providing all material and equipment which are usually furnished with such construction in order to complete the installation, whether indicated or not.
H. Contractor shall familiarize himself with the existing conditions of the site and advise Architect of any discrepancy or conflict prior to bidding.
I. Contractor shall be responsible for all permits, fees, and licenses required for the Project. All cost of such permits or fees shall be included in the bid.
J. All equipment and material shall be installed in accordance with applicable manufacturer's recommendations and standards.
K. Install sleeves, sealant pans, and roof penetrations as required for the installation of the electrical work. All such work is subject to the approval of Architect.
L. Contractor shall be responsible for coordinating with the utility service provider to verify all locations, routing, equipment and labor that will be furnished as a part of this Contract.
M. Any fees or charges associated with delivering permanent power for the Project shall be included in Contractor's bid.

1.3 SUBMITTALS

A. The intent of this Section is to give general submittal information; refer to specific submittal information in the subsequent Mechanical Sections.
B. Within 10 days after award of the Contract, and before orders are placed, Contractor shall submit specific information on list of equipment and principal materials specified. Contractor shall indicate and/or provide names of manufacturers, catalog and model numbers, cut sheets, and such other supplementary information as necessary for evaluation. Minimum of six copies, or as directed by Architect, of each shall be submitted and shall include all items mentioned by model number and/or manufacturer's name in the Specifications or in schedules on the Drawings.
C. Requirements for Each Submittal:
    1. Bear a dated stamp or specific written indication that Contractor has reviewed and approved all submittal prior to submission to Architect.
    2. Have all information deleted by Contractor that pertains to the means and methods of construction or to fabrication, assembly, installation, or erection (approval by Architect shall not extend to these areas unless specifically noted by Architect).
    3. Be clearly and SPECIFICALLY marked as to which specific piece of equipment is being submitted, by use of a permanent marker, stamp, etc., so as to distinguish it from other pieces of equipment that may occur on the same page.
    4. Be clearly marked as to which available options are being submitted that are associated with a piece of equipment.
    5. Be complete with respect to quantities, dimensions, specific performance, materials, and similar data to enable Architect to review the proposed equipment.
D. Omission by Contractor of any of the above requirements or submittals will subject submittal to automatic rejection without review.
E. Any submittals received by Architect that were not requested shall be returned without review of any kind.

PART 2 - PRODUCTS

2.1 EQUIPMENT REQUIREMENTS

A. The electrical requirements for equipment specified or indicated on the Drawings are based on information available at the time of design. If equipment furnished for installation has electrical requirements other than indicated on the Electrical Drawings, Contractor shall make any required changes to wire and conduit size, controls, overcurrent protection, and installation as required to accommodate the equipment supplied, without additional charge to Owner. The complete responsibility and costs for such adjustments shall be assigned to the respective Section of this Specification under which the equipment is furnished.

2.2 MATERIALS

A. All similar materials and equipment shall be the product of the same manufacturer unless specified otherwise.
B. Materials and equipment shall be the standard products of manufacturers regularly engaged in the production of such material and shall be the manufacturer's current and standard design.
C. Altitude: Equipment affected by altitude shall perform satisfactorily for the function intended at the altitude of the Project site.
D. Detectable Warning Tape: Acid and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, minimum 6-inch wide and 4 mils thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inch deep; colored as follows:
    1. Red: Electric.
    2. Yellow: Gas, oil, steam, and dangerous materials.
    3. Orange: Telephone and other communications.
    4. Blue: Water systems.
    5. Green: Sewer systems.
E. Backfill Material:
    1. Material 4 inches below and 12 inches above pipes and conduit shall be natural or manufactured sand complying to ASTM C33.
    2. Material more than 12 inches above pipes and conduits shall be sand indicated above or native fill free of rock or gravel larger than 3/8 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.

PART 3 - EXECUTION

3.1 GENERAL

A. Fabrication, erection, and installation of the complete electrical system shall be done in accordance with accepted good practice by qualified personnel experienced in such work and shall proceed in an orderly manner so as not to impede the progress of the Project. Electrical Contractor shall check all areas and surfaces where electrical equipment material is to be installed, removed, or relocated and report any unsatisfactory conditions before starting work. Commencement of work signifies this Contractor's acceptance of existing conditions. In the acceptance or rejection of the finished installation, no allowance will be made for lack of skill on the part of workers. Surfaces requiring coatings will be completed prior to installation of any electrical work on these surfaces.
B. The Electrical Drawings are diagrammatic. The installation requirements shall be carefully coordinated with structural, architectural, and mechanical conditions and shall be adjusted to avoid conflict.

C. All work shall be concealed in walls, ceilings, and chases unless specifically noted to be exposed or otherwise approved.

D. The locations of electrical equipment are approximate and are not intended to convey the exact details and mounting of location of outlets, equipment, and other items. Exact locations are to be field determined by actual measurements.

E. The location height and projection of fixtures illuminating signs or special features shall be approved by Architect prior to installation.

F. Contractor shall coordinate the location of all exterior fixtures with architectural Drawings and Specifications.

G. Consult architectural Drawings to determine wall finishes and locations of wall-mounted equipment, countertop splashes, and similar items to avoid conflict with electrical equipment. At locations where surface or pendant mounted light fixtures are noted, provide for all necessary framing channels, pendants, chains, canopies, and other hardware as required for a complete and operable system.

H. Protect subgrades and foundation soils against freezing temperatures or frost. Provide protective insulating materials as necessary.

I. Excavation for Pipe and Conduit:
   1. Excavate trenches to indicated gradients, lines, depths, and elevations.
   2. Excavate trenches to uniform widths to provide a working clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit, unless otherwise indicated.
   3. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.
      a. For pipes and conduit less than 6 inches in nominal diameter and flat-bottomed, multiple-duct conduit units, hand excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.
      b. For pipes and conduit 6 inches or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe circumference. Fill depressions with tamped sand backfill.
      c. Excavate trenches 4 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.
   4. Place backfill and fill materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
   5. Compact soil to not less than the following percentages of maximum dry unit weight according to ASTM D698:
      a. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inch of existing subgrade and each layer of backfill or fill material at 95 percent.
      b. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill material at 92 percent.
      c. Under lawn or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill material at 85 percent.

6. Install detectable warning tape above conduits and pipe, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.
7. Protection:
    a. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
    b. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
        1) Scarify or remove and replace soil material to depth as directed by Architect; reshape and recompact.
    c. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
        1) Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to the greatest extent possible.
8. Disposal of Surplus and Waste Materials:
    a. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property unless otherwise directed by Owner.
    b. Repair: Any damage to shrubs, grass or structures shall be repaired to previous condition by Contractor at no additional expense to Owner.

J. It shall be the responsibility of Division 26 Contractor to provide for all disconnecting and motor control devices for all equipment. Contractor shall coordinate to determine voltage, phase, and configurations. Any changes necessary to coordinate these items between Divisions 22, 23, and 26 shall be considered part of this Contract.

K. Division 26 Contractor shall be responsible for providing for all power requirements associated with the mechanical systems including power, control devices, smoke dampers, etc. Refer to Division 22 and 23 Drawings for locations and requirements. Connect all smoke dampers to the fire alarm control panel.

3.2 PERFORMANCE TESTS

A. Thoroughly test all control circuits, fixtures, services, and all circuits for proper operating condition and freedom from grounds and short circuits before acceptance is requested. All equipment, appliances, and devices shall be operated under load conditions.

B. After the interior wiring system installation is complete conduct operating tests for approval. When requested, test all the wire, cable, devices, and equipment after installation, to assure that all material continues to possess all the original characteristics as required by governing codes and standards listed in these Specifications.

C. After motor operation has been verified make voltage readings at all panelboards and starters. Based on these readings, make final adjustments of primary taps on all transformers in the building as directed, or coordinate with the utility proper building voltage.
D. Perform such other tests as required by other Sections of these Specifications or as requested to prove acceptability.
E. Furnish all instruments and labor for testing.
F. All material installed shall be listed, inspected, and approved by a nationally accepted testing laboratory such as UL and/or ETL. All material shall bear the UL or ETL label where available.

3.3 SUBMITTAL AND APPROVAL OF MATERIALS

A. All requirements for submittals shall comply with the applicable provisions included in the individual Specification Sections.
B. Unless identified as a sole source item, the listing of product manufacturers, catalog numbers, etc., on Drawings is intended to establish a standard of quality of the product. It is the responsibility of Contractor to review all items he intends to submit. If equipment other than that indicated on Drawings is proposed by Contractor, the information will be reviewed at the time of the submission of the submittal.

END OF SECTION

SECTION 26 05 13 - BUILDING WIRE AND CABLE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Building wire and cable.
   2. Wiring connectors and connections.
B. Related Requirements:
   1. Division 01 Specification Sections apply to Work of this Section.
   2. Section 01 40 00 "Quality Requirements" for requirements for references and standards.
   3. Section 26 05 53 "Electrical Identification."

1.2 REFERENCES

A. NECA Standard of Installation (National Electrical Contractors Association).
B. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems (International Electrical Testing Association).
C. NFPA 70 - National Electrical Code.

1.3 SUBMITTALS FOR REVIEW

A. Refer to Section 01 33 00 "Submittal Procedures" for procedures for submittals.
B. Product Data: Provide for each cable assembly type.

1.4 SUBMITTALS FOR INFORMATION

A. Refer to Section 01 33 00 "Submittal Procedures" for procedures for submittals.
B. Test Reports: Indicate procedures and values obtained.
C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements.

1.5 SUBMITTALS AT PROJECT CLOSEOUT

A. Refer to Section 01 70 00 "Execution and Closeout Requirements" for procedures for submittals.
B. Project Record Documents: Record actual locations of components and circuits.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum 3 years' documented experience.

1.7 REGULATORY REQUIREMENTS

A. Conform to NFPA 70.
B. Furnish products listed and classified by UL as suitable for the purpose specified and indicated.

1.8 FIELD SAMPLES

A. Provide under provisions of Section 01 40 00 "Quality Requirements."

1.9 PROJECT CONDITIONS

A. Refer to Section 01 30 00 "Administrative Requirements."
B. Verify that field measurements are as indicated.
C. Conductor sizes are based on copper.
D. Wire and cable routing indicated is approximate unless dimensioned.

1.10 COORDINATION

A. Coordinate Work under provisions of Section 01 30 00 "Administrative Requirements."
B. Where wire and cable destination is indicated and routing is not shown, determine exact routing and lengths required.

PART 2 - PRODUCTS

2.1 BUILDING WIRE

A. Manufacturers:
   1. American Cable.
   2. Houston Wire and Cable.
   3. Southwire.
   4. Substitutions: Refer to Section 01 60 00 "Product Requirements."
B. Description: Single conductor insulated wire.
C. Conductor: Copper.
D. Insulation Voltage Rating: 600 volts.
E. Insulation: NFPA 70, Type indicated herein.
F. MC Cable: Shall not be utilized on this Project.

2.2 WIRING CONNECTORS

A. Split Bolt Connectors:
   1. Buchanan.
   2. Burndy.
   3. Ilsco.
   4. Substitutions: Refer to Section 01 60 00 "Product Requirements."

B. Solderless Pressure Connectors:
   1. Buchanan.
   2. Burndy.
   3. Ilsco.
   4. Substitutions: Refer to Section 01 60 00 "Product Requirements."
C. Spring Wire Connectors:
   1. Ideal.
   2. Substitutions: Refer to Section 01 60 00 "Product Requirements."
D. Compression Connectors:
   1. Buchanan.
   2. Burndy.
   3. Ilsco.
   4. Substitutions: Refer to Section 01 60 00 "Product Requirements."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Refer to Section 01 30 00 "Administrative Requirements" for verification of existing conditions before starting Work.
B. Verify that interior of building has been protected from weather.
C. Verify that mechanical work likely to damage wire and cable has been completed.
D. Verify that raceway installation is complete and supported.

3.2 PREPARATION

A. Completely and thoroughly swab raceway before installing wire.

3.3 WIRING METHODS

A. Concealed Dry Interior Locations: Use only building wire, Type THHN/THWN insulation, in raceway.
B. Exposed Dry Interior Locations: Use only building wire, Type THHN/THWN insulation, in raceway.
C. Above Accessible Ceilings: Use only building wire, Type THHN/THWN insulation, in raceway.
D. Wet or Damp Interior Locations: Use only building wire, Type THHN/THWN insulation, in raceway.
E. Exterior Locations: Use only building wire, Type THHN/THWN insulation, in raceway.
F. Use wiring methods indicated.

3.4 INSTALLATION

A. Refer to Section 01 40 00 "Quality Requirements" for manufacturer's instructions.
B. Route wire and cable as required to meet Project Conditions.
C. Install cable in accordance with the NECA "Standard of Installation."
D. Use solid conductor for feeders and branch circuits 10 AWG and smaller.
E. Use stranded conductors for control circuits.
F. Use conductor not smaller than 12 AWG for power and lighting circuits with the exception of pre-manufactured fixture whips, listed for such use and not exceeding 6 feet in length.
G. Use conductor not smaller than 14 AWG for control circuits.
H. Use 10 AWG conductors for 20 ampere, 120 volt branch circuits longer than 100 feet and as indicated on the Drawings.
I. Install all conductors in conduit.
J. Pull all conductors into raceway at same time.
K. Use suitable wire pulling lubricant for building wire 4 AWG and larger.
L. Protect exposed cable from damage.
M. All cables shall be neatly supported.
N. Use suitable cable fittings and connectors.
O. Neatly train and lace wiring inside boxes, equipment, and panelboards.
P. Clean conductor surfaces before installing lugs and connectors.
Q. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.
R. Use split bolt connectors for copper conductor splices and taps, 6 AWG and larger. Tape uninsulated conductors and connector with electrical tape to 150 percent of insulation rating of conductor.
S. Use solderless pressure connectors with insulating covers for copper conductor splices and taps, 8 AWG and smaller.
T. Use insulated spring wire connectors with plastic caps for copper conductor splices and taps, 10 AWG and smaller.
U. Identify and color code wire and cable under provisions of Section 26 05 53 "Electrical Identification." Identify each conductor with its circuit number or other designation indicated.
V. The number of conductors in each conduit run shall be limited to the requirements as indicated on the Drawings and indicated in Article 310 of the National Electrical Code.

3.5 FIELD QUALITY CONTROL

A. Refer to Section 01 40 00 "Quality Requirements" for field inspection, testing, and adjusting.
B. Inspect and test in accordance with NETA ATS, except Section 4.
C. Perform inspections and tests listed in NETA ATS, Section 7.3.1.

END OF SECTION

SECTION 26 05 19 - EQUIPMENT WIRING SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes basic electrical connections to equipment specified under other Sections.
B. Related Requirements:
   1. Division 01 Specification Sections apply to Work of this Section.
   2. Section 26 05 00 "Basic Electrical Methods."

1.2 REFERENCES

A. NEMA WD 1 - General Purpose Wiring Devices.
B. NEMA WD 6 - Wiring Device Configurations.
C. ANSI/NFPA 70 - National Electrical Code.

1.3 SUBMITTALS

A. Submit under provisions of Section 01 33 00 "Submittal Procedures."
B. Product Data: Provide wiring device manufacturer's catalog information showing dimensions, configurations, and construction.
C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

1.4 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.
B. Furnish products listed and classified by UL as suitable for purpose specified and shown.

1.5 COORDINATION

A. Coordinate work under provisions of Section 01 30 00 "Submittal Procedures."
B. Obtain and review shop drawings, product data, and manufacturer's instructions for equipment furnished under other Sections.
C. Determine connection locations and requirements.
D. Sequence rough-in of electrical connections to coordinate with installation schedule for equipment.
E. Sequence electrical connections to coordinate with startup schedule for equipment.

PART 2 - PRODUCTS

2.1 CORDS AND CAPS

A. Attachment Plug Construction: Conform to NEMA WD 1.
B. Configuration: NEMA WD 6; match receptacle configuration at outlet provided for equipment.
C. Cord Construction: ANSI/NFPA 70, multiconductor flexible cord with identified equipment grounding conductor, suitable for use in damp locations.
D. Size: Suitable for connected load of equipment, length of cord, and rating of branch circuit overcurrent protection.
E. Division 26 Contractor shall be responsible for providing matching cord/receptacle for all equipment not furnished with such equipment.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify conditions under provisions of Section 01 30 00 "Submittal Procedures."
B. Verify that equipment is ready for electrical connection, wiring, and energization.

3.2 ELECTRICAL CONNECTIONS

A. Make electrical connections in accordance with equipment manufacturer's instructions.
B. Make conduit connections to equipment using flexible conduit. Use liquidtight flexible conduit with watertight connectors in damp or wet locations.
C. Make wiring connections using wire and cable with insulation suitable for temperatures encountered in heat producing equipment.
D. Provide receptacle outlet where connection with attachment plug is indicated. Provide cord and cap where field-supplied attachment plug is indicated.
E. Provide suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.
F. Install disconnect switches, controllers, control stations, and control devices as indicated.
G. Modify equipment control wiring with terminal block jumpers as indicated.
H. Provide interconnecting conduit and wiring between devices and equipment where indicated.
I. Check and modify phase connections as required for proper motor rotation.
J. Provide power to equipment only after equipment supplier verifies acceptance to receive and approves.
K. Contractor shall coordinate with all equipment to verify exact power and control wiring as required to properly serve equipment.

END OF SECTION

SECTION 26 05 26 - GROUNDING AND BONDING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Rod electrodes.
   2. Mechanical connectors.
   3. Exothermic connections.
   4. Wire.

B. Related Requirements:
   1. Division 01 Specification Sections apply to Work of this Section.
   2. Section 01 40 00 "Quality Requirements" for requirements for references and standards.

1.2 REFERENCES

A. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems (International Electrical Testing Association).
B. NFPA 70 - National Electrical Code.

1.3 GROUNDING SYSTEM DESCRIPTION

A. Metal underground water pipe.
B. Metal frame of the building.
C. Rod electrodes.

1.4 PERFORMANCE REQUIREMENTS

A. Grounding System Maximum Resistance: 10 ohms.

1.5 SUBMITTALS FOR REVIEW

A. Refer to Section 01 33 00 "Submittal Procedures."
B. Product Data: Provide for grounding electrodes and connections.

1.6 SUBMITTALS FOR CLOSEOUT

A. Refer to Section 01 70 00 "Execution and Closeout Requirements" for procedures for submittals.
B. Project Record Documents: Record actual locations of components and grounding electrodes.
C. Certificate of Compliance: Indicate approval of installation by Authority Having Jurisdiction (AHJ).

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum 3 years' documented experience, and with service facilities within 100 miles of Project.

1.8 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.
B. Products: Listed and classified by UL as suitable for the purpose specified and indicated.

PART 2 - PRODUCTS

2.1 ROD ELECTRODES

A. Material: Copper.
B. Diameter: 3/4-inch.
C. Length: 10 feet.

2.2 MECHANICAL CONNECTORS

A. Description: In lieu of exothermic connections, high compression type as manufactured by Burndy using the 12 ton Hy-Ground series.

2.3 EXOTHERMIC CONNECTIONS

A. Manufacturers: Cadweld.

2.4 WIRE

A. Material: Stranded copper.
B. Grounding Electrode Conductor: Minimum size to meet NFPA 70 requirements or as indicated on the Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Refer to Section 01 30 00 "Administrative Requirements" for verification of existing conditions prior to beginning Work.
B. Verify that final backfill and compaction has been completed before driving rod electrodes.

3.2 INSTALLATION

A. Refer to Section 01 40 00 "Quality Requirements" for manufacturer's instructions.
B. Install rod electrodes. Install additional rod electrodes as required to achieve a resistance to ground of 10 ohms or less. Rods shall be installed with a minimum separation of 6 feet.
C. Provide bonding to meet Regulatory Requirements.
D. Bond together metal siding not attached to grounded structure; bond to ground.
E. Equipment Grounding Conductor: Provide separate, insulated conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing.
F. Grounding Electrode System: The new grounding electrode system shall consist of the common bonding of building steel, underground steel water piping and supplemental ground rods, concrete re-enforcing bar, as detailed on the Drawings.
G. Provide proper bonding of the electrical system's grounded conductor (neutral) and the grounding electrode system sized in accordance with NEC Article 250. This bonding shall occur at all locations where there are separately derived systems.

3.3 FIELD QUALITY CONTROL

A. Refer to Section 01 40 00 "Quality Requirements" for field inspection, testing, and adjusting.
B. Inspect and test in accordance with NETA ATS, except Section 4.
C. Perform inspections and tests listed in NETA ATS, Section 7.13.

END OF SECTION

SECTION 26 05 29 - SUPPORTING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Supports for conduit and equipment.
   2. Anchors and fasteners.
B. Related Requirements:
   1. Division 01 Specification Sections apply to Work of this Section.

1.2 REFERENCES

A. NECA - National Electrical Contractors Association.
B. NFPA 70 - National Electrical Code.

1.3 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.
B. Furnish products listed and classified by UL as suitable for purpose specified and shown.

PART 2 - PRODUCTS

2.1 SUPPORTS

A. Provide materials, sizes, and types of anchors, fasteners and supports to carry the loads of equipment and conduit. Consider weight of wire in conduit when selecting products.

2.2 ANCHORS AND FASTENERS

A. Concrete Structural Elements: Use expansion anchors, powder actuated anchors, and preset inserts.
B. Steel Structural Elements: Use beam clamps, spring steel clips, and steel ramset fasteners.
C. Concrete Surfaces: Use self-drilling anchors and expansion anchors.
D. Sheet Metal: Use sheet metal screws.
E. Wood Elements: Use wood screws.
F. Roof Support/Jacks: Advanced supports products # SS1000A or approved equal.

2.3 MATERIALS AND FINISHES

A. Provide adequate corrosion resistance.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions.
B. Provide anchors, fasteners, and supports in accordance with NECA "Standard of Installation."
C. Do not fasten supports to pipes, ducts, mechanical equipment, and conduit.
D. Obtain permission from Architect before drilling or cutting structural members.
E. Fabricate supports from structural steel as indicated on Drawings. Rigidly weld members or use hexagon head bolts to present neat appearance with adequate strength and rigidity. Use lock washers under all nuts.
F. Install surface-mounted cabinets and panelboards with minimum of 4 anchors.
G. In wet and damp locations, use steel channel supports to stand cabinets and panelboards 1 inch off wall.
H. Install conduit supports a maximum spacing specified in the NEC.

END OF SECTION

SECTION 26 05 33 - CONDUIT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Metal conduit.
   2. Flexible metal conduit.
   3. Liquidtight flexible metal conduit.
   4. Electrical metallic tubing.
   5. Fittings and conduit bodies.

B. Related Requirements:
   1. Division 01 Specification Sections apply to Work of this Section.
   2. Section 26 05 33.16 "Boxes."
   3. Section 26 05 53 "Electrical Identification."

1.2 REFERENCES

A. ANSI C80.1 - Rigid Steel Conduit, Zinc Coated.
B. ANSI C80.3 - Electrical Metallic Tubing, Zinc Coated.
C. ANSI/NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.
D. NECA "Standard of Installation."
E. NEMA TC 3 - PVC Fittings for Use with Rigid PVC Conduit and Tubing.
F. NFPA 70 - National Electrical Code.

1.3 DESIGN REQUIREMENTS

A. Conduit Size: NFPA 70.

1.4 SUBMITTALS

A. Submit under provisions of Section 01 33 00 "Submittal Procedures."
B. Product Data: Provide for metallic conduit, flexible metal conduit, liquidtight flexible metal conduit, nonmetallic conduit, fittings and conduit bodies.

1.5 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Section 01 70 00 "Execution and Closeout Requirements."
B. Accurately record actual routing of conduits.

1.6 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.
B. Furnish products listed and classified by UL as suitable for purpose specified and shown.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect, and handle products to site under provisions of Section 01 60 00 "Product Requirements."
B. Accept conduit on site. Inspect for damage.
C. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.
D. Protect PVC conduit from sunlight.

1.8 PROJECT CONDITIONS

A. Verify that field measurements are as shown on Drawings.
B. Verify routing and termination locations of conduit prior to rough-in.
C. Conduit routing is shown on Drawings in approximate locations unless dimensioned. Route as required to complete wiring system.

PART 2 - PRODUCTS

2.1 CONDUIT REQUIREMENTS

A. Minimum Size: 3/4-inch for all branch circuits located above ceiling. Contractor may use 1/2-inch conduit down the wall to receptacles and light switches.
B. Wet and Damp Locations above grade: Use rigid steel or liquid tight flexible conduit.
C. Dry Locations: Use electrical metallic tubing for concealed and exposed locations.
D. Below Slab: Non-metallic PVC conduit is acceptable within limitations specified.
E. Below Grade: Use only PVC coated rigid galvanized steel, wrapped rigid steel, or non-metallic PVC conduit within limitations specified.
F. MC Cable: Shall not be utilized on this Project.

2.2 METAL CONDUIT

A. Manufacturers:
   1. Allied.
   2. Wheatland.
   3. Substitutions: Under provisions of Section 01 60 00 "Product Requirements."
B. Rigid Steel Conduit: ANSI C80.1.
C. Fittings and Conduit Bodies: ANSI/NEMA FB 1; all steel fittings.

2.3 FLEXIBLE METAL CONDUIT

A. Manufacturers:
   1. Allied Tube.
   2. Electri-Flex.
   3. Greenfield.
   4. Substitutions: Under provisions of Section 01 60 00 "Product Requirements."
B. Description: Interlocked steel construction. Aluminum is not permitted.
C. Fittings: ANSI/NEMA FB 1 with fittings approved for steel flex.
D. Applications: Use for final connections to motorized equipment, connections to recessed lighting fixtures located in accessible ceilings, and connections to dry type transformers. Utilization of 3/8-inch in lieu of the minimum 1/2-inch is acceptable under the limitations of the National Electrical Code.

2.4 LIQUIDTIGHT FLEXIBLE METAL CONDUIT

A. Manufacturers:
   1. Electri-flex.
   2. Ultratite.
   3. Substitutions: Under provisions of Section 01 60 00 "Product Requirements."
B. Description: Interlocked steel construction with PVC jacket.
C. Fittings: ANSI/NEMA FB 1.
D. Applications: Use for final connections to motorized equipment in exterior locations and areas subjected to moisture (kitchen).

2.5 ELECTRICAL METALLIC TUBING (EMT)

A. Manufacturers:
   1. Allied.
   2. Substitutions: Under provisions of Section 01 60 00 "Product Requirements."
B. Description: ANSI C80.3; galvanized tubing.
C. Fittings and Conduit Bodies: ANSI/NEMA FB 1; all steel, compression or set screw type.
D. Applications: Do not use below grade or in exterior locations. Use only in interior locations.

2.6 PVC COATED METAL CONDUIT

A. Manufacturers:
   1. Levy.
   2. Robroy Industries.
   3. Substitutions: Under provisions of Section 01 60 00 "Product Requirements."
B. Description: NEMA RN-1, rigid steel conduit with external PVC coating, 20 mil thick.
C. General: Protective layer may be factory applied or galvanized rigid steel conduit may be applied with two layers of corrosion resistant tape.
D. Fittings and Conduit Bodies: ANSI/NEMA FB 1; steel fittings with external PVC coatings to match conduit.

2.7 NON-METALLIC PVC CONDUIT

A. Manufacturers:
   1. Allied.
   2. Carlon.
   3. Substitutions: Under provisions of Section 01 60 00 "Product Requirements."
B. Description: NEMA TC2; Schedule 40 PVC. Flame retardant type resistant to bending and cracking.
C. Fittings and conduit bodies: NEMA TC3.
D. Vertical risers and ells installed below grade shall be rigid steel with wrapping.
E. Do not use above grade.
F. Joints made with PVC fittings shall be applied with solvent compound after thorough cleaning.
G. Refer to Part 3. Do not use PVC conduit for conduits passing vertically through the slab.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install conduit in accordance with NECA "Standard of Installation."
B. Install nonmetallic conduit in accordance with manufacturer's instructions.
C. Arrange supports to prevent misalignment during wiring installation.
D. Support conduit using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.
E. Group related conduits; support using conduit rack. Construct rack using steel channel.
F. Fasten conduit supports to building structure and surfaces under provisions of Section 26 05 29 "Supporting Devices."
G. Do not support conduit with wire or perforated pipe straps. Remove wire used for temporary supports.
H. Do not attach conduit to ceiling support wires.
I. Arrange conduit to maintain headroom and present neat appearance.
J. Route exposed conduit parallel and perpendicular to walls.
K. Route conduit installed above accessible ceilings parallel and perpendicular to walls.
L. Maintain adequate clearance between conduit and piping.
M. Maintain 12-inch clearance between conduit and surfaces with temperatures exceeding 104 degrees F.
N. Cut conduit square using saw or pipecutter; de-burr cut ends.
O. Bring conduit to shoulder of fittings; fasten securely.
P. Use conduit hubs or sealing locknuts to fasten conduit to sheet metal boxes in damp and wet locations and to cast boxes.

Q. Install no more than equivalent of three 90-degree bends between boxes. Use conduit bodies to make sharp changes in direction, as around beams. Use factory elbows for bends in metal conduit larger than 2-inch size.
R. Avoid moisture traps; provide junction box with drain fitting at low points in conduit system.
S. Provide suitable fittings to accommodate expansion and deflection where conduit crosses control and expansion joints.
T. Provide suitable pull string in each empty conduit except sleeves and nipples.
U. Use suitable caps to protect installed conduit against entrance of dirt and moisture.
V. Ground and bond conduit under provisions of Section 26 05 26 "Grounding and Bonding."
W. Identify conduit under provisions of Section 26 05 53 "Electrical Identification."
X. Ducts shall be cleaned with a flexible mandrel assembly.
Y. All conduits passing vertically through slabs or through earth on grade shall be PVC-coated, rigid steel. Rigid steel conduits shall be applied with protective coatings as indicated herein. All transitions from PVC to rigid steel shall occur below the slab.
Z. Underground branch circuit extensions to parking lot lighting fixtures and other branch circuits may be direct buried PVC conduit. Service entrance PVC conduit shall be concrete encased in accordance with the Drawings unless otherwise approved by Primary Designer.
AA. Minimum cover for underground conduits shall be 24 inches unless otherwise noted.
BB. All conduit shall be routed concealed as much as possible including conduit serving roof-mounted equipment. Roof penetrations for conduits shall adhere to the requirements and details as indicated on the Architectural Drawings.

3.2 INTERFACE WITH OTHER PRODUCTS

A. Install conduit to preserve fire resistance rating of partitions and other elements, using materials and methods under the provisions of Section 07 84 13 "Penetration Firestopping."
B. Route conduit through roof openings for piping and ductwork or through suitable roof jack with pitch pocket. Coordinate location with roofing installation.

END OF SECTION

SECTION 26 05 33.16 - BOXES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Wall and ceiling outlet boxes.
   2. Pull and junction boxes.
   3. Floor boxes.

B. Related Requirements:
   1. Division 01 Specification Sections apply to Work of this Section.
   2. Section 07 84 13 "Penetration Firestopping."
   3. Section 26 27 26 "Wiring Devices" for wall plates in finished areas.

1.2 REFERENCES

A. NECA - Standard of Installation.
B. NEMA FB 1 - Fittings and Supports for Conduit and Cable Assemblies.
C. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports.
D. NEMA 250 - Enclosures for Electrical Equipment (1,000 Volts Maximum).
E. NFPA 70 - National Electrical Code.

1.3 SUBMITTALS FOR CLOSEOUT

A. Refer to Section 01 70 00 "Execution and Closeout Requirements" for submittals for Project closeout.
B. Record actual locations and mounting heights of outlet, pull, and junction boxes on Project record documents.

1.4 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.
B. Provide Products listed and classified by UL as suitable for the purpose specified and indicated.

PART 2 - PRODUCTS

2.1 WALL AND CEILING OUTLET BOXES

A. Sheet Metal Outlet Boxes: NEMA OS 1, galvanized steel.
B. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; include 1/2-inch male fixture studs where required.
C. Cast Boxes: NEMA FB 1, Type FD, cast feralloy. Provide gasketed cover by box manufacturer.
D. Wall Plates for Finished Areas: As specified in Section 26 27 26 "Wiring Devices."

E. Boxes for 15A and 20A, 125V, and 250V receptacles installed in interior or exterior "Wet" locations shall be provided with "While-In-Use" shield and shall be listed as "extra-duty" in accordance with the N.E.C Article 406.9.

2.2 PULL AND JUNCTION BOXES

A. Sheet Metal Boxes: NEMA OS 1, galvanized steel.
B. Surface Mounted Cast Metal Box: NEMA 250, Type 4; flat-flanged, surface mounted junction box.
C. Material: Galvanized cast iron.
D. Cover: Furnish with ground flange, neoprene gasket, and stainless-steel cover screws.
E. Fiberglass boxes are allowed in landscaping areas. Equipment shall be pedestrian rated.

2.3 FLOOR BOXES

A. Stamped steel boxes with a minimum of 16-gauge steel for use in concrete slab applications.
B. 16-gauge steel powder coated finish for use with carpet inserts or without. Provide cover with cable door.
C. Provide a minimum of two duplex receptacles and two data outlet locations.
D. In addition to the required power conduits, provide a spare 1-inch conduit to above an accessible ceiling.
E. Boxes located on the first floor shall be Hubbell No. HBLCFB301 BASE with covers, faceplates, devices, and other accessories as noted.
F. Boxes located on the second floor shall be Hubbell System One, 6-inch recessed, fire rated poke thru, or equivalent.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify locations of outlets in all locations areas prior to rough-in.

3.2 INSTALLATION

A. Install boxes in accordance with NECA "Standard of Installation."
B. Install in locations as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections and compliance with regulatory requirements.
C. Set wall mounted boxes at elevations to accommodate mounting heights specified in Section for outlet device.
D. Electrical boxes are shown on Drawings in approximate locations unless dimensioned. Adjust box location up to 10 feet if required to accommodate intended purpose.
E. Orient boxes to accommodate wiring devices oriented as specified in Section 26 27 26 "Wiring Devices."
F. Maintain headroom and present neat mechanical appearance.

G. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.
H. Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 6 inches from ceiling access panel or from removable recessed luminaire.
I. Install boxes to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 13 "Penetration Firestopping."
J. Coordinate mounting heights and locations of outlets mounted above counters, benches, and backsplashes with Architectural Drawings and other trades.
K. Locate outlet boxes to allow luminaires positioned as shown on reflected ceiling plan.
L. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.
M. Use flush mounting outlet box in finished areas.
N. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.
O. Do not install flush mounting box back-to-back in walls; provide minimum 6-inch separation. Provide minimum 24-inch separation in acoustic rated walls.
P. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.
Q. Use stamped steel bridges to fasten flush mounting outlet box between studs.
R. Install flush mounting box without damaging wall insulation or reducing its effectiveness.
S. Use adjustable steel channel fasteners for hung ceiling outlet box.
T. Do not fasten boxes to ceiling support wires.
U. Support boxes independently of conduit.
V. Use gang box where more than one device is mounted together. Do not use sectional box.
W. Use gang box with plaster ring for single device outlets.
X. Use cast outlet box in exterior locations exposed to the weather and wet locations and at all locations serving kitchen equipment.
Y. Large Pull Boxes: Use hinged enclosure in interior dry locations, surface-mounted cast metal box in other locations.
Z. Coordinate with other trades for box rough-in, such that control devices are grouped (i.e., thermostats, wall switches, volume controls, etc.).

3.3 INTERFACE WITH OTHER PRODUCTS

A. Coordinate installation of outlet box for equipment connected under Section 26 05 19 "Equipment Wiring Systems."

3.4 ADJUSTING

A. Refer to Section 01 70 00 "Execution and Closeout Requirements" for adjusting installed Work.
B. Adjust flush-mounting outlets to make front flush with finished wall material.
C. Install knockout closures in unused box openings.

3.5 CLEANING

A. Refer to Section 01 70 00 "Execution and Closeout Requirements" for cleaning installed Work.
B. Clean interior of boxes to remove dust, debris, and other material.
C. Clean exposed surfaces and restore finish.

3.6 REPAIR

A. Repair any areas or surfaces damaged during conduit installation.
B. Paint (resurface) to original condition.

END OF SECTION

SECTION 26 05 36 - CABLE TRAYS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Wire basket.
B. Related Requirements:
   1. Division 01 Specification Sections apply to Work of this Section.
   2. Section 26 05 26 "Grounding and Bonding."
   3. Section 26 05 29 "Supporting Devices."
   4. Section 26 05 33.16 "Boxes."

1.2 REFERENCES

A. UL.
B. AISI.
C. ASTM.

1.3 SUBMITTALS

A. Submit under provisions of Section 01 33 00 "Submittal Procedures."
B. Product Data: Provide a complete description of product size, configuration, material, finish, and assembly operations.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and protect on-site.
B. Accept wire management products on-site and inspect for damage.

1.5 PROJECT CONDITIONS

A. Verify field measurements to determine actual length, fittings, and offsets.
B. Indicated routing is approximate.

PART 2 - PRODUCTS

2.1 WIRE BASKET

A. Flexible, site configurable wire mesh basket with a minimum 5 mm wire gauge.
B. Provide a continuous ground by utilizing approved splices and bonding jumpers.
C. Wire mesh shall be welded at all intersections.
D. The wire basket shall have a continuous safety edge wire welded to the top of the tray.
E. The wire basket shall be constructed from high mechanical strength steel wire. Covers and inserts shall be made from pre-galvanized steel.

F. Material shall be carbon steel wire in compliance with ASTM A510, Grade 1008. Surface treatment shall be applied after manufacturer.
G. Finish shall be electroplated zinc galvanizing. The electrodeposited zinc coating shall be applied to an average thickness of 0.7 mils to 0.8 mils. This application shall be suitable for indoor applications.
H. Manufacturer: Product as manufactured by Cablofil/Legrand, or approved equal.
I. Product Dimensions: 16 inches wide, 4 inches deep, length as indicated on Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that the building is ready to accept application.
B. Verify mechanical work that is likely to damage the wire basket has been completed.
C. Verify wire basket system has been supported along its entire length.

3.2 PREPARATION

A. Verify that bend radii of turns are in compliance with all information provided on the Drawings.
B. Verify there are no sharp edges to damage cable.

3.3 INSTALLATION

A. Install wire baskets in accordance with manufacturer's requirements.
B. Supports shall be as recommended by the manufacturer to provide for the maximum loading. Manufacturer's span loading criteria shall represent the maximum spacing between supports.
C. Utilize approved hangers attached to the building structure.
D. Utilize grounding/bonding connectors for attaching sections at basket to provide a continuous grounding path.
E. At locations where wire basket sections penetrate rated walls, provide UL classified fiberglass pillows with mineral fill. Provide insertion plates and retaining screen as recommended by fire stop manufacturer. Fire stop bags shall be as manufactured by IPC, Model KBS Sealbags.
F. Contractor shall carefully review the Architectural Drawings and field conditions to verify changes in elevation and locations with high ceilings that may require conduit extensions.

END OF SECTION

SECTION 26 05 53 - ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Nameplates and labels.
   2. Wire, conduit, and box markers.
B. Related Requirements:
   1. Division 01 Specification Sections apply to Work of this Section.

1.2 REFERENCES

A. ANSI/NFPA 70 - National Electrical Code.

PART 2 - PRODUCTS

2.1 NAMEPLATES AND LABELS

A. Nameplates and Labels: Engraved three-layer laminated plastic, white letters on black background.
B. Locations:
   1. Each electrical distribution and control equipment enclosure.
   2. Communication cabinets and computer cabinets.
   3. Field disconnects, start stop stations, control panels.
C. Letter Size:
   1. Use 1/4-inch letters for identifying individual equipment and loads.
   2. Use 1/4-inch letters for identifying grouped equipment and loads.
   3. Use 3/8-inch letters for identifying main disconnect equipment.
   4. Use 1/4-inch letters for identifying receptacle and light switches.

2.2 WIRE, CONDUIT, AND BOX MARKERS

A. Description: Brady B-321 Heat-Shrink Polyolefin markers. Typed label to identify each termination end point of the conductor. DC conductors shall identify polarity.
B. Locations: Each conductor at wireway, pull boxes, outlet and junction boxes, and each load connection. All conduit penetrations identifying the location of each end.
C. Legend:
   1. Power and Lighting Circuits: Branch circuit or feeder number indicated on Drawings.

D. Boxes:
   1. Label each junction box in accessible locations to indicate the type of system (i.e.; security; power circuit - 1, 3, 5; etc.).
   2. Boxes serving fire alarm system shall have box covers painted red.
   3. Provide label in each light switch and receptacle back box.

E. Panelboards and Switchboards:
   1. Provide phenolic label with maximum available fault current at main switchboard. Utilize number as indicated in panel schedule.
   2. Provide warning labels with arc-flash hazard warning for all electrical equipment as indicated in Article 110.16 of NEC.

PART 3 - EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive nameplates and labels.

3.2 APPLICATION

A. Install nameplate and label parallel to equipment lines.
B. Secure nameplate to equipment front using screws or rivets.
C. Identify underground conduits using underground warning tape. Install one tape per trench at 12 inches below finished grade. Identify all conduit at exposed locations into all boxes, cabinets, etc. (see Specification Section 26 05 00 "Basic Electrical Methods").
D. Identify all conductors at every termination indicating endpoints of termination and tag identification as required.
E. Color Coding for Phase Identification:

120/208 Volts	Phase	277/480 Volts
Black	A	Brown
Red	B	Orange
Blue	C	Yellow
White	Neutral	Gray
Green	Ground	Green

F. Conductor phase and voltage identification shall be made by color-coded insulation for all conductors smaller than No. 6 AWG. For conductors No. 6 AWG and larger, identification shall be made by color-coded insulation, or conductors with black insulation may be furnished and identified by colored electrical tape. Conductor identification shall be provided within each enclosure where a tap, splice, or termination is made.

END OF SECTION

SECTION 26 09 24 - LIGHTING CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Network lighting control system and components:
      a. Touch panel controls.
      b. Lighting management panels.
      c. Lighting management modules.
      d. Low voltage wall stations.
      e. Power interfaces.
      f. Wired sensors.

B. Related Requirements:
   1. Division 01 Specification Sections apply to Work of this Section.
   2. Section 26 27 26 "Wiring Devices"
   3. Section 26 05 53 "Electrical Identification"
   4. Section 26 51 00 "Interior Lighting"

1.2 REFERENCES

A. Underwriters Laboratories (UL):
   1. UL 508 - Industrial Control Equipment American National Standards Institute (ANSI)
   2. UL 924 - Emergency Lighting and Power Equipment

B. National Fire Protection Association (NFPA):
   1. NFPA 70 - National Electric Code

C. IEC 61000-4-2 Electromagnetic Compatibility (EMC) - Part 4-2: Testing and Measurement Techniques-Electrostatic Discharge Immunity Test; 2008

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate placement of daylight and occupancy sensors to achieve optimum performance. Proper sensor placement should be coordinated with others in order to avoid obstructions that would interfere with maintaining prescribed light levels.
   2. Coordinate the Work to provide luminaires and lamps that are compatible with the lighting controls to be installed.
   3. Notify Architect of any conflicts or deviations from the Contract Documents to obtain direction prior to proceeding with Work.

1.4 SUBMITTALS

A. Submit under provisions of Section 01 33 00 "Submittal Requirements."
B. Specification Conformance Document. Clearly define where the equipment submitted for review:
    1. Meets Specification exactly as specified.
    2. Meets Specification as an Alternate with clear definition of compliance.
C. Shop Drawings Include:
    1. CAD renderings of the device with precise dimensions.
    2. System schematic/typical riser diagrams.
D. Product Data Sheets: Include ratings, configurations, standard wiring diagrams, dimensions, colors, service condition requirements, and installed features.
    1. Occupancy/Vacancy Sensors: Include detailed basic motion detection coverage range diagrams.
    2. Wall Dimmers: Include derating information for ganged multiple devices.
E. Manufacturer's Installation Instructions: Include application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
F. Project Record Documents: Record actual installed locations and settings for lighting control system components.
G. Operations and Maintenance Data: Include detailed information on lighting control system operation, equipment programming and setup, replacement parts, and recommended maintenance procedures and intervals.

1.5 PROJECT CLOSEOUT DOCUMENTATION

A. Section 01 70 00 "Execution and Closeout Requirements": Submittals for Project closeout.
B. Provide a factory published manual:
    1. Warranty.
    2. Technical support contact.
    3. Submit manufacturer's operation and maintenance instructions for each product.

1.6 QUALITY ASSURANCE

A. Manufacturer: Minimum 10 years of experience designing and assembling architectural lighting controls.
B. All devices are 100 percent factory function tested prior to delivery.
C. Compliant with the requirements of NFPA 70.
D. All power components UL listed for required loads.
E. Maintain at the Project Site a copy of each referenced document that prescribes execution requirements.

1.7 PROJECT CONDITIONS

A. Only install equipment after the following site conditions are maintained:
   1. Ambient Temperature 14 to 105 degrees F.
   2. Relative Humidity less than 90 percent non-condensing.
B. Standard electrical enclosures are permanently installed.
C. Equipment is protected from dust, debris, and moisture.

1.8 WARRANTY

A. Refer to Section 01 70 00 "Execution and Closeout Requirements" for additional warranty requirements.
B. Five year 100 percent parts replacement.

1.9 MAINTENANCE AND SUSTAINABILITY

A. Provide new parts, upgrades, and/or replacements available for a minimum of 5 years available to the end user.
B. Provide free telephone technical support.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable:
   1. Acuity Brands.
   2. Lutron.
   3. Watt Stopper.
   4. Cooper/Eaton.
   5. Hubbell.
B. Basis of Design Controls Manufacturer: Acuity Brands
   1. Sensorswitch.
C. Substitutions:
   1. Refer to Section 26 05 00 "Basic Electrical Methods" for requirements.

2.2 GENERAL

A. Provide system hardware that is designed, tested, manufactured, and warranted by a single manufacturer.
B. Operational Life: At least 10 years expected life while operating within the specified ambient temperature and humidity range.
C. Power Failure Memory: Automatically store system settings and recover from a power failure without requiring user input.
D. Wireless Devices:
   1. Automatically sync for system operation without addressing.
   2. Send and receive messages for real-time operation and feedback.
   3. Use industry standard RF protocols.
   4. Be in compliance with FCC and IEE standards.

2.3 OCCUPANCY DETECTION TECHNOLOGY REQUIREMENTS

A. The occupancy sensor system shall sense the presence of human activity within the desired space and fully control the on/off function of the lights.
B. Sensors shall utilize passive infrared (PIR) technology, which detects occupant motion, to initially turn lights on from an off state; thus preventing false on conditions. Ultrasonic or Microwave based sensing technologies shall not be accepted.
C. Sensors shall be suitable for space and application.
D. For applications where a second method of sensing is necessary to adequately detect maintained occupancy (such as in rooms with obstructions), a sensor with an additional "dual" technology shall be used.
E. Dual technology sensors shall have one of its 2 technologies not require motion to detect occupancy. Acceptable dual technology includes PIR/Mircrophonics (also known as Passive Dual Technology or PDT) which both looks for occupant motion and listens for sounds indicating occupants. Sensors where both technologies detect movement (PIR/Ultrasonic) shall not be acceptable.
F. All sensing technologies shall be acoustically passive, meaning they do not transmit sound waves of any frequency (for example in the Ultrasonic range), as these technologies have the potential for interference with other electronic devices within the space (such as electronic white board readers). Acceptable detection technologies include Passive Infrared (PIR), and/or Microphonics technology. Ultrasonic or Microwave based sensing technologies shall not be accepted.

2.4 OCCUPANCY SENSOR OPERATION REQUIREMENTS

A. Sensors shall offer a minimum on timer of at least 15 minutes, in order to prevent all cycling of lamps before they have burned for the lamp manufacturer's minimum recommended time period. This timer shall be in addition to the regular occupancy time delay that keeps lights on after last detected occupancy. User shall be able to disable/enable and change the value of this timer.
B. Sensors shall utilize an occupancy time delay that keeps lights on after last detected occupancy. Factory default setting of the occupancy time delay shall be 10 minutes. Sensors with a longer factory default setting shall not be permitted as they greatly restrict energy savings potential.
C. Manual adjustment to the occupancy time delay so as to increase it shall be accommodated, but shall not be allowed unless a calculation showing the resulting energy savings loss is presented to the building owner and specifying engineer.
D. Automatic adjustments to the occupancy time delay shall only be permitted if the controlling algorithm maximizes both lamp life and energy savings. For example, a shorter, more energy saving time delay setting shall only be allowed if the resulting lamp life is also improved.
E. Installer, in accordance with manufacturer's recommendation, shall determine final sensor location. All sensors shall be factory calibrated for optimum performance for its installed PIR lens, and shall not require initial or subsequent field adjustment of detection sensitivity.
F. All sensor setting adjustments shall be digital and made using a push-button. Dip switches, analog dials, and/or the need for tools of any kind shall not be accepted.
G. The installing contractor shall be responsible for a complete and functional system in accordance with all applicable local and national codes.

2.5 WALL SWITCH OCCUPANCY SENSORS - SMALL AREAS

A. Sensor shall provide wall-to-wall PIR detection such that small hand motions are detected out to 20 feet.
B. In areas with periodic or permanent obstruction to a sensor's field of view, sensors that utilize dual technology (PIR/Microphonics) detection shall be used (as specified in above Section 1.1, Occupancy Sensor Technology Requirements).
C. For applications requiring independent control of 2 loads, a sensor with 2 dual relays and dual override switches shall be required. Each relay shall have independent programmable occupancy time delays.
D. Sensors shall be capable of switching both 120 VAC and 277 VAC and run off of 50/60 Hz power. Load ratings shall be 800 W at 120 VAC, 1,200 W at 277 VAC, and 1/4 HP motor load.
E. Sensor shall recess into single gang switch box and fit a standard GFI opening.
F. Sensor shall meet NEC grounding requirements by providing a dedicated ground connection and intrinsically grounding through its mounting strap.
G. Line and load wire connections shall be interchangeable, such that installer cannot make an improper connection to a line/load in a manner that will cause malfunction or damage to the sensor.
H. Sensor shall not require a neutral connection regardless of number of poles and/or detection technology (only exception is versions with lighted push-buttons).
I. Sensor shall not allow any leakage of current to pass to the load when sensor is in the unoccupied (off) condition. Sensor shall not require a minimum load to be connected in order to function.
J. Sensor shall have optional features for photocell/daylight override, vandal resistant lens, low temperature/high humidity operation.
K. All sensor settings, including time delay and photocell settings, shall be digital and accessible for adjustment via a push-button without requiring removal of cover plate or tools of any kind.
L. Wall Switch sensors shall have field programmable adjustments for selecting operational modes, occupancy time delays, minimum on time, and photocell set point as applicable.
M. All models shall be capable of both Auto-On and Manual On operation.
N. All models shall be capable of a "Reduced Turn On" operation where the initial PIR turn on level is higher in order to eliminate PIR from reflective surfaces from being detected. PIR shall be returned to normal levels upon initial PIR detection.
O. All models shall have a "Predictive Off" mode where user can manually turn the lights off when leaving the room and still have them come on automatically when they return to space.
P. All models shall be capable of disabling override switch.

2.6 WALL SWITCH OCCUPANCY SENSORS - LARGE AREAS

A. Sensor shall provide wall-to-wall PIR detection such that small hand motions are detected out to 40 feet.
B. In areas with periodic or permanent obstruction to a sensor's field of view, sensors that utilize dual technology (PIR/Microphonics) detection shall be used (as specified in above Section 1.1, Occupancy Sensor Technology Requirements).

C. For applications requiring independent control of 2 loads, a sensor with 2 dual relays and dual override switches shall be required. Each relay shall have independent programmable occupancy time delays.
D. Sensors shall be capable of switching both 120 VAC and 277 VAC and run off of 50/60 Hz.
E. Load ratings shall be 13A each pole, 1/4 HP motor load.
F. Sensor shall meet NEC grounding requirements by providing a dedicated ground connection and intrinsically grounding through its mounting strap.
G. Line and load wire connections shall be interchangeable, such that installer cannot make an improper connection to a line/load in a manner that will cause malfunction or damage to the sensor.
H. Sensor shall not require a neutral connection regardless of number of poles and/or detection technology.
I. Sensor shall not allow any leakage of current to pass to the load when sensor is in the unoccupied (Off) condition. Sensor shall not require a minimum load to be connected in order to function.

2.7 LOW VOLTAGE OCCUPANCY SENSORS

A. The installing contractor shall install one or more sensors with PIR coverage areas that cover the entire space and all entrance points. Exact placement and quantity required shall be per manufacturer's best practice recommendations.
B. In areas with periodic or permanent obstruction to a sensor's field of view, sensors that utilize dual technology (PIR/Microphonics) detection shall be used (as specified in above Section 1.1, Occupancy Sensor Technology Requirements).
C. Sensors shall utilize a digital PIR detector (dual element pyro-electric detector) component, so as to provide a high degree of RF immunity.
D. Sensors shall interconnect with other sensors and power/relay packs with class 2, three-conductor wire.
E. Sensors shall operate on 12 to 24 VAC or VDC and consume no more than 5 mA so that up to 14 sensors may be connected to a single power pack.
F. Upon initial power up, sensors must immediately turn on. Power packs may be wired on the line or load side of local switching and must not exhibit any delays when switch is energized.
G. Each designated zone shall contain one sensor with a SPDT class 2 auxiliary relay, providing an input to building automation system (BAS). All sensors in designated zone shall communicate to sensor with relay for status to BAS. Sensor relay coil shall energize in the unoccupied state to load share the low voltage current from power pack. Note that power pack must be installed on the Line side of the local toggle switch for auxiliary relay to work properly.
H. Sensors shall have test mode that temporarily shortens/disable all time delays (e.g., minimum on, occupancy, photocell transition, dimming rates) such that an installer can quickly test operation of sensor. Test mode shall time out and return sensor to normal operation should the installer forget to disable test mode after installation.
I. Sensors shall have optional features for on/off photocell control, automatic dimming control photocell, high/low occupancy-based dimming, and usage in low temperature/high humidity environments.

2.8 POWER PACKS

A. Power packs shall accept and switch 120 or 277 VAC, be plenum rated, and provide class 2 power for up to 14 remote sensors.
B. Power pack shall securely mount to junction location through a threaded 1/2-inch chase nipple. Plastic clips into junction box shall not be accepted. All class 1 wiring shall pass through chase nipple into adjacent junction box without any exposure of wire leads. Note: UL Listing under Energy Management or Industrial Control Equipment automatically meets this requirement, whereas Appliance Control Listing does not meet this safety requirement.
C. When required by local code, power pack must install inside standard electrical enclosure and provide UL recognized support to junction box. All class 1 wiring is to pass through chase nipple into adjacent junction box without any exposure of wire leads.
D. Power pack shall incorporate a Class 1 relay and an AC electronic switching device. The AC electronic switching device shall make and break the load, while the relay shall carry the current in the on condition. This system shall provide full 20 Amp switching of all load types and be rated for 400,000 cycles.
E. Power packs shall be single circuit, or 2 circuits. Slave packs may be used to control additional circuits. When 2 circuit power packs, or slave packs are used, the power packs must be wired directly to circuit breaker. Otherwise, power packs may be wired on the line or load side of the local switch.

2.9 LINE VOLTAGE OCCUPANCY SENSORS

A. Sensors shall be self-contained and accept Class 1 wiring directly without the use of a power pack.
B. The installing contractor shall install one or more sensors with PIR coverage areas that cover the entire space and all entrance points. Exact placement and quantity required shall be per manufacturer's best practice recommendations.
C. In areas with periodic or permanent obstruction to a sensor's field of view, sensors that utilize dual technology (PIR/Microphonics) detection shall be used (as specified in above Section 1.1, Occupancy Sensor Technology Requirements).
D. Sensors shall utilize a digital PIR detector (dual element pyro-electric detector) component, so as to provide a high degree of RF immunity.
E. Line and load wire connections shall be interchangeable, such that installer cannot make an improper connection to a line/load in a manner that will cause malfunction or damage to the sensor.
F. Multiple sensors controlling the same load shall be wired in parallel.
G. For applications requiring independent control of 2 loads, a sensor with 2 dual relays shall be required. Each relay shall have independent programmable occupancy time delays.
H. Dual relay sensors shall have an optional operational mode called "Alternating On" where when during unoccupied periods, one relay is always left closed (thus one load is always on). The particular relay that is left closed alternates each cycle so that the aging of the connected lamps is even.
I. Sensors shall be capable of switching both 120 VAC and 277 VAC and run off of 50/60 Hz power. Load ratings shall be 800 W at 120 VAC, 1200 W at 277 VAC, and 1/4 HP motor load.

J. Specific sensors capable of switching 5 Amps of 2-phase power (208/240 or 480 VAC) shall be available. These sensors shall always simultaneously switch both phases as per NEC guidelines.
K. Wall mounted sensors must be installed at 7 to 8 feet above the floor. Single and 2 circuit units shall be available.
L. Sensors shall have test mode that temporarily shortens/disables all time delays (e.g., minimum on, occupancy, photocell transition, dimming rates) such that an installer can quickly test operation of sensor. Test mode shall time out and return sensor to normal operation should the installer forget to disable test mode after installation.
M. Sensors shall have optional features for on/off photocell control, automatic dimming control photocell, high/low occupancy-based dimming, and usage in low temperature/high humidity environments.

2.10 INDOOR PHOTOCELLS AND DAYLIGHT HARVESTING CONTROLS

A. Low voltage photocell shall accept 12 to 24 VAC or VDC and provide a SPDT relay for interface with remote switching system. Sensor shall interface with occupancy sensors, directly with power pack, or other system as shown.
B. Photocell shall provide for an on/off set-point, and a deadband to prevent the artificial light from cycling. Delay shall be incorporated into the photocell to prevent rapid response to passing clouds.
C. Photocell set-point and deadband shall be automatically calibrated through the sensor's microprocessor by initiating an "Automatic Set-point Programming" procedure. Further adjustment may be made manually if needed.
D. Deadband setting shall be verified and modified by the sensor automatically every time the lights cycle to accommodate physical changes in the space (i.e., furniture layouts, lamp depreciation, or lamp outages).
E. Low voltage dimming sensors shall accept 12 to 24 VAC or VDC (from power pack or other low voltage source) and control 0 to 10 VDC dimmable ballasts by sinking up to 20 mA of class 2 current (typically 40 or more ballasts).
F. Low voltage dimming sensor's set point shall be automatically calibrated through the sensor's microprocessor by initiating the "Automatic Set-point Programming" procedure. Min and max dim settings as well as set-point may be manually entered.
G. Low voltage dimming sensors shall be equipped with an automatic override for 100 hour burn-in of lamps. This feature must be available at any time for lamp replacements. (Note: This function should be performed prior to any dimming of the lamps including the "auto set-point" setting).
H. Combination photocell/dimming sensors shall accept 12 to 24 VAC or VDC (from power pack or other low voltage source) and control the on/off function as well as the dimming function of 0 to 10 VDC dimmable ballasts.
I. Combination photocell/dimming sensor's set-point and deadband shall be automatically calibrated through the sensor's microprocessor by initiating the "Automatic Set-Point Programming" procedure. Min and max dim settings as well as set point may be manually entered.
J. Combination photocell/dimming sensors shall be equipped with an automatic override for 100 hour burn-in of lamps. This feature must be available at any time for lamp replacements. (Note: This function should be performed prior to any dimming of the lamps including the "auto set-point" setting.)

K. Dual zone option shall be available for photocell, dimming, or combination units. The second zone shall be controlled as an "offset" from the primary zone and shall be the zone farthest from the natural light source.
L. Standalone ambient light sensors (CM ALC version only) shall interface directly with the 0 to 10 VDC, without any other power source connection, and control dimmable ballasts by sinking up to 20 milliamps of class 2 current. Sensor shall incorporate a photodiode viewing out of a ceiling enclosure at a 30-degree angle from horizontal to detect diffused light from the ambient and artificial sources. Sensor shall allow for removal of response delays for adjustment, however provide dampening delay for normal operation. Settings shall be made manually.
M. Line voltage versions of the above-described photocell and combination photocell/dimming sensors shall be capable of switching both 120 VAC and 277 VAC and run off of 50/60 Hz power. Load ratings shall be 800 W at 120 VAC, 1200 W at 277 VAC, and 1/4 HP motor load.
N. Line voltage versions of the above-described dimming sensors shall be capable of powering off 120/277 VAC.
O. Line voltage versions of the above-described photocell and combination photocell/dimming sensors shall be capable of switching 5 Amps of two-phase power (208/240 or 480 VAC) shall be available. These sensors shall always simultaneously switch both phases as per NEC guidelines.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as shown on Drawings.
B. Verify that ratings and configurations of system components are consistent with indicated requirements.
C. Verify that mounting surfaces are ready to receive system components.
D. Verify that conditions are satisfactory for installation prior to starting Work.

3.2 INSTALLATION

A. Follow manufacturer's instructions for all installation steps.
B. Provide a complete installation per Contract Documents.
C. Ensure sensor locations provide complete coverage of associated areas and are placed to avoid conflicts with equipment and appurtenances of other trades.
D. Ensure daylight sensor placement minimizes sensor view of electric light sources. Locate ceiling-mounted and luminaire-mounted daylight sensors to avoid direct view of luminaires.
E. Identify system components in accordance with Section 26 05 53 "Electrical Identification."

3.3 FIELD QUALITY CONTROL

A. Refer to Section 01 40 00 "Quality Requirements," for additional requirements.
B. Manufacturer's Full-Scope Start-Up Service is required.
C. Correct defective work, adjust for proper operation, and retest until entire system complies with Contract Documents.
D. Provide a complete installation per Contract Documents.

3.4 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.5 CLOSEOUT ACTIVITIES

A. Refer to Section 01 70 00 "Execution and Closeout Requirements" for closeout submittals.
B. Demonstration:
    1. Demonstrate proper operation of lighting control devices to Owner and correct deficiencies or make adjustments as directed.
    2. On-Site Performance-Verification Walkthrough: Provide on-site demonstration of system functionality to commissioning agent.
C. Training:
    1. Include services of manufacturer's certified service representative to perform on-site training of Owner's personnel on operation, adjustment, and maintenance of lighting control system as part of on-site start-up services.

3.6 STARTUP AND PROGRAMMING

A. Provide telephone support via toll free line.
B. Factory trained service.

3.7 MAINTENANCE

A. Refer to Section 01 70 00 "Execution and Closeout Requirements," for additional related maintenance service.
B. Factory trained service technicians available within the continental US.
C. Offer integrated help on-screen and via online videos.
D. Factory telephone support via toll free line.

3.8 PROTECTION

A. Protect installed products from subsequent construction operations.

END OF SECTION

SECTION 26 18 39 - ENCLOSED MOTOR CONTROLLERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Manual controllers.
   2. Automatic controllers.
   3. Disconnects.

B. Related Requirements:
   1. Division 01 Specification Sections apply to Work of this Section.

1.2 REFERENCES

A. NFPA 70 - National Electrical Code.
B. UL 1 98C - High-Interrupting Capacity Fuses; Current Limiting Type.
C. UL 1 98E - Class R Fuses.
D. NECA "Standard of Installation," published by National Electrical Contractors Association.
E. NEMA ICS 2 - Industrial Control Devices, Controllers, and Assemblies.
F. NEMA ICS 6 - Enclosures for Industrial Controls and Systems.
G. NEMA KS 1 - Enclosed Switches.

1.3 SUBMITTALS

A. Submit under provisions of Section 01 33 00 "Submittal Procedures."
B. Product Data: Provide catalog sheets showing voltage, controller size, ratings and size of switching and overcurrent protective devices, short circuit ratings, dimensions, and enclosure details.
C. Test Reports: Indicate field test and inspection procedures and test results.
D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with NECA Standard of Installation.
B. Maintain one copy of each document on-site.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum 3 years' documented experience.

1.6 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.
B. Furnish products listed and classified by UL as suitable for purpose specified and indicated.

PART 2 - PRODUCTS

2.1 MANUAL CONTROLLERS

A. Manual Motor Controller: NEMA ICS 2, AC general-purpose Class A manually operated, full-voltage controller with overload element, NO auxiliary contact, and toggle operator.
B. Fractional Horsepower Manual Controller: NEMA ICS 2, AC general-purpose Class A manually operated, full-voltage controller for fractional horsepower induction motors, with thermal Overload unit, and toggle operator.
C. Enclosure: NEMA ICS 6; Type 1.

2.2 AUTOMATIC CONTROLLERS

A. Magnetic Motor Controllers: NEMA ICS 2, AC general-purpose Class A magnetic controller for induction motors rated in horsepower.
B. Coil Operating Voltage: 120 volts, 60 Hertz.
C. Overload Relay: NEMA ICS; electronic type; with phase loss and unbalance protection.
D. Enclosure: NEMA ICS 6, Type 1.

2.3 PRODUCT OPTIONS AND FEATURES

A. Auxiliary Contacts: NEMA ICS 2, 2 each field convertible contacts in addition to seal-in contact.
B. Cover Mounted Pilot Devices: NEMA ICS 2, heavy duty type.
C. Pushbuttons: Recessed type.
D. Indicating Lights: LED type.
E. Selector Switches: Rotary type.
F. Relays: NEMA ICS 2.
G. Control Power Transformers: 120 volt secondary. Provide fused primary and secondary, and bond unfused leg of secondary to enclosure.

2.4 DISCONNECTS

A. Combination Controllers: Combine motor controllers with fusible switch disconnect in common enclosure.
B. Fusible Switch Assemblies: NEMA KS 1, enclosed knife switch with externally operable handle. Fuse clips: Designed to accommodate Class R fuses.

2.5 FUSES

A. Description: Dual element, current limiting, time delay, one-time fuse, 250V volt, UL 198E, Class RK 5.
B. Interrupting Rating: 200,000 rms amperes.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install enclosed controllers where indicated, in accordance with manufacturer's instructions. Provide a motor controller for all equipment not furnished as integral with equipment. Coordinate actual motor loads with overload protection.
B. Install enclosed controllers plumb. Provide supports in accordance with Section 26 05 29 "Supporting Devices."
C. Height: 5 feet to operating handle.
D. Install fuses in fusible switches.
E. Select and install overload heater elements in motor controllers to match installed motor characteristics.
F. Provide engraved plastic nameplates under the provisions of Section 26 05 53 "Electrical Identification."
G. Provide neatly typed label inside each motor controller door identifying motor served, nameplate horsepower, full load amperes, code letter, service factor, and voltage/phase rating.

3.2 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under provisions of other Sections.
B. Inspect and test each enclosed controller to NEMA ICS 2.

END OF SECTION

SECTION 26 24 16 - PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Distribution and branch circuit panelboards.
B. Related Requirements:
   1. Division 01 Specification Sections apply to Work of this Section.
   2. Section 26 05 29 "Supporting Devices."
   3. Section 26 05 53 "Electrical Identification" for engraved nameplates.

1.2 REFERENCES

A. NECA (National Electrical Contractors Association) "Standard of Installation."
B. NEMA AB 1 - Molded Case Circuit Breakers.
C. NEMA ICS 2 - Industrial Control Devices, Controllers, and Assemblies.
D. NEMA KS 1 - Enclosed Switches.
E. NEMA PB 1 - Panelboards.
F. NEMA PB 1.1 - Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.
G. NFPA 70 - National Electrical Code.

1.3 SUBMITTALS

A. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, integrated short circuit ampere rating, circuit breaker, fusible switch arrangement, and sizes.
B. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.
C. Panelboard manufacturer shall provide short circuit and arc fault calculations per NEC requirements. Equipment shall be rated per calculations. Refer to Section 26 05 73.10 "Electrical Power System Studies" for additional information.

1.4 PROJECT RECORD DOCUMENTS

A. Submit under provisions of General Conditions. Record actual locations of products; indicate actual branch circuit arrangement.

1.5 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of General Conditions. Maintenance Data: Include spare parts data listing; and recommended maintenance procedures and intervals.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with NECA Standard of Installation.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum 5 years' experience.

1.8 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70. Furnish products listed and classified by UL as suitable for purpose specified and indicated.

1.9 FIELD MEASUREMENTS

A. Verify that field measurements are as indicated.

1.10 MAINTENANCE MATERIALS

A. Provide maintenance materials under provisions of General Conditions. Provide 2 of each panelboard key if required.

PART 2 - PRODUCTS

2.1 PANELBOARDS

A. Manufacturers:
   1. Eaton.
   2. G.E.
   3. Siemens.
   4. Square-D.
B. Description: NEMA PB-1, circuit breaker type.
C. Panelboard Bus: Copper with ratings as indicated. Provide a copper ground bus in each panelboard.
D. Minimum integrated short circuit rating: Fully rated devices with minimum levels as indicated. Series rated systems will not be allowed. Minimum calculated values are labeled on each panelboard and are indicated as "AIC."
E. Molded Case Circuit Breakers: NEMA AB 1, bolt-on, circuit breakers with integral thermal and instantaneous magnetic trip in each pole. Provide circuit breakers UL listed as type HACR for air-conditioning equipment loads and type SWD for switching applications.
F. Enclosure: NEMA PB-1, Type 1.
G. Cabinet Front: Surface or recessed type as indicated on the Drawings, fastened with concealed trim clamps, hinged door with flush lock, metal directory frame, and finished in manufacturer's standard gray enamel.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install panelboards in accordance with NEMA PB 1.1. Install panelboards plumb. Provide supports in accordance with drawings and Section 26 05 29 "Supporting Devices." Height: 6 feet maximum to top of panelboard. Provide filler plates for unused spaces in panelboards. Provide typed circuit directory for each branch circuit panelboard. Revise directory to reflect circuiting changes required to balance phase loads. Spare slots shall be labeled as such in erasable pencil on directory. Provide engraved plastic nameplates under the provisions of Section 26 05 53 "Electrical Identification."

B. Provide 2 empty 1 inch conduits from each recessed panelboard to an accessible location above and label as "spare."

C. Ground each panelboard in accordance with Section 26 05 26 "Grounding and Bonding."

3.2 FIELD QUALITY CONTROL

A. Field inspection and test for grounds on each circuit after installation is completed. Measure steady state load currents at each panelboard feeder; rearrange circuits in the panelboard to balance the phase loads to within 20 percent of each other. Maintain proper phasing for multi-wire branch circuits.

B. Visual and Mechanical Inspection: Inspect for physical damage, proper alignment, anchorage, and grounding. Check proper installation and tightness of connections for circuit breakers, fusible switches, and fuses.

END OF SECTION

SECTION 26 27 26 - WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Wall switches.
   2. Receptacles.
   3. Wall plates.
B. Related Requirements:
   1. Division 01 Specification Sections apply to Work of this Section.
   2. Section 26 05 33.16 "Boxes."

1.2 REFERENCES

A. NECA - Standard of Installation.
B. NEMA WD 1 - General Requirements for Wiring Devices.
C. NEMA WD 6 - Wiring Device - Dimensional Requirements.
D. NFPA 70 - National Electrical Code.

1.3 SUBMITTALS FOR REVIEW

A. Refer to Section 01 33 00 "Submittal Procedures."
B. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.
C. Manufacturers with similar catalog numbers will not be considered as a basis for an equivalent product.

1.4 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum 3 years' documented experience.

1.5 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.
B. Provide products listed and classified by UL as suitable for the purpose specified and indicated.

PART 2 - PRODUCTS

2.1 WALL SWITCHES

A. Manufacturers:
   1. Hubbell PRO 1221-W.
   2. Substitutions: Refer to Section 01 60 00 "Product Requirements."

B. Description: NEMA WD 1, 20 amp, Heavy-Duty, AC only general-use snap switch.
C. Body and Handle: Nylon white handle.
D. Utilize equivalent series of manufacturer's numbers above for three-way, four-way, and two-pole applications.

2.2 RECEPTACLES

A. Manufacturers:
1. Hubbell PRO 5352TR-W.
2. Substitutions: Refer to Section 01 60 00 "Product Requirements." Or equivalent.
B. Description: NEMA WD 1, Heavy-duty, general-use receptacle, with triple wipe contacts and grounding contacts integral with backstrap (no rivets).
C. Device Body: White plastic.
D. Configuration: NEMA WD 6, type as specified and indicated.
E. Convenience Receptacle: Type 5-20.
F. GFCI Receptacle: Convenience receptacle with integral ground fault circuit interrupter to meet regulatory requirements. Hubbell GF5352TR-W or equivalent.
G. Tamper-Resistant: Receptacles shall be tamper-resistant types.
H. All 15A and 20A, 125V and 250V non-locking-type receptacles installed in "Wet" locations shall be listed and so identified as weather-resistant type.

2.3 WALL PLATES

A. Decorative Cover Plate: Stainless steel.
B. Weatherproof Cover Plate: Gasketed cast metal with gasketed device cover on exterior devices. Provide "while in-use" cover on all 15A and 20A, 125V and 250V receptacles installed in "Wet" locations.
C. Surface Mounted Plates: Galvanized steel plates.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Refer to Section 01 30 00 "Administrative Requirements" for verification of existing conditions prior to beginning Work.
B. Verify that outlet boxes are installed at proper height.
C. Verify that wall openings are neatly cut and will be completely covered by wall plates.
D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.
E. Verify installation location of all boxes to be installed in millwork with Architect.

3.2 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.
B. Clean debris from outlet boxes.

3.3 INSTALLATION

A. Install in accordance with NECA "Standard of Installation."
B. Install devices plumb and level.
C. Install switches with OFF position down.
D. Do not share neutral conductor on load side of dimmers.
E. Install receptacles with grounding pole located on the bottom as required by Owner.
F. Connect wiring device grounding terminal to branch circuit equipment grounding conductor.
G. Install decorative plates on switch, receptacle, and blank outlets in finished areas.
H. Connect wiring devices by wrapping conductor around screw terminal.
I. Use jumbo size plates for outlets installed in masonry walls.
J. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.
K. Install blank cover plate to match other wall plates on all unused boxes.

3.4 INTERFACE WITH OTHER PRODUCTS

A. Coordinate locations of outlet boxes provided under Section 26 05 33.16 "Boxes" to obtain mounting heights specified and indicated on Drawings.
B. Install all wall switches, thermostats, and fire alarm pull stations at 48 inches above finished floor.
C. Install convenience receptacle 18 inches above finished floor.
D. Install convenience receptacle 6 inches above backsplash of counter unless otherwise directed by Architect.
E. Install telephone jack 18 inches above finished floor.
F. Install telephone for jack wall telephone to position top of telephone at 48 inches above finished floor.

3.5 FIELD QUALITY CONTROL

A. Refer to Section 01 40 00 "Quality Requirements" for field inspection, testing, adjusting, and balancing.
B. Inspect each wiring device for defects.
C. Operate each wall switch with circuit energized and verify proper operation.
D. Verify that each receptacle device is energized.
E. Test each receptacle device for proper polarity.
F. Test each GFCI receptacle device for proper operation.

3.6 ADJUSTING

A. Refer to Section 01 70 00 "Execution and Closeout Requirements" for adjusting installed work.
B. Adjust devices and wall plates to be flush and level.

3.7 CLEANING

A. Refer to Section 01 70 00 "Execution and Closeout Requirements" for cleaning installed Work.
B. Clean exposed surfaces to remove splatters and restore finish.

END OF SECTION

SECTION 26 28 16.16 - ENCLOSED SWITCHES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Fusible switches.
   2. Non-fusible switches.
   3. Fuses.
B. Related Requirements:
   1. Division 01 Specification Sections apply to Work of this Section.

1.2 REFERENCES

A. NEMA KS 1 - Enclosed Switches.
B. NFPA 70 - National Electrical Code.
C. UL 198C - High-Interrupting Capacity Fuses; Current Limiting Type.
D. UL 198E - Class R Fuses.
E. NEMA AB 1 - Molded Case Circuit Breakers.
F. NECA - Standard of Installation.

1.3 SUBMITTALS

A. Submit under provisions of Section 01 33 00 "Submittal Procedures."
B. Product Data: Provide switch ratings and enclosure dimensions.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with NECA Standard of Installation.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum 3 years' documented experience.

1.6 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.
B. Furnish products listed and classified by UL as suitable for purpose specified and shown.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Eaton.
B. General Electric.
C. Siemens.
D. Square D.

2.2 ENCLOSED SWITCHES

A. Fusible or Non-fusible as indicated.
B. Switch Assemblies: NEMA KS 1, Type HD load interrupter enclosed knife switch with externally operable handle interlocked to prevent opening front cover with switch in ON position. Handle lockable in OFF position.
C. Fuse Clips: Designed to accommodate NEMA FU1, class R fuses.
D. Enclosures: NEMA KS 1.
E. Interior Dry Locations: Type 1.
F. Exterior Locations: Type 3R or 4.
G. NEMA ratings of enclosures as specified on Drawings take precedence over location specification.
H. Current rating of switch to be equal to or greater than that of the circuit it is interrupting.

2.3 FUSES

A. Manufacturers:
   1. Bussman.
   2. Gould Shawmut.
   3. Littlefuse.
B. Dimensions and Performance: NEMA FU 1, Class as specified or indicated.
C. Voltage: Provide fuses with suitable voltage ratings for phase to phase voltages.
D. Service Entrance: Class L, Bussman Low-peak or equivalent.
E. General Purpose Loads: Class RK1, Bussman Low-peak or equivalent.
F. Motor Loads: Class RK5, Bussman Fusetron or equivalent.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with NECA Standard of Installation.
B. Install fuses in all fusible disconnects.
C. Apply adhesive tag on the inside door of all disconnects indicating the NEMA class fuse and size installed.
D. Provide a disconnect switch for all equipment where indicated or required by the National Electrical Code. Coordinate with other disciplines to determine where disconnects are furnished with equipment.

END OF SECTION

SECTION 26 51 00 - INTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Luminaires.
   2. Exit signs.
B. Related Requirements:
   1. Division 01 Specification Sections apply to Work of this Section.

1.2 REFERENCES

A. NEMA WD 6 - Wiring Devices-Dimensional Requirements.
B. NFPA 70 - National Electrical Code.
C. NFPA 101 - Life Safety Code.

1.3 SUBMITTALS

A. Refer to Section 01 33 00 "Submittal Procedures" for submittals.
B. Shop Drawings: Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.
C. Product Data: Provide dimensions, ratings, and performance data.

1.4 SUBSTITUTIONS

A. Refer to Section 26 05 00 "Basic Electrical Methods" for requirements.

1.5 CLOSEOUT SUBMITTALS

A. Refer to Section 01 70 00 "Execution and Closeout Requirements" for submittals for Project closeout.
B. Operation and Maintenance Data: Submit manufacturer's operation and maintenance instructions for each product.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum 3 years' documented experience.

1.7 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.
B. Conform to requirements of NFPA 101.
C. Products: Listed and classified by UL as suitable for the purpose specified and indicated.

PART 2 - PRODUCTS

2.1 LUMINAIRES

A. Furnish products as scheduled. Refer to Section 01 60 00 "Product Requirements" for substitutions and product options.

2.2 EXIT SIGNS

A. Furnish products as scheduled.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install suspended luminaires using pendants supported from swivel hangers. Provide pendant length required to suspend luminaire at indicated height.
B. Locate recessed ceiling luminaires as indicated on reflected ceiling plan.
C. Install surface mounted luminaires and exit signs plumb and adjust to align with building lines and with each other. Secure to prevent movement.
D. Exposed Grid Ceilings: Support surface mounted luminaires on grid ceiling directly from building structure.
E. Install recessed luminaires to permit removal from below.
F. Install recessed luminaires using accessories and firestopping materials to meet regulatory requirements for fire rating in locations where fire rated ceilings are present.
G. Install clips to secure recessed grid-supported luminaires in place.
H. Install wall mounted luminaires, emergency lighting units and exit signs at height as indicated on the Drawings or as scheduled.
I. Install accessories furnished with each luminaire.
J. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.
K. Bond products and metal accessories to branch circuit equipment grounding conductor.
L. Install specified lamps in each emergency lighting unit, exit sign, and luminaire.

3.2 FIELD QUALITY CONTROL

A. Refer to Section 01 40 00 "Quality Requirements" for field inspection, testing, and adjusting.
B. Operate each luminaire after installation and connection. Inspect for proper connection and operation.

3.3 ADJUSTING

A. Refer to Section 01 70 00 "Execution and Closeout Requirements" for adjusting installed work.
B. Aim and adjust luminaires as directed.
C. Position exit sign directional arrows as indicated.

3.4 CLEANING

A. Refer to Section 01 70 00 "Execution and Closeout Requirements" for cleaning installed Work.
B. Clean electrical parts to remove conductive and deleterious materials.
C. Remove dirt and debris from enclosures.
D. Clean photometric control surfaces as recommended by manufacturer.
E. Clean finishes and touch up damage.

3.5 DEMONSTRATION AND INSTRUCTIONS

A. Refer to Section 01 70 00 "Execution and Closeout Requirements" for demonstrating installed Work.

3.6 PROTECTION OF FINISHED WORK

A. Refer to Section 01 70 00 "Execution and Closeout Requirements" for protecting installed Work.
B. Relamp luminaires that have failed lamps at Substantial Completion.

END OF SECTION

SECTION 28 31 00 - FIRE ALARM SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Control panel.
   2. Initiating devices.
      a. Manual station.
      b. Photoelectric smoke detectors.
      c. Thermal detectors.
   3. Signaling appliances.
   4. Auxiliary devices.
   5. Voice evacuation.

B. Related Requirements:
   1. Division 01 Specification Sections apply to Work of this Section.
   2. Section 26 05 13 "Building Wire and Cable."
   3. Section 26 05 33 "Conduit."
   4. Section 26 05 33.16 "Boxes."

1.2 REFERENCES

A. NFPA 70 - National Electrical Code.
B. NFPA 72 - National Fire Alarm Code.
C. NFPA 101 - Life Safety Code.
D. State of Texas Accessibility Standards.
E. Federal Americans with Disabilities Act.
F. ASME 17.1 - Elevator Code.

1.3 SYSTEM DESCRIPTION

A. Fire Alarm System: System is comprised of a new intelligent manual and automatic local fire alarm system with connections for off-site reporting and voice evacuation.

1.4 SUBMITTALS FOR REVIEW

A. Product Data: Provide electrical characteristics and connection requirements.
B. Shop Drawings: Provide a system layout and wiring diagram showing each device and the wiring connections that are required.
C. Test Reports: Provide testing reports for certification that the system has been tested and inspected.
D. Manufacturer's Installation Instructions: Indicate the application conditions and limitations of use stipulated by the product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of products.
E. Battery calculations.

1.5 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70 and NFPA 101.
B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this Section with minimum 3 years' documented experience.
C. Installer Qualifications: Company and/or installer specializing in installing the products specified in this Section with minimum 3 years' documented experience, and certified by State of Texas as Fire Alarm Installer.
D. Products: Listed and classified by UL testing firm as acceptable to the Authority Having Jurisdiction (AHJ) and suitable for the purpose specified and indicated.
E. At the completion at the Project, Contractor shall provide certification tests and completion documentation in accordance with NFPA 72.
F. Provide to Owner an electronic file with all fire alarm control panel software settings.

1.6 MAINTENANCE SERVICE

A. Provide service and maintenance of fire alarm equipment for one year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Notifier.
B. Fire-Lite.
C. Or approved equal.

2.2 CONTROL PANEL

A. Control panel shall be a Notifier N16E-X or approved equal. The system shall be microprocessor controlled and shall communicate with intelligent detectors, addressable modules, annunciators, and other system controlled devices. Provide control panel with automatic and manual voice module. Provide for panel expansion as required to accommodate the number of devices.
B. The system shall include alarm and trouble relays.
C. The control panel shall feature a full operator interface control and annunciation panel that includes an 80-character backlit liquid crystal display (LCD), individual, color coded system status LEDs, and an alphanumeric keypad for the field programming and control of the fire alarm system. All programming shall be achieved without special equipment and without interrupting the alarm monitoring functions of the control panel.
D. The following minimum features shall be included in the control panel:
    1. Drift compensation to extend detector accuracy over life.
    2. Sensitivity test compliant with NFPA 72.
    3. System status reports for display.
    4. Non-alarm points for general (non-fire) control.
    5. Periodic detector tests conducted automatically by system software.

6. March time and temporal coding options.
7. Walk test option.
8. Alarm signals shall not be lost following a power outage until the signal is processed.
9. Printer and printer interface capable of logging all events.
10. Alpha-numeric pager interface.
11. Real time clock for logging events.

E. The system display shall provide all system control and indication of the system parameters. The display shall provide for custom alphanumeric labels for all intelligent detectors, modules, and zones. The display shall include operator functions for SIGNAL SILENCE, RESET, DRILL, and ACKNOWLEDGE.

F. The signal line circuit (SLC) shall provide power to and communicate with the number of detectors and modules as required to serve all devices. All building risers shall be configured for Class A, Style 6, and building loops on individual floors shall be Class B, Style 3.5. The detector software shall allow manual or automatic sensitivity adjustment.

G. The control panel shall be housed in a UL-listed cabinet suitable for flush mounting. The door shall be key locked and shall include a glass or other transparent opening for viewing of all indicators.

H. The system power supply and battery charger shall operate on 120 volts, 60 Hz, and shall provide for all of the power needs of the system. Provide circuit breaker, wire, and conduit as required.

I. Any proposed control panel substitutions shall also comply with all other system features that are included with the system specified by manufacturer name and number indicated as a part of this Specification.

J. Provide for any necessary interface devices as required to operate SLC and notification appliance circuits (NAC) to accommodate the distances for this Project. Coordinate with Electrical Contractor for all power requirements.

2.3 INITIATING DEVICES

A. Manual Station: Semi-Flush mounted, addressable type, double action manual station with key operated test-reset lock, and shall be so designed so they cannot be restored to normal position except by the use of a key. Station shall have the word "FIRE" on the front of the unit in raised letters. Stations shall be red in color. Provide semi-recessed single gang back box which can accept surface mounted raceway. Refer to Section 26 05 33.16 "Boxes" for additional box restrictions.

B. General Area Intelligent Photoelectric Smoke Detectors: The detectors shall use the photoelectric (light-scattering) principal to measure smoke density and shall, on command from the control panel, send data to the panel representing the analog level of smoke density. Detectors shall include a twist-lock base with a tamper proof feature. The detectors shall provide a test means whereby they will simulate an alarm condition and report that condition to the control panel. Such a test may be initiated by the detector itself (by activating a magnetic switch).

C. Intelligent Thermal Detectors: Provide addressable, fixed temperature 135 degrees F detectors where indicated.

D. Modules: Monitor and control modules shall be provided for the system as required for the operations as indicated. Control modules for notification appliance circuits shall supervise the circuits and shall be wired as Style Z in accordance with NFPA.

2.4 SIGNALING APPLIANCES

A. Audible/Visual Devices: The devices shall be combination horn/light units. The audible portion of the device shall have a sound output level of at least 85 dBA measured at 10 feet from the device. This visual portion of the devices shall meet the requirements of the Americans with Disabilities Act and the Texas Accessibility Standards. Minimum candela level for the strobe light intensity shall be 75 and the flash rate shall be a minimum of 1 Hz and a maximum of 3 Hz. The maximum flash duration shall be two-tenths of one second. All visual devices shall be synchronized. Contractor is responsible to provide sound level of horns and fire alarm chimes meeting requirements of NFPA. Contractor shall provide additional speaker/light units, amplifier, 120 V wiring, fire alarm wiring, and conduit as required.

B. All NAC shall be installed in accordance with NFPA 72, Class A, style Z wiring.

C. Refer to the Drawings for device locations. Where devices are shown as ceiling mounted, provide equivalent intensity devices per NFPA.

2.5 AUXILIARY DEVICES

A. Connection to shut down all mechanical equipment provided with duct-mounted smoke detectors and all mechanical equipment that has associated smoke dampers upon initiation of general alarm. Refer to Mechanical Drawing for the location of dampers.

B. Provide 120 V power, control transformers, and control wiring as required for connection to any equipment associated with the shutdown and control of mechanical equipment.

C. Provide for all control wiring and connections for interface with tamper and flow switches associated with the suppression system. Coordinate with Fire Protection Suppression Contractor for all locations. Any modules for the outdoor shut-off valve shall be mounted inside the building as directed. No modules shall be located below grade. This will include connection to the tamper switch at the post indicator valve on the site.

D. Provide door hold-open devices powered by the fire alarm system where indicated. Provide all chains and mounting extensions as required for a complete and operable system.

E. Provide remote fire alarm annunciator panel (FAAP), including audible and visual indication of fire alarm condition device description. Indications shall be provided on an alpha-numeric display. Provide FAAP with in-factory mounted flush wall enclosure.

F. Provide Universal Dialer (UDACT) and Digital Cellular Communicator for off-stie reporting, with or without copper telephone lines.

2.6 FIRE ALARM WIRE AND CABLE

A. Fire Alarm Power Branch Circuits: Building wire as specified in Section 26 05 13 "Building Wire and Cable."

B. Fire alarm circuit conductors have insulation color or coded as follows:
   1. Power Branch Circuit Conductors: Black, red, white.
   2. Initiating Device Circuit: Black, red.

3. Signal Device Circuit: Blue (positive), white (negative).
4. Door Release: Gray, gray.
5. All fire alarm wiring shall be installed in conduit.

C. All fire alarm wiring shall be UL listed for use as a fire protective signaling system.

D. All wiring shall be complying with the recommendations by the fire alarm equipment manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Provide for the service of a competent, factory-trained engineer or technician authorized by manufacturer of the fire alarm equipment to technically supervise and participate during all of the adjustments and tests for the system. All software modifications shall be supervised by this technician. All testing shall comply with NFPA.

B. Before energizing the wiring, check for correct connections and tests for shorts and grounds.

C. Install manual station with operating handle 42 inches above floor. Install audible and visual signal devices on the ceiling as indicated.

D. Automatic Detector Installation: Conform to NFPA.

E. At a minimum, provide the following systems tests:
1. Open and short signal line circuits and verify that a trouble signal actuates and alarm receipt is present.
2. Open and short notification appliance circuits and verify that trouble signal actuates and alarm receipt is present.
3. Ground all circuits and verify response of trouble signals and alarm receipt is present.
4. Check presence and audibility of tone at all notification devices.
5. Check the installation, supervision, and operation of all initiating devices.
6. Check proper operation of door release, damper operation, and mechanical unit shutdown.
7. All alarm inputs and optional features shall be verified.

F. All smoke detectors shall be firmly supported to the ceiling. On lay-in ceiling, secure detectors with suitable ceiling grid bridges that fasten securely to 2 grid runners.

G. Fire alarm reporting will include all modules, fiber, etc., to extend and connect through the building's system to report trouble and alarm.

3.2 FIELD QUALITY CONTROL

A. Test in accordance with NFPA 72 and local fire department requirements. All test procedures and requirements shall also meet the requirements as set by the AHJ.

3.3 MANUFACTURER'S FIELD SERVICES

A. Include services of certified technician to supervise installation, adjustments, final connections, and system testing.

3.4 DEMONSTRATION AND INSTRUCTIONS

A. Demonstrate normal and abnormal modes of operation, and required responses to each.
B. Contractor shall provide for a minimum of 8 hours of training for Owner's personnel.

END OF SECTION

SECTION 28 35 00 - EMERGENCY RADIO COMMUNICATION ENHANCEMENT SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Related Requirements:
   1. Division 01 Specification Sections apply to Work of this Section.

1.2 REQUIREMENTS OF REGULATORY AGENCIES AND STANDARDS

A. Regulatory Agencies: Installation, materials, equipment, and workmanship shall conform to the applicable provisions of the following:
   1. U.L., Inc.
   2. National Fire Protection Association (NFPA)
   3. International Fire Code (IFC).
B. Terms and conditions of the authorities having lawful jurisdiction pertaining to Work required.

1.3 SUBMITTALS

A. The intent of this Section is to give general submittal information, refer to specific submittal information in the subsequent Mechanical Sections.
B. Within 10 days after award of Contract, and before orders are placed, Contractor shall submit specific information on list of equipment and principal materials specified. Contractor shall indicate/provide names of manufacturers, catalog and model numbers, cut sheets, and such other supplementary information as necessary for evaluation. Minimum 6 copies, or as directed by Architect, of each shall be submitted and include all items mentioned by model number/manufacturer's name in specifications or in Schedules on Drawings.
C. Requirements for each submittal:
   1. Bear a dated stamp or specific written indication that Contractor reviewed and approved all submittal prior to submission to Architect.
   2. Have all information deleted by Contractor that pertains to means and methods of construction or to fabrication, assembly, installation, or erection (approval by Architect shall not extend to these areas unless specifically noted by Architect).
   3. Be clearly and SPECIFICALLY marked as to which specific piece of equipment is submitted, by use of a permanent marker, stamp, etc., to distinguish it from other pieces of equipment that may occur on the same page.
   4. Clearly mark which available options are submitted associated with equipment.
   5. Be complete with respect to quantities, dimensions, specific performance, materials, and similar data to enable Architect to review the proposed equipment.
   6. Clearly indicate compliance with standards indicated.
D. Omission by Contractor of any requirement or submittal will subject submittal to automatic rejection without review.
E. Return any submittals received by Architect that were not requested without review of any kind.

PART 2 - PRODUCTS

2.1 EQUIPMENT REQUIREMENTS

A. Electrical requirements for equipment specified or indicated on Drawings are based on information available at time of design. If equipment furnished for installation has electrical requirements other than indicated on Electrical Drawings, Contractor shall make any required changes to wire and conduit size, controls, overcurrent protection and installation as required to accommodate the equipment supplied, without additional charge to Owner. Complete responsibility and costs for such adjustments shall be assigned to respective Section of this Specification under which equipment is furnished.

2.2 MATERIALS

A. All similar materials and equipment shall be product of same manufacturer unless specified otherwise.
B. Materials and equipment shall be standard products of manufacturers regularly engaged in production of such material and manufacturer's current and standard design.
C. Altitude: Equipment affected by altitude shall perform satisfactorily for the function intended at altitude of Project Site.

PART 3 - EXECUTION

3.1 GENERAL

A. As a part of base bid of this Project, provide for testing of radio frequency signal throughout building to determine if Emergency Radio Communication Enhancement System (ERCES) is required. Testing shall be done at direction of Authority Having Jurisdiction. This testing shall include documentation of qualifications of person performing tests, signal strength measurements documented on a building floor plan for both internal to rooms of building as well as areas surrounding building. All testing methods, qualifications, and other requirements shall be in accordance with International Fire Code-2021 (IFC-2021).
B. If testing proves that the system is required, provide and install a complete and operational Emergency Radio Communication Enhancement System (ERCES) for coverage throughout building and surrounding areas around building. Contractor shall provide design, installation and certification of the system. This Work shall be done in accordance with the International Fire Code-2021 (IFC-2021).
    1. Provide submittal documentation of all correspondence with AHJ, product data, certification of compliance with standards, and a plan layout of all system components on building floor plan. Include wiring diagrams and equipment diagrams.
    2. All power, conduit, controls, etc. required for ERCES shall be included in project.

END OF SECTION

SECTION 31 10 00 - SITE CLEARING

PART 1 - GENERAL

1.1 SUMMARY

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

B. Related Requirements:
   1. Division 01 Specification Sections apply to Work of this Section.
   2. Section 01 50 01 "Erosion Sediment Control During Construction" for temporary erosion- and sedimentation-control measures.

1.2 DEFINITIONS

A. Subsoil: Soil beneath the level of subgrade; soil beneath the topsoil layers of a naturally occurring soil profile, typified by less than 1 percent organic matter and few soil organisms.

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

C. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil; the zone where plant roots grow. Its appearance is generally friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, rock, and other objects larger than 1-inch in diameter; and free of weeds, roots, toxic materials, or other nonsoil materials.

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

E. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction and indicated on Drawings.

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

1.3 MATERIAL OWNERSHIP

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

1.4 INFORMATIONAL SUBMITTALS

A. Existing Conditions: Documentation of existing trees and plantings, adjoining construction, and site improvements that establishes preconstruction conditions that might be misconstrued as damage caused by site clearing.
   1. Use sufficiently detailed photographs or video recordings.
   2. Include Plans and notations to indicate specific wounds and damage conditions of each tree or other plant designated to remain.
B. Topsoil stripping and stockpiling program.
C. Rock stockpiling program.
D. Burning: Not allowed.

1.5 QUALITY ASSURANCE

A. Topsoil Stripping and Stockpiling Program: Prepare a written program to systematically demonstrate the ability of personnel to properly follow procedures and handle materials and equipment during the Work. Include dimensioned diagrams for placement and protection of stockpiles.
B. Rock Stockpiling Program: Prepare a written program to systematically demonstrate the ability of personnel to properly follow procedures and handle materials and equipment during Work. Include dimensioned diagrams for placement and protection of stockpiles.

1.6 FIELD CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
   1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
   2. Provide alternate routes around closed or obstructed trafficways if required by Owner or authorities having jurisdiction.
B. Improvements on Adjoining Property: Is prohibited.
   1. Coordinate with Owner and Engineer prior to performing Work on adjoining property if necessary.
C. Salvageable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises as directed by Owner or Engineer.
D. Utility Locator Service: Notify One Call, 811 for area where Project is located before site clearing.
E. Do not commence site clearing operations until temporary erosion- and sedimentation-control and plant-protection measures are in place.
F. Tree- and Plant-Protection Zones: Protect according to requirements in Drawings.
G. Soil Stripping, Handling, and Stockpiling: Perform only when the soil is dry or slightly moist.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Section 31 20 00 "Earth Moving."
   1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.
B. Verify that trees, shrubs, and other vegetation to remain or to be relocated have been flagged and that protection zones have been identified and enclosed according to requirements in Drawings.
C. Protect existing site improvements to remain from damage during construction.
   1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

A. Provide temporary erosion- and sedimentation-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings and requirements of authorities having jurisdiction.
B. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.
C. Inspect, maintain, and repair erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
D. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.3 TREE AND PLANT PROTECTION

A. Protect trees and plants remaining on-site according to requirements in Drawings.
B. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations per Owner requirements.

3.4 EXISTING UTILITIES

A. Locate, identify, disconnect, and seal or cap utilities indicated to be removed or abandoned in place.
   1. Arrange with utility companies to shut off indicated utilities.

B. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others, unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
   1. Notify Owner and utility company not less than 3 days in advance of proposed utility interruptions.
   2. Do not proceed with utility interruptions without Owner's or utility company's written permission.

C. Removal of underground utilities may be included in Earthwork Sections; in applicable Fire Suppression, Plumbing, HVAC, Electrical, Communications, Electronic Safety and Security, and Utilities Sections; and in Section 02 41 16 "Structure Demolition."

3.5 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction.
   1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
   2. Grind down stumps and remove roots larger than 2 inches in diameter, obstructions, and debris to a depth of 18 inches below exposed subgrade.
   3. Use only hand methods or air spade for grubbing within protection zones.
   4. Chip removed tree branches and stockpile in areas approved by Engineer dispose of off-site.

B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated. De-water existing natural depressions and fill with satisfactory soil materials as defined in Section 31 20 00 "Earth Moving," or as allowed by Engineer.
   1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches, and compact each layer to a density equal to adjacent original ground.

3.6 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.

B. Strip topsoil in a manner to prevent intermingling with underlying subsoil or other waste materials. Contractor to identify and determine depth per topsoil definition in this Section.
   1. Remove subsoil and nonsoil materials from topsoil, including clay lumps, gravel, and other objects larger than 2 inches in diameter; trash, debris, weeds, roots, and other waste materials.

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

3.7 STOCKPILING ROCK

A. Remove from construction area naturally formed rocks that measure more than 1-foot cross in least dimension.
   1. Separate or wash off non-rock materials from rocks, including soil, clay lumps, gravel, and other objects larger than 2 inches in diameter; trash, debris, weeds, roots, and other waste materials.

B. Stockpile rock as directed by Owner or Engineer, without intermixing with other materials. Cover to prevent windblown debris from accumulating among rocks.
   1. Limit height of rock stockpiles to 36 inches.
   2. Do not stockpile rock within protection zones.
   3. Dispose of surplus rock. Surplus rock is that which exceeds quantity indicated to be stockpiled or reused.

3.8 SITE IMPROVEMENTS

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

B. Remove concrete slabs, concrete paving, asphalt paving, curbs, gutters, and aggregate base as indicated.
   1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut along line of existing pavement to remain before removing adjacent existing pavement. Saw-cut faces vertically.
   2. Paint cut ends of steel reinforcement in concrete to remain with 2 coats of antirust coating, following coating manufacturer's written instructions. Keep paint off surfaces that will remain exposed.

3.9 DISPOSAL OF SURPLUS AND WASTE MATERIALS

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

END OF SECTION

SECTION 31 20 00 - EARTH MOVING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Excavating and filling for rough grading the site.
2. Preparing subgrades for structures (as defined in this Section) slabs-on-grade, walks, pavements, turf and grasses, and plants.
3. Excavating and backfilling for buildings and structures.
4. Drainage course for concrete slabs-on-grade.
5. Subbase course for concrete walks and pavements.
6. Subbase course and base course for asphalt paving.
7. Subsurface drainage backfill for walls and trenches.
8. Excavating and backfilling trenches for utilities and pits for buried utility structures.

B. Related Requirements:
1. Division 01 Specification Sections apply to Work of this Section.

2. Section 31 50 00 "Excavation Support and Protection" for shoring, bracing, and sheet piling of excavations.
3. Section 32 92 00 "Turf and Grasses" for finish grading in turf and grass areas, including preparing and placing planting soil for turf areas.
4. Section 32 93 00 "Plants" for finish grading in planting areas and tree and shrub pit excavation and planting.

1.2 DEFINITIONS

A. Retain definitions remaining after this Section has been edited. Revise to suit office or local earth-moving practices.
1. Backfill: Soil material or controlled low-strength material used to fill an excavation.
2. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
3. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: Aggregate layer placed between the subbase course and hot-mix asphalt paving and concrete paving (when shown on details).

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

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

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

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

G. Fill: Satisfactory soil materials used to raise existing grades.

H. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material 3/4 cu. yd. or more in volume that exceed a standard penetration resistance of 100 blows/2 inches when tested by a geotechnical testing agency, according to ASTM D1586.

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

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

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

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

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct preexcavation conference at Project Site.
   1. Review methods and procedures related to earth moving, including, but not limited to, the following:
      a. Personnel and equipment needed to make progress and avoid delays.
      b. Coordination of Work with utility locator service.
      c. Coordination of Work and equipment movement with the locations of tree- and plant-protection zones.
      d. Extent of trenching by hand or with air spade.
      e. Field quality control.

1.4 ACTION SUBMITTALS

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

1.5 INFORMATIONAL SUBMITTALS

A. Coordinate "Qualification Data" Paragraph below with qualification requirements in Section 01 40 00 "Quality Requirements" and as supplemented in "Quality Assurance" Article.
B. Qualification Data: For qualified testing agency.

C. Material Test Reports: For each on-site and borrow satisfactory soil material proposed for fill and backfill as follows:
   1. Classification according to ASTM D2487.
   2. Laboratory compaction curve according to ASTM D698.

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

1.6 QUALITY ASSURANCE

A. Blasting: NOT ALLOWED.

B. Geotechnical Testing Agency Qualifications: Qualified according to ASTM E329 and ASTM D3740 for testing indicated.

1.7 FIELD CONDITIONS

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

B. Improvements on Adjoining Property: Work on adjoining property is not anticipated. Obtain written permission from property Owner, prior to working on adjoining property, if necessary.

C. Utility Locator Service: Notify private and public utilities, and One Call (811) for area where Project is located before beginning earth-moving operations.
D. Do not commence earth-moving operations until erosion- and sedimentation-control measures specified in Section 01 50 01 "Erosion and Sediment Control During Construction" and Section 31 10 00 "Site Clearing" are in place.

E. Do not commence earth-moving operations until plant-protection measures as shown on Drawings are in place.

F. The following practices are prohibited within protection zones:
   1. Storage of construction materials, debris, or excavated material.

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

G. Do not direct vehicle or equipment exhaust towards protection zones.
H. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.
B. Satisfactory Soils: Soils that meet the select fill Section of the Geotechnical Engineer's report, free of rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.
   1. Plasticity Index: Per Geotechnical Engineer's report.
C. Unsatisfactory Soils: Soils that do not meet the Geotechnical Engineer's report for select fill.
   1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction and prior to placing the next lift of soil, aggregate base course or final pavement layer, and/or as approved by the Engineer.

D. Subbase Material: Soil lime mixture per Geotechnical Engineer's report.
E. Base Course: Naturally or artificially graded mixture of crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940; with at least 95 percent passing a 1-1/2-inch sieve and not more than 8 percent passing a No. 200 sieve.
F. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 5 percent passing a No. 200 sieve.
G. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.
H. Drainage Course: Narrowly graded mixture of washed crushed stone, or crushed gravel; ASTM D448; coarse-aggregate grading Size 57 or 67; with 100 percent passing a 1-1/2-inch sieve and zero to 5 percent passing a No. 8 sieve.
I. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch sieve and zero to 5 percent passing a No. 4 sieve.
J. Sand: ASTM C33; fine aggregate.

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

2.2 CONTROLLED LOW-STRENGTH MATERIAL

A. Controlled Low-Strength Material: Self-compacting, low-density, flowable concrete material produced from the following:
   1. Portland Cement: ASTM C150, Type I or Type II or Type IL.
   2. Fly Ash: ASTM C618, Class F.
   3. Normal-Weight Aggregate: ASTM C33, 3/8-inch-nominal maximum aggregate size.
   4. Foaming Agent: ASTM C869.
   5. Water: ASTM C94.

B. Produce low-density, controlled low-strength material with the following physical properties:
   1. Compressive Strength: 150 psi, when tested according to ASTM C495.

2.3 ACCESSORIES

A. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored as follows:
   1. Red: Electric.
   2. Yellow: Gas, oil, steam, and dangerous materials.
   3. Orange: Telephone and other communications.
   4. Blue: Water systems.
   5. Green: Sewer systems.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth-moving operations.
B. Protect and maintain erosion and sedimentation controls during earth-moving operations.
C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.2 DEWATERING

A. Provide dewatering system of sufficient scope, size, and capacity to control hydrostatic pressures and to lower, control, remove, and dispose of ground water and permit excavation and construction to proceed on dry, stable subgrades.

B. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project Site and surrounding area.
C. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.
    1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.
D. Dispose of water removed by dewatering in a manner that avoids endangering public health, property, and portions of Work under construction or completed. Dispose of water and sediment in a manner that avoids inconvenience to others.

3.3 EXPLOSIVES

A. Explosives: Do not use explosives.

3.4 EXCAVATION, GENERAL

A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum will be authorized for rock excavation or removal of obstructions.
    1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
    2. Remove rock to lines and grades indicated to permit installation of permanent construction.

    3. Earth excavation includes excavating pavements and obstructions visible on surface; underground structures, utilities, and other items indicated to be removed; and soil, boulders, and other materials not classified as rock or unauthorized excavation.

3.5 EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.
    1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.

B. Excavations at Edges of Tree- and Plant-Protection Zones:
    1. Excavate by hand or with an air spade to indicated lines, cross sections, elevations, and subgrades. If excavating by hand, use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots. See Drawings for tree and plant protection zones.
    2. Cut and protect roots according to Landscape Architect requirements.

3.6 EXCAVATION FOR WALKS AND PAVEMENTS

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

3.7 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.
   1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.

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

C. Trench Bottoms: Excavate trenches as indicated on Drawings, deeper than bottom of pipe and conduit elevations to allow for bedding course. Hand-excavate deeper for bells of pipe.
   1. Excavate trenches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

D. Trenches in Tree- and Plant-Protection Zones:
   1. Hand-excavate to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
   2. Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities. Seek guidance from Landscape Architect as necessary.
   3. Cut and protect roots according to Landscape Architect requirements.

3.8 SUBGRADE INSPECTION

A. Notify Engineer when excavations have reached required subgrade.

B. If Engineer determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed at no additional compensation.

C. Proof-roll subgrade subbase course of asphalt and concrete pavements with a pneumatic-tired and loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades. Use alternate vehicles as approved by Engineer.
   1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.
   2. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Engineer, and replace with compacted backfill or fill as directed.

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

3.9 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2,500 psi, may be used when approved by Engineer.
   1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Engineer.

3.10 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
   1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.11 BACKFILL

A. Place and compact backfill in excavations promptly, but not before completing the following:
   1. Construction below finish grade including, where applicable, subdrainage, damp proofing, waterproofing, and perimeter insulation.
   2. Surveying locations of underground utilities for Record Documents.
   3. Testing and inspecting underground utilities.
   4. Removing concrete formwork.
   5. Removing trash and debris.
   6. Removing temporary shoring, bracing, and sheeting.
   7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

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

3.12 UTILITY TRENCH BACKFILL

A. Backfill utility trenches per City of Florence standard details and specifications or as directed by Engineer.
B. Place backfill on subgrades free of mud, frost, snow, or ice.
C. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

D. Backfill voids with satisfactory soil while removing shoring and bracing.
E. Initial Backfill: Per City of Florence standard details and specifications or as directed by Engineer.

F. Final Backfill:
   1. Soil Backfill: Place and compact final backfill of satisfactory soil to final subgrade elevation. Lime stabilized satisfactory soil layer required for this Project.

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

3.13 SOIL FILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.
B. Place and compact fill material in layers to required elevations as follows:
   1. Under grass and planted areas, use satisfactory soil material.
   2. Under walks and pavements, use satisfactory soil material.
   3. Under steps and ramps, use engineered fill.

   4. Under footings and foundations, use engineered fill or as recommended by Geotechnical Engineer.
C. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.14 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.
   1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.

   2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.15 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
B. Place backfill and fill soil materials evenly on all sides of structures to required elevations and uniformly along the full length of each structure.

C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D698:
   1. Under structures, pavements, scarify and recompact top 12 inches of existing or proposed subgrade and each layer of backfill or fill soil material at 95 percent. Subgrade shall meet the requirements for satisfactory soils.
   2. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 95 percent.
   3. Under turf or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 85 percent.

4. For utility trenches, compact each layer of initial and final backfill soil material at 95 percent.

3.16 GRADING

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

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

3.17 SUBSURFACE DRAINAGE

A. Drainage Backfill: Place and compact filter material over subsurface drain, in width indicated, to within 12 inches of final subgrade, in compacted layers 6 inches thick.
   1. Compact each filter material layer to 85 percent of maximum dry unit weight according to ASTM D698 with a minimum of 2 passes of a plate-type vibratory compactor.

   2. Place and compact impervious fill over drainage backfill in 6-inch-thick compacted layers to final subgrade and/or as directed by Geotechnical Engineer or Structural Engineer.

3.18 SUBBASE AND BASE COURSES UNDER PAVEMENTS AND WALKS

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

B. On prepared subgrade, place subbase course under pavements and walks as follows:
   1. Under concrete pavement, lime treat subbase course per Geotechnical Engineer's recommendations.

   2. Shape subbase course to required crown elevations and cross-slope grades.
   3. Place subbase course 6 inches or less in compacted thickness in a single layer.
   4. Place subbase course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.

   5. Compact subbase course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D698.

3.19 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified geotechnical engineering testing agency to perform tests and inspections:
   1. Determine prior to placement of fill that site has been prepared in compliance with requirements.
   2. Determine that fill material classification and maximum lift thickness comply with requirements.
   3. Determine, during placement and compaction, that in-place density of compacted fill complies with requirements.

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

C. Footing Subgrade: At footing subgrades, at least 1 test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Engineer.

D. Testing agency will test compaction of soils in place according to ASTM D6938, as applicable. Tests will be performed at the following locations and frequencies:
   1. Paved Areas: At subgrade and at each compacted fill and backfill layer, at least 1 test for every 2,000 sq. ft. or less of paved area or building slab but in no case fewer than 3 tests or as directed/ allowed by Engineer.
   2. Foundation Wall Backfill: At each compacted backfill layer, at least 1 test for every 25 feet or less of wall length but no fewer than 2 tests or as directed or allowed by the Engineer.
   3. Trench Backfill: At each compacted initial and final backfill layer, at least 1 test for every 150 feet or less of trench length but no fewer than 2 tests, or as directed or allowed by the Engineer.

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

3.20 PROTECTION

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

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose moisture and compaction due to subsequent construction operations or weather conditions.
   1. Scarify or remove and replace soil material to depth as directed by Engineer; reshape and recompact.

C. Where settling occurs before Project acceptance, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
   1. Restore appearance, quality, and condition of finished surfacing to match adjacent Work, and eliminate evidence of restoration to greatest extent possible.

3.21 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property, at no extra compensation.

END OF SECTION

SECTION 31 20 00.10 - EARTH MOVING FOR FACILITY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Preparing subgrades for slabs-on-grade.
   2. Excavating and backfilling for buildings and structures.
B. Related Requirements:
   1. Division 01 Specification Sections apply to Work of this Section.

1.2 DEFINITIONS

A. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
   1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
   2. Bulk Excavation: Excavation more than 10 feet in width and more than 30 feet in length.
   3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.
B. Fill: Soil materials used to raise existing grades.
C. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material 3/4 cu. yd. or more in volume that exceed a standard penetration resistance of 100 blows per 2 inches when tested by a geotechnical testing agency, according to ASTM D1586.
D. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
E. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.
F. Utilities: On-site underground pipes, conduits, ducts, and cables as well as underground services within buildings.

1.3 INFORMATIONAL SUBMITTALS

A. Material Test Reports: For each borrow soil material proposed for fill and backfill as follows:
   1. Classification according to ASTM D2487.
   2. Laboratory compaction curve according to ASTM D698.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth-moving operations.
B. Protect and maintain erosion and sedimentation controls during earth-moving operations.
C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.2 DEWATERING

A. Provide dewatering system of sufficient scope, size, and capacity to control hydrostatic pressures and to lower, control, remove, and dispose of ground water and permit excavation and construction to proceed on dry, stable subgrades.
B. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project Site and surrounding area.
C. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.
    1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.
D. Dispose of water removed by dewatering in a manner that avoids endangering public health, property, and portions of work under construction or completed. Dispose of water and sediment in a manner that avoids inconvenience to others.

3.3 EXPLOSIVES

A. Explosives: Do not use explosives.

3.4 EXCAVATION, GENERAL

A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.
    1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
    2. Remove rock to lines and grades indicated to permit installation of permanent construction without exceeding the following dimensions:
        a. Outside of concrete forms other than at footings.
        b. Outside of concrete forms at footings.

c. 6 inches outside of minimum required dimensions of concrete cast against grade.
d. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
e. 6 inches beneath bottom of concrete slabs-on-grade.

3.5 EXCAVATION FOR STRUCTURES

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

B. Excavations at Edges of Tree- and Plant-Protection Zones:
   1. Excavate by hand or with an air spade to indicated lines, cross sections, elevations, and subgrades. If excavating by hand, use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.

3.6 EXCAVATION FOR WALKS AND PAVEMENTS

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

3.7 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.
   1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.

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

C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.
   1. For pipes and conduit less than 6 inches in nominal diameter, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.
   2. For pipes and conduit 6 inches or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe or conduit circumference. Fill depressions with tamped sand backfill.
   3. For flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support conduit on an undisturbed subgrade.
   4. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

D. Trench Bottoms: Excavate trenches 4 inches deeper than bottom of pipe and conduit elevations to allow for bedding course. Hand-excavate deeper for bells of pipe.
   1. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

E. Trenches in Tree- and Plant-Protection Zones:
   1. Hand-excavate to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
   2. Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities.

3.8 SUBGRADE INSPECTION

A. Notify Architect when excavations have reached required subgrade.

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

C. Proof-roll subgrade below the building slabs and pavements ith a pneumatic-tired and loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
   1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.
   2. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.

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

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

3.9 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2,500 psi, may be used when approved by Architect.
   1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Architect.

3.10 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
   1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.11 BACKFILL

A. Place and compact backfill in excavations promptly, but not before completing the following:
   1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
   2. Surveying locations of underground utilities for Record Documents.
   3. Testing and inspecting underground utilities.
   4. Removing concrete formwork.
   5. Removing trash and debris.
   6. Removing temporary shoring, bracing, and sheeting.
   7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

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

3.12 UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice.
B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.
C. Trenches under Footings: Backfill trenches excavated under footings and within 18 inches of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings. Concrete is specified in Section 03 30 00 "Cast-in-Place Concrete."

D. Backfill voids with satisfactory soil while removing shoring and bracing.
E. Initial Backfill:
   1. Soil Backfill: Place and compact initial backfill of satisfactory soil, free of particles larger than 1 inch in any dimension, to a height of 12 inches over the pipe or conduit.
      a. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.
F. Final Backfill:
   1. Soil Backfill: Place and compact final backfill of satisfactory soil to final subgrade elevation.

3.13 SOIL FILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.
B. Place and compact fill material in layers to required elevations as follows:
   1. Under grass and planted areas, use satisfactory soil material.
   2. Under walks and pavements, use satisfactory soil material.
   3. Under steps and ramps, use engineered fill.
   4. Under building slabs, use engineered fill.
   5. Under footings and foundations, use engineered fill.
C. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.14 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.
   1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
   2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.15 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
B. Place backfill and fill soil materials evenly on all sides of structures to required elevations and uniformly along the full length of each structure.
C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D698:
   1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 95 percent.

3.16 GRADING

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

B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to elevations required to achieve indicated finish elevations.

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

3.17 DISPOSAL OF SURPLUS AND WASTE MATERIALS

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

END OF SECTION

SECTION 31 23 33 - TRENCHING AND BACKFILLING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Excavating trenches for utilities to existing municipal utilities.
   2. Compacted fill from top of utility bedding to subgrade elevations.
   3. Backfilling and compaction.

B. Related Requirements:
   1. Section 00 31 32 "Geotechnical Data" Document: Geotechnical report; bore hole locations, and findings of subsurface materials.
   2. Division 01 Specification Sections apply to Work of this Section.
   3. Section 31 20 00 "Earth Moving."
   4. Section 33 10 00 "Water Utilities."
   5. Section 33 31 00.10 "Sanitary and Storm Utility Sewerage Piping."

1.2 REFERENCES

A. ASTM C136 - Method for Sieve Analysis of Fine and Coarse Aggregates.
B. ASTM D698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 5 lb. Rammer and 18-inch Drop.
C. ASTM D6938 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
D. ASTM D3017 - Test Methods for Moisture Content of Soil and Soil-Aggregate Mixtures.

1.3 DEFINITIONS

A. Utility: Any buried pipe, duct, conduit, or cable.

1.4 FIELD MEASUREMENTS

A. Verify survey benchmark, control point, and intended elevations for Work are as shown on Drawings.

1.5 COORDINATION

A. Verify Work associated with lower elevation utilities is complete before placing higher elevation utilities.

PART 2 - PRODUCTS

2.1 FILL MATERIALS

A. Pipe bedding and encasement, per City of Florence detail in Plans.
B. Trench back fill in public rights-of-way shall be per requirements of local municipality. Refer to City of Florence details contained in Plans. Trench backfill on private property may be most granular material from excavated trench spoils. Only material passing through the 2-inch screen size, and free of organic material shall be used.
C. Trench backfill within building areas shall be as specified by other disciplines.
D. Top 12 inches of subgrade shall meet the requirements of satisfactory soils as defined in Section 31 20 00 "Earth Moving."

PART 3 - EXECUTION

3.1 PREPARATION

A. Identify required lines, levels, contours, and datum locations.
B. Protect plant life, lawns, and other features remaining as a portion of final landscaping.
C. Protect benchmarks, fences, paving, and curbs from excavating equipment and vehicular traffic.
D. Maintain and protect above and below grade utilities which are to remain.
E. Cut out soft areas of subgrade not capable of compaction in place. Backfill and compact to density equal to or greater than requirements for subsequent backfill material.

3.2 EXCAVATING

A. Excavate subsoil required for utilities.
B. Cut trenches sufficiently wide to enable installation and allow inspection. Remove water or materials that interfere with Work.
C. Do not interfere with 45-degree bearing splay of foundations.
D. Hand trim excavation. Hand trim for bell and spigot pipe joints. Remove loose matter.
E. Remove lumped subsoil, boulders, and rock.
F. Correct areas over excavated at no additional cost.
G. Excavate trenches to indicated gradients, lines, depths, and elevations.
H. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit, unless otherwise indicated, or as directed by Engineer.
I. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

3.3 BACKFILLING

A. Backfill trenches to contours and elevations with unfrozen fill materials.
B. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen, or spongy subgrade surfaces.
C. Place and compact materials in equal continuous layers not exceeding 8 inches compacted depth.
D. Employ a placement method that does not disturb or damage existing or planned facilities.
E. Maintain optimum moisture content of fill materials.
F. Transport surplus fill materials to designated stockpile area as noted on the Plans, or as directed.
G. Place backfill on subgrades free of mud, frost, snow, or ice.
H. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.
I. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.
J. Place and compact final backfill of satisfactory soil to final subgrade elevation.
K. Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs

3.4 TOLERANCES

A. Top Surface of Backfilling Under Paved Areas: Plus or minus 1/2-inch from required elevations.
B. Top Surface of General Backfilling: Plus or minus 1 inch from required elevations.

3.5 FIELD QUALITY CONTROL

A. Compaction testing will be performed per ASTM D698 and D6938.
B. Backfill loose lifts equal to 12-inch maximum. Density requirements: Top 4 feet of trench below subgrade equal to 95 percent ASTM D698. Trench levels below 4 feet equal to 95 percent ASTM D698.
C. If tests indicate Work does not meet specified requirements, remove Work, replace, compact, and retest.
D. Frequency of Tests: One test per 150 linear feet of trench, at lift level chosen by Engineer representative.

3.6 PROTECTION OF FINISHED WORK

A. Protect finished Work.
B. Reshape and recompact fills subjected to vehicular traffic during construction.

END OF SECTION

SECTION 31 50 00 - EXCAVATION SUPPORT AND PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes temporary excavation support and protection systems.
B. Related Requirements:
   1. Drawings and general provisions of the Contract.
   2. Division 01 Specification Sections apply to Work of this Section.
   3. Section 31 20 00 "Earth Moving" for excavating and backfilling, for controlling surface-water runoff and ponding, and for dewatering excavations.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project Site.
   1. Review geotechnical report.
   2. Review existing utilities and subsurface conditions.
   3. Review coordination for interruption, shutoff, capping, and continuation of utility services.
   4. Review proposed excavations.
   5. Review proposed equipment.
   6. Review monitoring of excavation support and protection system.
   7. Review coordination with waterproofing.
   8. Review abandonment or removal of excavation support and protection system.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, performance properties, and dimensions of individual components and profiles, and calculations for excavation support and protection system.

B. Delegated-Design Submittal: For excavation support and protection systems, including analysis data signed and sealed by the qualified Professional Engineer responsible for their preparation.
   1. Include Plans, elevations, Sections, and details.
   2. Show arrangement, locations, and details of soldier piles, piling, lagging, tiebacks, bracing, and other components of excavation support and protection system according to engineering design.
   3. Indicate type and location of waterproofing.
   4. Include a written Plan for excavation support and protection, including sequence of construction of support and protection coordinated with progress of excavation.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For the following:
   1. Land surveyor.

   2. Professional Engineer: Experience with providing delegated-design engineering services of the type indicated, including documentation that engineer is licensed in the state in which Project is located.

B. Usually retain "Existing Conditions" Paragraph below for determining the effect of excavation support and protection system on permanent construction.
C. Existing Conditions: Using photographs and video recordings, show existing conditions of adjacent construction and site improvements that might be misconstrued as damage caused by inadequate performance of excavation support and protection systems. Submit before Work begins.

1.5 CLOSEOUT SUBMITTALS

A. Record Drawings: Identify locations and depths of capped utilities, abandoned-in-place support, and protection systems, and other subsurface structural, electrical, or mechanical conditions.

1.6 FIELD CONDITIONS

A. Survey Work: Engage a qualified land surveyor or Professional Engineer to survey adjacent existing buildings, structures, and site improvements; establish exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified Professional Engineer, to design excavation support and protection systems to resist all lateral loading and surcharge, including but not limited to, retained soil, groundwater pressure, adjacent building loads, adjacent traffic loads, construction traffic loads, material stockpile loads, and seismic loads, based on the following:
   1. Compliance with OSHA Standards and interpretations, 29 CFR 1926, Subpart P.
   2. Compliance with AASHTO Standard Specification for Highway Bridges or AASHTO LRFD Bridge Design Specification, Customary U.S. Units.
   3. Compliance with requirements of authorities having jurisdiction.
   4. Compliance with utility company requirements.
   5. Compliance with railroad requirements.
B. Follow delegated design professional’s requirements as it pertains to materials, preparation, installation, maintenance, bracing, quality control, removal and repairs.

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 32 13 13 - CONCRETE PAVING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes driveways, roadways, and parking lots.
B. Related Requirements:
   1. Division 01 Specification Sections apply to Work of this Section.
   2. Section 32 17 23 "Pavement Markings."
   3. TxDOT Item 360.

1.2 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with 1 or more of blended hydraulic cement, fly ash and other pozzolans.

1.3 SUBMITTALS

A. Product Data for each type of product indicated.
B. Shop Drawings: Furnish 4 sets of Reinforcing Fabrication Shop Drawings to Engineer and receive approval before any reinforcing steel is fabricated.
C. Design Mixtures: For each concrete paving mixture. Include alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
D. Qualification Data: For qualified Installer of detectable warnings, and ready-mix concrete manufacturer.
E. Material Certificates for the following, from manufacturer:
   1. Cementitious materials.
   2. Steel reinforcement and reinforcement accessories.
   3. Admixtures.
   4. Curing compounds.
   5. Applied finish materials.
   6. Bonding agent or epoxy adhesive.
   7. Joint fillers.
F. Material Test Reports for aggregates from a qualified materials testing firm or as approved by Engineer.
G. Field quality-control reports.
H. Submit haul tickets after each day's delivery of concrete to the job site.
I. Submit a paving and quality control Plan for approval before beginning pavement construction operations. Include details of all operations in the concrete paving process, including methods to construct all joints, methods to consolidate concrete, traverse and longitudinal construction joint layout, sequencing, curing, lighting, early opening, leave-outs, sawing, construction methods, other details, and description of all equipment. List certified personnel performing the testing if QC personnel will be provided. Submit revisions to the paving and quality control Plan for approval.

1.4 QUALITY ASSURANCE

A. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94 requirements for production facilities and equipment.
B. ACI Publications: Comply with ACI 301 unless otherwise indicated.

1.5 PROJECT CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.
B. Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at an ambient or surface temperature of as recommended by the Manufacturer.
C. Construction: Chamfer all exposed edges on all structures 3/4-inch unless otherwise noted on Plans.

PART 2 - PRODUCTS

2.1 FORMS

A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, and smooth exposed surfaces. Use flexible or uniformly curved forms for curves with a radius of 100 feet or less. Do not use notched and bent forms.
B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and that will not impair subsequent treatments of concrete surfaces.

2.2 STEEL REINFORCEMENT

A. All reinforcing bars shall be deformed unless shown otherwise on the plans. Any bars delivered to the site that are not marked with ASTM A615 Grade 60 shall immediately be removed from the site at Contractor expense.
B. Plain-Steel Welded Wire Reinforcement: ASTM A185, fabricated into flat sheets.
C. Deformed-Steel Welded Wire Reinforcement: ASTM A497, flat sheet.
D. Epoxy-Coated Welded Wire Reinforcement: ASTM 884, Class A, plain steel.
E. Reinforcing Bars: ASTM A615, Grade 60; deformed.
F. Galvanized Reinforcing Bars: ASTM A767, Class II zinc coated, hot-dip galvanized after fabrication and bending; with ASTM A615, Grade 60 deformed bars.
G. Epoxy-Coated Reinforcing Bars: ASTM A775 or A934; with A615, Grade 60 deformed bars.
H. Steel Bar Mats: ASTM A184; with A615, Grade 60, deformed bars; assembled with clips.
I. Plain-Steel Wire: ASTM A82, as drawn.
J. Deformed-Steel Wire: ASTM A496.
K. Epoxy-Coated-Steel Wire: ASTM A884, Class A coated, plain.
L. Joint Dowel Bars: ASTM A615, Grade 60 plain-steel bars. Cut bars true to length with ends square and free of burrs.

M. Tie Bars: ASTM A615, Grade 60, deformed.
N. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded wire reinforcement, and dowels in place. Manufacture bar supports per CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete specified.

2.3 CONCRETE MATERIALS

A. Use the following cementitious materials, same type, brand, and source throughout Project:
   1. Portland Cement: ASTM C150, gray Portland cement Type I/II or Ty IL.
   2. Class F Fly Ash.
B. Normal-Weight Aggregates: ASTM C33, uniformly graded. Provide aggregates from a single source. Course aggregate required to meet specified soundness and percentage of wear shall not be more than 45 at 500 revolutions as determined by AASHTO.
   1. Maximum Coarse-Aggregate Size: 1-1/2 inches nominal.
   2. Soundness Loss: 18.
   3. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
C. Water: Potable and complying with ASTM C94.
D. Air-Entraining Admixture: ASTM C260.
E. Chemical Admixtures: Admixtures certified by manufacturer to be compatible with other admixtures and to contain no more than 0.1 percent water-soluble chloride ions by mass of cementitious material. All admixtures require Engineer's approval for use.
   1. Water-Reducing Admixture: ASTM C494, Type A.
   2. Retarding Admixture: ASTM C494, Type B.
   3. Water-Reducing and Retarding Admixture: ASTM C494, Type D.
   4. High-Range, Water-Reducing Admixture: ASTM C494, Type F.
   5. High-Range, Water-Reducing and Retarding Admixture: ASTM C494, Type G.
   6. Plasticizing and Retarding Admixture: ASTM C1017, Type II.

2.4 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 3, burlap cloth made from jute or kenaf, weighing approximately 9 oz/sq. yd. or cotton mats.
B. Moisture-Retaining Cover: ASTM C171, polyethylene film or white burlap-polyethylene sheet.
C. Water: Potable.
D. Evaporation Retarder: Waterborne, monomolecular, film forming, manufactured for application to fresh concrete.
E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C309, Type 1, Class B, dissipating. Products are subject to compliance with requirements, equal to MB-429 manufactured by Master Builders, Inc.

2.5 RELATED MATERIALS

A. Joint Fillers: ASTM D1751 in preformed strips.
B. Joint Sealants: Joint sealants for concrete pavement shall be suitable for horizontal traffic joints exposed to fuel or gas spillage and shall be a chemically curing urethane polyurethane or polysulfide polymer-based elastomeric sealant complying with ASTM C920, Type M, Grade P, Class 25, or Type S, Grade P, Class 25. Color shall be Gray.
C. Joint Backing: ASNI/ASTM D1056, round, closed cell polyethylene foam rod, oversized 30 to 50 percent larger than joint width.
D. See Section 32 13 73 "Concrete Paving Joint Sealants."

2.6 PAVEMENT MARKINGS

A. See Section 32 17 23 "Pavement Markings."

2.7 WHEEL STOPS

A. For Site Wheel Stops: Precast, air-entrained concrete, 4,500 psi 28-day strength minimum compressive strength, 4-1/2 inches high by 9 inches wide by 72 inches long. Provide chamfered corners and drainage slots on underside and holes for anchoring to substrate.
    1. Dowels: Galvanized steel, 1/2-inch in diameter, 10-inch-minimum length.

2.8 CONCRETE MIXTURES

A. Prepare design mixtures, proportioned per ACI 301, for each type and strength of normal-weight concrete, as determined by laboratory trial mixtures or field experience.
    1. Use a qualified independent testing agency for preparing and reporting proposed concrete design mixtures for the trial batch method.
    2. When automatic machine placement is used, determine design mixtures, and obtain laboratory test results that meet or exceed requirements.
B. Proportion mixtures to provide normal-weight concrete with the following properties:
    1. Compressive Strength (28 Days): 4,000 psi.
    2. Minimum 5.0 sacks of cement per cu. yd.
    3. Maximum Water-Cementitious Materials Ratio at Point of Placement: 0.50.
    4. Slump Limit: 1.5-inch if slip-formed (3 inches max). 4 inches if formed (6 inches max).
C. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement with an air content of 4 percent plus or minus 1.5 percent.
D. Chemical Admixtures: Use admixtures per manufacturer-written instructions.
    1. Use water-reducing admixture in concrete as required for placement and workability with Engineer approval.
    2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions with Engineer's approval.

E. Cementitious Materials: Limit percentage by weight of cementitious materials other than Portland cement per ACI 301 requirements as follows:
   1. Fly Ash or Pozzolan: 20 percent. Engineer approval is necessary for the use of Fly Ash.

F. **Synthetic Fiber: Uniformly disperse in concrete mixture at manufacturer-recommended rate, but not less than 1.5 lb/cu. yd. Fiber is specified for this Project in addition to steel reinforcement, unless otherwise directed by Engineer.**

2.9 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete per ASTM C94. Furnish batch certificates for each batch discharged and used in Work.
   1. When air temperature is 75 to 90 degrees F, reduce mixing and delivery time from 60 to 90 minutes.
   2. When air temperature is above 90 degrees F, reduce mixing and delivery time to 45 minutes.

B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete per ASTM C94. Mix concrete materials in appropriate drum-type batch machine mixer. Site mixing for batches larger than 1 cu. yd. requires Engineer approval.
   1. For concrete batches of 1 cubic yard or smaller, continue mixing at least 1 but no more than 5 minutes after ingredients are in mixer, before any part of batch is released.
   2. For concrete batches larger than 1 cu. yd., increase mixing time by 15 seconds for each additional cu. yd.
   3. Provide batch ticket for each batch discharged and used in Work, indicating Project identification name and number, date, mixture type, mixing time, quantity, and amount of water added.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.

B. Proof-roll prepared subbase surface below concrete paving to identify soft pockets and areas of excess yielding.

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

3.2 PREPARATION

A. Remove loose material from compacted subbase surface immediately before placing concrete.

3.3 EDGE FORMS AND SCREED CONSTRUCTION

A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides to required lines, grades, and elevations. Install forms to allow continuous progress of Work so forms can remain in place at least 24 hours after concrete placement.
B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.4 STEEL REINFORCEMENT

A. Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.
C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.
D. Install welded wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least 1 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 flat and free of distortions. Straighten bends, kinks, and other irregularities, or replace units as required before placement. Set mats for minimum 2-inch overlap of adjacent mats.
F. Minimum splice length shall be 18 inches.

3.5 JOINTS

A. Form construction, isolation, and contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline unless otherwise indicated. When joining existing paving, place transverse joints to align with previously placed joints unless otherwise indicated.
B. Construction Joints: Set at side and end terminations of paving and at locations where paving operations are stopped more than 1/2 an hour unless paving terminates at isolation joints.
    1. Omit steel reinforcement from construction joints unless otherwise indicated.
    2. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt 1/2 of dowel length to prevent concrete bonding to 1 side of joint.
C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, other fixed objects, and where indicated.
    1. Locate expansion joints as shown on Plans.
    2. Extend joint fillers full width and depth of joint.
    3. Terminate joint filler not less than 1/4-inch below finished surface if joint sealant indicated.
    4. Place top of joint filler flush with finished concrete surface if joint sealant not indicated.

5. Furnish joint fillers in one-piece lengths. Where more than 1 length required, lace or clip joint-filler sections together.
6. During concrete placement, protect top edge of joint filler with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete is placed on both sides of joint.

D. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least 1/4 concrete thickness.
1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with grooving tool to 3/8-inch radius. Repeat grooving of contraction joints after applying surface finishes.
2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch-wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.
3. Doweled Contraction Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt 1/2 of dowel length to prevent concrete bonding to 1 side of joint.

E. Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool to a 3/8-inch-radius. Repeat tooling of edges after applying surface finishes.

3.6 CONCRETE PLACEMENT

A. Before placing concrete, inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast-in.
B. Remove snow, ice, or frost from subbase surface and steel reinforcement before placing concrete. Do not place concrete on frozen surfaces.
C. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.
D. Comply with ACI 304 requirements for measuring, mixing, transporting, and placing concrete.
E. Do not add water to concrete during delivery or at Project Site. Do not add water to fresh concrete after testing.
F. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.
G. Consolidate concrete per ACI 301 by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating reinforcement, dowels, and joint devices.
H. Screed paving surface with a straightedge and strike off.
I. Commence initial floating using bull floats or darbies to impart an open-textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.

J. Slip-Form Paving: Use design mixture for automatic machine placement. Produce paving to required thickness, lines, grades, finish and jointing. Compact subbase and prepare subgrade sufficient width to prevent displacement of slip-form paving machine during operations.

K. Cold-Weather Placement: Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing, or low temperatures. Comply with ACI 306.1 and:
   1. When air temperature has fallen to or is expected to fall below 40 degrees F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 nor more than 80 degrees F at point of placement.
   2. Do not use frozen materials or materials containing ice or snow.
   3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in design mixtures.

L. Hot-Weather Placement: Comply with ACI 301 and as follows with hot-weather conditions:
   1. Cool ingredients before mixing to maintain concrete temperature below 95 degrees F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated in total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor option.
   2. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
   3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

M. Concrete Batching Time shall not exceed Table 14, Item 421 of TxDOT Specification 2014 in order to avoid placing concrete that has been on site for long periods.

N. Ensure concrete free falls no more than 3 feet except in cases of thin walls such as in culverts.

3.7 FLOAT FINISHING

A. Do not add water to concrete surfaces during finishing operations.

B. Float Finish: Begin second floating operation (see 3.6 I for initial float) when bleed-water sheen disappears, and concrete surface stiffens sufficiently to permit operations. Float surface with power-driven floats or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.
   1. Burlap Finish: Drag a seamless strip of damp burlap across float-finished concrete, perpendicular to line of traffic, to provide a uniform, gritty texture; or
   2. Coarse-Textured Broom Finish: Provide a coarse finish by striating float-finished concrete surface 1/8-inch-deep with a stiff-bristled broom, transverse to largest dimension.

3.8 CONCRETE PROTECTION AND CURING

A. Protect freshly placed concrete from premature drying and excessive cold/hot temperatures.
B. Comply with ACI 306.1 for cold-weather protection.
C. Evaporation Retarder: Apply to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. by height before and during finishing operations. Apply per manufacturer-written instructions after placing, screeding, and bull floating/ darbying concrete but before float finishing.
D. Begin curing after finishing concrete but not before free water disappears from concrete surface.
E. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound or a combination of these as follows:
    1. Moisture Curing. Keep surfaces continuously moist not less than 7 days with:
        a. Water.
        b. Continuous water-fog spray.
        c. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
    2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover, place in widest practicable width, with sides and ends lapped at least 12 inches and seal by waterproof tape/adhesive. Immediately repair any holes or tears occurring during installation or curing period using cover material and waterproof tape.
    3. Curing Compound: Apply uniformly in continuous operation by power spray or roller per manufacturer-written instructions. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.

3.9 PAVING TOLERANCES

A. Comply with tolerances in ACI 117 and:
    1. Elevation: 1/2-inch; however, all pavements shall be graded to drain. Repair depressions resulting in standing water over 1/8-inch-deep.
    2. Thickness: Plus 1/4-inch, minus 1/4-inch.
    3. Surface: Gap below 10-foot-long, unleveled straightedge not to exceed 1/4-inch.

3.10 PAVEMENT MARKING

A. Do not apply pavement-marking paint until Engineer verifies layout, colors, and placement.
B. Allow concrete paving to cure minimum 28 days and dry before starting pavement marking.
C. Sweep and clean surface to eliminate loose material and dust.
D. Apply paint with mechanical equipment to produce markings of dimensions indicated with uniform, straight edges. Apply at manufacturer-recommended rates to provide a minimum wet film thickness of 15 mils.

3.11 WHEEL STOPS

A. When shown on Plans or specified securely attach wheel stops to paving with not less than 2 galvanized steel dowels located at 1/4 to 1/3 points. Install dowels in drilled holes in paving and bond dowels to wheel stop. Recess head of dowel beneath top of wheel stop.

3.12 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency for tests and inspections.
B. Testing Services: Test composite samples of fresh concrete obtained per ASTM C172:
   1. Testing Frequency: Obtain at least 1 set of 3 samples for each 50 cu. yd. or as allowed by Engineer or fraction thereof of each concrete mixture placed each day. When frequency of testing will provide fewer than 5 compressive-strength tests for each concrete mixture, test from at least 5 randomly-selected batches or each batch if fewer than 5 used.
   2. Slump: ASTM C143; Perform 2 slump tests on randomly selected batches for every 50 cu. yds. Or as allowed by Engineer or fraction thereof of concrete placed each day. Perform additional tests when concrete consistency appears to change.
   3. Air Content: ASTM C231, pressure method; 2 tests for each 50 cu. yds. placed or as allowed by Engineer, but not less than 2 tests for each day's pour of each concrete mixture.
   4. Concrete Temperature: ASTM C1064; 1 test hourly when air temperature is 40 degrees F and below. When 80 degrees F and above, 1 test for each composite sample.
   5. Compression Test Specimens: ASTM C31; cast and laboratory cure 1 set of 3 standard cylinder specimens for each composite sample.
   6. Compressive-Strength Tests: ASTM C39; test 2 specimen at 7 and 2 specimens at 28 days. Compressive-strength test shall be average compressive strength from
      2 specimens obtained from same composite sample tested at 28 days.
C. Strength of each concrete mixture will be satisfactory if average of any 3, consecutive compressive-strength tests equal or exceeds specified compressive.
D. Test results shall be reported in writing to Engineer and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
E. Nondestructive Testing: Engineer may permit impact hammer, sonoscope, or other nondestructive device but not used as sole basis for approval or rejection of concrete.
F. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate slump, air entrainment, compressive strengths, or other requirements are not met, as directed by Engineer. Cost for additional testing shall be borne by Contractor.

G. Concrete paving will be considered defective if it does not pass tests and inspections.
H. Additional testing and inspecting, at Contractor expense, will be performed to determine compliance of replaced or additional Work with specified requirements.
I. Prepare test and inspection reports.

3.13 REPAIRS AND PROTECTION

A. Remove and replace concrete paving broken, damaged, or defective or that does not comply with requirements herein. Remove Work in complete sections from joint to joint unless otherwise approved by Engineer.
B. Drill test cores, when allowed by Engineer, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory paving areas with Portland cement concrete bonded to paving with epoxy adhesive.
C. Protect concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur. Construction traffic is permitted after 48 hours and a strength test of 3,200 psi obtained.
D. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than 2 days before date scheduled for Substantial Completion inspections.

END OF SECTION

SECTION 32 13 73 - CONCRETE PAVING JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Expansion and contraction joints within portland cement concrete pavement.
   2. Joints between Portland cement concrete and asphalt pavement.

B. Related Requirements:
   1. Division 01 Specification Sections apply to Work of this Section.

1.2 REFERENCES

A. ASTM C1193 - Use of Joint Sealants.
B. ASTM D5249 - Backer Material for Use with Cold-and-Hot-Applied Joint Sealants in Portland Cement Concrete and Asphalt Joints.
C. ASTM D1751 - Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
D. ASTM D3405 - Joint Sealants, Hot Applied, for Concrete and Asphalt Pavements.
E. ASTM D3406 - Joint Sealant, Hot Applied, Elastomeric Type, for Portland Cement Concrete Pavements.
F. ASTM C920 - Elastomeric Joint Sealants.

1.3 SUBMITTALS

A. Product Data: For each joint-sealant product indicated.
B. Samples for Verification: For each type and color of joint sealant required. Install joint-sealant samples in 1/2-inch-wide joints formed between two 6-inch-long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.
C. Product Certificates: Signed by manufacturers of joint sealants certifying products furnished comply with requirements and suitable for use indicated.
D. Compatibility and Adhesion Test Reports: From joint sealant manufacturer indicating:
   1. Materials forming joint substrates and joint-sealant backer materials were tested for compatibility and adhesion with joint sealants.
   2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.
E. Product Test Reports: From a qualified testing agency indicating joint sealants comply with requirements, based on comprehensive testing of current product formulations.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Experienced installer who specialized in installing joint sealants similar in material, design, and extent to those indicated for Project and Work resulted in joint-sealant installations with a record of successful in-service performance.

B. Source Limitations: Obtain each type of joint sealant through 1 source and manufacturer.
C. Product Testing: Obtain test results for Article 1.3.E from a qualified testing agency, based on testing current sealant formulations within a 36-month period.
   1. Testing Agency Qualifications: Independent testing agency qualified per ASTM C1021 to conduct testing indicated, as documented per ASTM E548.
   2. Test joint sealants for compliance with requirements indicated by referencing standard Specifications and test methods.
D. Preconstruction Compatibility and Adhesion Testing: Submit to joint sealant manufacturer, for testing indicated, samples of materials that contact or affect joint sealants. Use manufacturer-standard test methods to determine if priming and other specific joint preparation techniques required to obtain rapid, optimum adhesion of joint sealants to joint substrates.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project Site in original, unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multicomponent materials.
B. Store and handle materials per manufacturer-written instructions to prevent deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not install joint sealants under these conditions:
   1. Ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer.
   2. Joint substrates are wet.
   3. Blowing dust conditions exist.
B. Joint-Width Conditions: Do not install joint sealants where joint widths are less than allowed by joint sealant manufacturer for application indicated.
C. Joint-Substrate Conditions: Do not install joint sealants until contaminants able to interfere with adhesion are removed from joint substrates.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backing materials, and other related materials compatible with 1 another and with joint substrates under conditions of service and application, per joint sealant manufacturer based on testing and field experience.
B. Bituminous premolded expansion joint shall conform to ASTM D1751.

C. Elastomeric sealant for contraction joints shall be/equivalent to W.R. Meadows "SOF-SEAL" or "Gardox."
   1. Hot-poured sealant for joints between Portland cement concrete and bituminous concrete shall conform to ASTM D3405.
   2. Hot-poured sealant for all other joints in Portland cement concrete pavement shall conform to ASTM D3406.
   3. Cold-poured joint sealant shall conform to ASTM C920, Ty M or S, Grade P, Class 25, and ASTM 5893 Ty SL.

D. Mix material per manufacturer recommendations.

2.2 JOINT-SEALANT BACKER MATERIALS

A. Provide joint-sealant backer materials that are nonstaining, compatible with joint substrates, sealants, primers, and other joint fillers, and approved for applications indicated by joint sealant manufacturer based on field experience and laboratory testing.

B. Round Backer Rod for Cold- and Hot-Applied Sealants: ASTM D5249, Type 1, of diameter and density required to control sealant depths and prevent bottom-side adhesion of sealant.

C. Backer Strips for Cold- and Hot-Applied Sealants: ASTM D5249, Type 2, thickness and width required to control sealant depths, prevent bottom-side adhesion of sealant, and fill remainder of joint opening under sealant.

D. Round Backer Rods for Cold-Applied Sealants: ASTM D5249, Type 3, diameter and density required to control sealant depths and prevent bottom-side adhesion of sealant.

2.3 PRIMERS

A. Product recommended by joint sealant manufacturer where required for adhesion of sealant to joint substrates indicated, determined from preconstruction joint-sealant-substrate and field tests.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

B. Proceed with installation only after unsatisfactory conditions are corrected.

3.2 PREPARATION

A. Surface Clean Joints: Clean out joints immediately before installing joint sealants to comply with joint sealant manufacturer's written instructions.
B. Joint Priming: Prime joint substrates where indicated or recommended in writing by joint sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

3.3 INSTALL JOINT SEALANTS

A. Comply with joint sealant manufacturer's written installation instructions applicable to products and applications indicated, unless more stringent requirements apply.
B. Sealant Installation Standard: Comply with ASTM C1193 recommendations for use of joint sealants as applicable to materials, applications, and conditions indicated.
C. Install backer materials type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths to allow optimum sealant movement capability.
    1. Do not leave gaps between ends of backer materials.
    2. Do not stretch, twist, puncture, or tear backer materials.
    3. Remove absorbent backer materials that are wet before sealant application and replace them with dry materials.
D. Install sealants by proven techniques to comply with these when backings are installed:
    1. Place sealants so they directly contact and fully wet joint substrates.
    2. Completely fill recesses provided for each joint configuration.
    3. Produce uniform, cross-sectional shapes and depths relative to joint widths to allow optimum sealant movement capability.
E. Tooling Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants per specified requirements to form smooth, uniform beads of configuration indicated, eliminate air pockets, and ensure contact and adhesion of sealant with sides of joint.
    1. Remove excess sealants from surfaces adjacent to joint.
    2. Use tooling agents approved in writing by joint sealant manufacturer and do not discolor sealants or adjacent surfaces.
F. Provide joint configuration to comply with joint sealant manufacturer's written instructions, unless otherwise indicated.
G. Provide recessed joint configuration for silicone sealants of recess depth and at locations indicated.

3.4 CLEANING

A. Clean off excess sealants or sealant smears adjacent to joints as Work progresses by methods and with cleaning materials approved by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

END OF SECTION

SECTION 32 16 12 - CONCRETE SIDEWALKS, CURBS, AND GUTTERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes concrete sidewalks, curbs, gutters, wheel stops.
B. Related Requirements:
   1. Division 01 Specification Sections apply to Work of this Section.
   2. Section 31 20 00 "Earth Moving."

1.2 REFERENCES

A. ACI 301 - Specifications for Structural Concrete for Buildings.
B. ACI 304 - Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete.
C. ASTM C33 - Concrete Aggregates.
D. ASTM C78 - Standard Test Method for Flexural Strength of Concrete.
E. ASTM C94 - Ready Mix Concrete.
F. ASTM C143 - Slump of Hydraulic Cement Concrete.
G. ASTM C150 - Portland Cement.
H. ASTM C172 - Sampling Freshly Mixed Concrete.
I. ASTM C173 - Air Content of Freshly Mixed Concrete by the Volumetric Method.
J. ASTM C260 - Air-Entraining Admixtures for Concrete.
K. ASTM C309 - Liquid Membrane-Forming Compounds for Curing Concrete.
L. ASTM C494 - Chemical Admixtures for Concrete.
M. ASTM C1116 - Fiber-Reinforced Concrete and Shotcrete.
N. ASTM D1751 - Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction.

1.3 SUBMITTALS

A. Submit following in accordance with the requirements of Contract Documents.
B. Product Data: Provide data on joint filler admixtures, curing compounds and fibrous reinforcing.
C. Submit manufacturers printed product data, clearly marked, indicating required volume of fibrous concrete reinforcement materials to be added to each cubic yard of concrete.
D. Submit manufacturers printed batching mixing instructions.
E. Submit certificate prepared by concrete supplier stating approved fibrous concrete reinforcement materials were added at required volume to each batch of concrete delivered to Project Site. Accompany each certificate by 1 copy of each batch delivery ticket indicating amount of fibrous concrete reinforcement material added to each concrete batch.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with ACI 301.
B. Obtain cementitious materials from same source throughout.

1.5 ENVIRONMENTAL REQUIREMENTS

A. Cold-Weather Requirements: Do not place concrete when base surface temperature is less than 40 degrees F or surface is wet or frozen.
B. Warm-Weather Requirements: Do not place concrete when temperature of mix exceeds 85 degrees F without approved retarder nor 95 degrees F with approved retarder.

PART 2 - PRODUCTS

2.1 FORM MATERIALS

A. Concrete Curbs and Gutters: Steel form material, specifically designed for curb and gutter Work, profiled to suit conditions, except that the curves may be formed with wood sections built up or laminated, upon prior approval by Engineer.
B. Sidewalks: Steel or wood at Contractor's option.
C. Joint Filler: ASTM D1751 type; 1/2-inch thick.

2.2 REINFORCEMENT

A. Sidewalks shall have 100 percent virgin homopolymer polypropylene fibrillated fibers specifically manufactured for use as concrete reinforcement and contain no reprocessed olefin materials.
B. Reinforcing Steel Bars: ASTM A615, deformed steel bars.

2.3 CONCRETE MATERIALS

A. Cement: ASTM C150 Type I/II or Ty IL.
B. Fine and Coarse Mix Aggregates: ASTM C33, max 1 inch aggregate size.
C. Water-Potable, not detrimental to concrete.
D. Air Entrainment: ASTM C260.

2.4 ACCESSORIES

A. Curing/Sealing Compound: ASTM C309, Type 1, Class B; equal to MB-429 manufactured by Master Builders, Inc.
B. Joint Sealers: ASTM D3405 or approved equal.

2.5 CONCRETE MIX - BY PERFORMANCE CRITERIA

A. Mix concrete in accordance with ACI 304. Deliver concrete in accordance with ASTM C94.
B. Select proportions for normal weight concrete in accordance with ACI 301 Methods 1 or 2.
C. Add fibrous concrete reinforcement to concrete materials at the time concrete is batched in amounts in accord with approved submittals.
D. Mix batched concrete in strict accord with fibrous concrete reinforcement manufacturer's instructions and recommendations for uniform and complete dispersion.

E. Provide concrete to the following criteria:
   1. Compressive Strength: 3,000 psi.
   2. Slump: 3 to 5 inches ±1-inch.
   3. Air Entrained: 4 percent ±1.5 percent.
F. Use accelerating admixtures in cold weather only when approved by Engineer. Use of admixtures will not relax cold weather placement requirements.
G. Use set retarding admixtures during hot weather only when approved by Engineer.

2.6 SOURCE QUALITY CONTROL AND TESTS

A. Provide mix design for each class of concrete to Engineer for review before commencing Work.
B. Test cement and aggregates to ensure conformance with specified requirements.
C. Test samples in accordance with ACI 301.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify base conditions.
B. Verify compacted subgrade is acceptable and ready to support concrete Work and imposed loads.
C. Verify gradients and elevations of base are correct.

3.2 PREPARATION

A. Moisten base to minimize absorption of water from fresh concrete.
B. Notify Engineer minimum 24 hours prior to commencement of concreting operations.

3.3 FORMING

A. Forms for curb and gutter shall be approved type metal forms. Form sections shall be straight, free of warp and of a depth equal to depth of concrete section formed. The forms shall consist of a back form and gutter form with steel templates. Forms shall be constructed accurately to line and grade as established in the field, shall be adequately braced so that they will not move during placing of the concrete, and shall remain in place at least 12 hours after placing of concrete. Forms shall be oiled with a light oil before each use and forms which are to be reused shall be cleaned immediately after use and maintained in good condition. Forms for concrete paving shall also conform to provisions of this paragraph. Forms for curb and gutter on curves with a radius of 130 feet or less shall be flexible steel forms.
B. Templates: The steel templates shall have the shape of the cross-section of the curb and gutter except the bottom portion of the template shall be cut away to allow for a solid mass of concrete. An acceptable shape is shown on a detail sheet of the Plans; however, other shapes may be used upon submission of a design and the approval of Engineer.

C. Machine Laid Curb and Gutter:
   1. The concrete curb and gutter sections may be formed with a curb and gutter laydown machine, provided the machine is capable of laying the curb and gutter to the proper grade, alignment and cross-section, and is equipped with adequate vibrators to produce a dense concrete free of honeycombs.
   2. Laydown machines that cannot meet requirements will not be acceptable for use.

D. Curb and Gutter Cross-Section: Should Contractor desire to use metal templates which differ slightly from the sections shown on the Plans, such templates or Drawings thereof shall be submitted for approval. Slight differences which will not affect the general appearances of the curb and gutter sections will be approved but no forms or templates shall be used which have not been approved by Engineer.

E. Place joint filler vertical in position, in straight lines. Secure to formwork during concrete placement.

3.4 MIXING AND PLACING CONCRETE

A. Concrete shall be mixed in an approved batch type mixer which shall be equipped with a device for measuring the water which is accurate to within two percent. Minimum time for mixing each batch after all ingredients are in the mixer shall be 1-1/2 minutes. The speed of the mixer shall not exceed that recommended by the manufacturer. Excessive overmixing, requiring the addition of water to preserve the required consistency, will not be permitted. Concrete not in place within 45 minutes from the time of charging the drum, or which has developed initial hardening, shall not be used. Transit mixed concrete conforming to these Specifications will be acceptable.

B. Concrete shall be deposited in place to require the minimum of rehandling and shall be placed to produce a uniformly dense section, free of honeycomb or other voids, conforming to the grade, thickness, and shapes shown on Plans. Before placing concrete, subgrade or base surface shall be sprinkled so it is in a thoroughly moistened condition (but not muddy). Concrete adjacent to forms or joints shall be thoroughly spaded or vibrated in order to eliminate honeycomb. Honeycombed places in back of the curb or face of gutter will not be permitted, all honeycombed places shall be patched as directed by Engineer. Concrete shall not be placed when the temperature is less than 40 degrees F and under no circumstances shall it be placed on frozen ground.

C. Mixing concrete for use in a curb and gutter laydown machine shall be mixed as specified above and shall be placed to form the curb and gutter section with the laydown machine. Slump of the concrete shall be accurately controlled and shall be low enough to prevent sagging or slumping of the curb section behind the machine. Batches with excessive slump will be rejected.

D. Place concrete in accordance with ACI 301.

E. Place concrete continuously over the full width of the panel and between predetermined construction joints. Do not break or interrupt successive pours such that cold joints occur.

3.5 JOINTS

A. Align curb, gutter, and sidewalk joints.
B. Place joint filler between paving components and building or other appurtenances. Recess top of filler 1/4-inch for sealant placement.
C. Sidewalk Joints:
    1. Place transverse contraction joints continuous across width of walk at a distance not to exceed sidewalk width or 5 feet on center, whichever is less.
    2. Place longitudinal contraction joints in centerline of walks 10 feet or more in width.
    3. Place transverse expansion joints at sidewalk returns, opposite expansion joints in adjoining curbs and around structures projecting through or into sidewalk, but not less than 20 feet on center.
D. Curb and gutter shall be constructed with an expansion joint at the tangent point of each return at intersections, at intervals of not more than 40 feet between intersections (odd length sections as directed by Engineer), and at the end of each day's concrete pour. A construction or contraction joint shall be located at 10-foot intervals, or at each template or as directed by Engineer. All joints shall be perpendicular to the surface of the concrete and to the axis of the section. Construction or contraction joints for curb and gutter poured in metal forms shall be formed by metal template plates accurately shaped to the cross-section shown on the Plans and so constructed that they can be removed during the finishing operations. Templates shall be maintained in good condition and warped or bent templates shall not be used.
E. In machine laid curb and gutter the contraction joints shall be made at 10-foot intervals by cutting into the curb and gutter sections with a trowel a depth of approximately 1/2-inch these joints shall be finished as specified under finishing. Expansion joints shall be placed at end returns, but not to exceed a maximum spacing of 300 feet, and at the end of each day's concrete pour.
F. Expansion joint material shall be an approved preformed bituminous impregnated non-extruding type jointing material, 1/2-inch thick (3/4-inch thick for machine laid curb and gutter) and shaped to the section of the curb and gutter, or concrete drainage apron.

3.6 FINISHING

A. Sidewalk Paving: Light broom, radius to 3/8-inch radius, and trowel joint edges.
B. Curbs and Gutters: Light broom.
C. Ramps: Heavy broomed texture perpendicular to slope.
D. Direction of Texturing: Transverse to longest dimension.
E. Place curing compound on exposed concrete surfaces immediately after finishing. Apply in accordance with manufacturer's instructions.

F. Curb and gutter, gutter, concrete valley gutters, fillets, and other miscellaneous concrete Work shall be accurately shaped to the cross section shown on the Plans or approved by the Engineer and finished to a surface of uniform texture by floating with a wood float and troweling. The final finishing shall be done with a brush, the last stroke being one from the back of the curb to the lip of the gutter. Both sides of all joints, the lip of the gutter, and back edge of the curb shall be finished with an approved edging tool before the final brushing. Curves at the top and bottom of curb sections shall be accurately shaped and finished and the finished curb and gutter shall present a uniform appearance without "waves" in the face of the curb or "pockets" in the gutters or slabs. Particular care shall be exercised at valley gutters, both in setting forms and finishing, to ensure that the shape of the gutter shall conform to the details of the Plans and that no water pockets will be formed in the gutter of the pavement. At construction and contraction joints the mortar shall be cut the full width of the joint and shall be neatly finished with an approved edging or grooving tool of such design to groove the joint approximately 2 inches in depth.

G. The construction and contraction joints in machine laid curb and gutter shall be neatly formed and finished with an approved edging or grooving tool of such design to groove the joint approximately 2 inches in depth.

3.7 JOINT SEALING

A. Separate pavement from vertical surfaces with 1/2-inch-thick joint filler.

B. Place joint filler in pavement pattern placement sequence. Set top to required elevations. Secure to resist movement by wet concrete.

C. Extend joint filler from bottom of pavement to within 1/4-inch of finished surface. Joint sealer shall conform to ASTM 3405 or approved equal.

3.8 PROTECTING AND CURING

A. All concrete Work shall be covered with burlap or other suitable material as soon as it has set sufficiently to prevent marking and kept wet continuously for at least 4 days. Care shall be taken to prevent mechanical injury to concrete Work during this period and until the Work is accepted. Any Work damaged prior to acceptance shall be repaired to the satisfaction of Engineer.

B. In lieu of the above method of curing, the curb and gutter may be cured by applying a liquid membrane coating to all exposed surfaces as soon as the concrete has set sufficiently. The back and front of the concrete curb and gutter shall have the membrane applied as soon as the forms have been removed. The materials and method of application shall be approved by Engineer before concrete placement begins. The coating shall conform to ASTM C309.

C. Suitable means shall be provided to prevent concrete from freezing for not less than 72 hours after placing. Any concrete damaged by freezing shall be removed and replaced by Contractor at his expense. The addition of any admixture of chemicals to the concrete to prevent freezing shall not be allowed, unless specifically approved by Engineer.

D. Suitable means shall be provided to protect freshly poured concrete from rain damage. Such means shall be kept readily accessible at all times during placement of concrete.

3.9 DEFECTIVE WORK

A. Any defective Work disclosed after the forms have been removed shall be immediately removed and replaced. If any dimensions are deficient, or if any section is not constructed to the proper grade, or if the surface of the concrete is bulged, uneven, or shows honeycomb, which in the opinion of Engineer cannot be repaired satisfactorily, the entire section shall be removed and replaced at the expense of Contractor.

3.10 BACKFILLING

A. Backfill behind and adjacent to all concrete Work including curb, gutter, sidewalks, drives, drainage structures and other miscellaneous concrete Work shall be made from good quality topsoil. This material shall be free from organic material such as leaves, grass, roots, and other unsuitable materials and free of rocks or stones. Contractor shall provide a smooth, even slope between the property line and the top of curb or other concrete structure. Backfill behind the curb and gutter shall be compacted to at least the density of the undisturbed natural ground in the adjacent area.
B. Care shall be taken during the backfill and cleanup process not to scrape, chip, crack or otherwise damage the concrete including tire marks from equipment or trucks. Any damaged concrete will be removed and replaced at the expense of Contractor.

3.11 TOLERANCES

A. Maximum Variation of Surface Flatness: 1/4-inch in 10 feet.
B. Maximum Variation from True Position: 1/4-inch.

3.12 FIELD QUALITY CONTROL

A. Strength Tests:
   1. Take minimum of 1 set of 3 samples for each day's pour but not less than 1 set for each 50 cu. yds. placed or as allowed by Engineer.
   2. Take samples in accordance with ASTM C172.
B. Air Content: Perform 2 tests for air content on randomly selected batches of concrete for each day's pour but not less than 2 for each 50 cu. yds. placed or as allowed by Engineer.
C. Slump Test: Perform 2 slump tests in accordance with ASTM G143 on randomly selected batches for every 50 cu. yds. or as allowed by Engineer or fraction thereof of concrete placed each day.
D. One additional test cylinder will be taken during cold weather and cured on site under same conditions as concrete it represents.
E. Maintain records of placed concrete items. Record date, location of pour, quantity, air temperature and test samples taken.

END OF SECTION

SECTION 32 17 23 - PAVEMENT MARKINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes painting markings and stripes on pavement surfaces applied per these Specifications, at locations shown on plans, or as directed by Engineer.
B. Related Requirements:
   1. Division 01 Specification Sections apply to Work of this Section.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Paint shall meet requirements of the following Specifications:
   1. Federal Test Method Standard No. 141, Methods 4121, 4184, 4281, 6121.
   2. Fed. Spec. TT-P-85b.
   3. Fed. Spec. TT-P-115A.
   4. Fed. Spec. TT-14-16, Methods 408.1, 409.1, 409.2.
   5. ASTM D771-5S.

PART 3 - EXECUTION

3.1 CONSTRUCTION METHODS

A. Weather Limitations: Paint only when surface is dry, atmospheric temperature is above 45 degrees F, and weather not foggy or windy.
B. Equipment:
   1. All equipment for Work shall be approved by Engineer and include apparatus necessary to properly clean the existing surface, mechanical marking machine, and such auxiliary hand-painting equipment as necessary to satisfactorily complete job.
   2. Mechanical marker shall be an atomizing spray-type marking machine suitable for application of traffic paint. It shall produce an even and uniform film thickness at required coverage and designed to apply markings of uniform cross sections and clear-cut edges without running or spattering.
C. Preparation of Surface:
   1. Immediately before paint application, surface shall be dry and free from dirt, grease, oil, laitance, or other foreign material which would reduce bond between paint and pavement. Clean area to be painted by sweeping, blowing, or other methods required to remove all dirt, laitance, and loose materials.
   2. Do not apply paint to Portland cement concrete pavement until concrete in areas to paint is clean of curing material. Sandblast or high-pressure water removes curing material from concrete surfaces.

D. Layout of Markings: On sections of pavement where no previously-applied markings available to serve as a guide, lay out proposed markings in advance of paint application.

E. Fire Lane Markings: Provide all required fire lanes as designated by local Fire Chief or official with fire lane striping consisting of 6-inch wide red background stripe with 4-inch high white letters using 3/4-inch stroke stating "FIRE LANE NO PARKING" or "NO PARKING FIRE LANE" painted upon red stripe every 40 feet along entire length of fire lane, showing exact boundary of fire lane. "FIRE LANE NO PARKING" or "NO PARKING FIRE LANE" must be grouped together as a phrase. Separating "NO PARKING" and "FIRE LANE," spacing them 40 feet apart, does not meet intention of this ordinance. Fire lane markings shall be upon vertical surface of curb unless otherwise approved by the Chief.

F. Application:
   1. Apply markings at locations and to dimensions and spacing shown on Plans. Do not apply paint until layout and condition of surface have been approved by Engineer.
   2. Mix paint per manufacturer instructions and apply to pavement with a marking machine at 100-110 sq. ft. per gallon. Do not add thinner. 15 days shall elapse between placing bituminous surface course or seal coat and application of paint.
   3. Marking edges shall not vary from a straight line more than 1/2-inch in 50 feet, and dimensions shall be within a tolerance of ±5 percent. If indicated on Plans, distribute glass spheres to surface of marked areas immediately after application of paint. Furnish a dispenser properly designed for attachment to marking machine and suitable for dispensing glass spheres. Apply spheres at 10 pounds per gallon of paint.
   4. Furnish certified test reports for materials shipped to Project. Reports shall not be interpreted as a basis for final acceptance. Notify Engineer upon arrival of a paint shipment to job site. Return all emptied containers to paint storage area for checking by Engineer. Do not remove containers from site or destroy until Engineer authorizes.

G. Protection: After application of paint, protect all markings from damage until paint is dry. Protect all surfaces from disfiguration by spatter, splashes, spillage, or drippings of paint.

END OF SECTION

SECTION 33 10 00 - WATER UTILITIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Pipe and fittings for site water line including domestic water line and fire protection water lines from 5-foot outside the building to public water mains.
   2. Valves and fire hydrants.

B. Related Requirements:
   1. Division 01 Specification Sections apply to Work of this Section.
   2. Section 31 23 33 "Trenching and Backfilling."
   3. Section 33 13 00 "Disinfecting of Water Utility Distribution."

1.2 REFERENCES

A. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
B. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
C. ASTM B 88 - Seamless Copper Water Tube.
D. ASTM D1557 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb Rammer and 18-inch Drop.
E. ASTM D1785 - Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
F. ASTM D2241 - Poly (Vinyl Chloride) (PVC) Plastic Pipe (SDR-PR).
G. ASTM D2466 - Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
H. ASTM D2855 - Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and fittings.
I. ASTM D2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
J. ASTM D3017 - Test Methods for Moisture Content of Soil and Soil-Aggregate Mixtures.
K. ASTM D3139 - Joints for Plastic Pressure Pipes using Flexible Elastomeric Seals.
L. ASTM D3035 - Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Controlled Outside Diameter.
M. AWS A5.8 - Brazing Filler Metal.
N. AWWA C104 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
O. AWWA C105 - Polyethylene Encasement for Ductile Iron Piping for Water and Other liquids.
P. AWWA C111- Rubber-Gasket Joints for Ductile Iron and Grey-Iron Pressure Pipe and Fittings.
Q. AWWA C151 - Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids.
R. AWWA C500 - Gate Valves, 3 through 48 in NPS, for Water and Sewage Systems.
S. AWWA C502 - Dry Barrel Fire Hydrants.
T. AWWA C504 - Rubber Seated Butterfly Valves.
U. AWWA C508 - Swing-Check Valves for Waterworks Service, 2 in through 24 in NPS.
V. AWWA C509 - Resilient Seated Gate Valves 3 in through 12 in NPS, for Water and Sewage Systems.

W. AWWA C600 - Installation of Ductile-Iron Water Mains and Appurtenances.
X. AWWA C606 - Grooved and Shouldered Type Joints.
Y. AWWA C900 - Standard for Polyvinyl Chloride (PVC) Pressure Pipe, 4 inches through 12 inches, for Water.
Z. AWWA C901 - Polyethylene (PE) Pressure Pipe, Tubing, and Fittings, 2 inches through 3 inches, for Water
AA. UL 246 - Hydrants for Fire - Protection Service.

1.3 SUBMITTALS FOR REVIEW

A. Provide Product Data on pipe materials, pipe fittings, valves, and accessories.

1.4 SUBMITTALS AT PROJECT CLOSEOUT

A. Record actual locations of piping mains, valves, connections, and invert elevations.
B. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.5 QUALITY ASSURANCE

A. Perform Work per standards of local municipality for public items in right-of-way.
B. Valves: Manufacturer's name and pressure rating marked on valve body.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect, and handle products to site to prevent damage.
B. Deliver and store valves in shipping containers with labeling in place.

PART 2 - PRODUCTS

2.1 PIPE MATERIALS

A. Verify with local municipality regarding allowed fire line material types. Types and classes of pipe used at various locations shall be as scheduled on Proposal, Drawings, and:

Pipe Size	Type Pipe
1- to 3-inch Diameter	Seamless Pex Tubing, ASTM B88 or Polyethylene Plastic Tubing, ASTM D2737, 160 psi.
4-inch to 12-inch	PVC Pipe, AWWA C-900, or Ductile Iron Pipe, Diameter Pressure Rating 150 psi.
16-Inch Diameter	Ductile Iron Pipe, Pressure Rating 150 psi.

B. Pipe shall be best quality in materials and workmanship. All pipe shall be subjected to thorough inspection at the job site before placing in trench. Reject and remove any piece found defective from Project.

C. Ductile Iron Pipe:
   1. All ductile iron pipe shall be new and manufactured in the U.S. per current AWWA C 151.
   2. Pipe shall be designed for a minimum working pressure of 150 pounds per square inch. Thickness of ductile iron pipe shall be designed per Specification AWWA C 150, based on 150 pounds per square inch, working pressure for 10 feet of cover and laying condition Type 2.
   3. Standard Bell and Spigot, Mechanical Joint (Type III), or boltless single gasketed joint pipe similar to that known as "Bell-Tite", "Fastite", "Tyton", or approved equal, may be used for the line and at other specific locations as approved by Engineer. Flange joints where noted shall be 150 psi rated.
   4. Ductile iron pipe shall be asphalt coated outside and cement lined, and seal coated inside per AWWA C 104 (ANSI A21.4). Lining shall be standard cement lining.

D. PVC Pipe:
   1. PVC pipe shall conform to requirements of AWWA C900 pressure pipe, 4- through 12-inch for water distribution pressure class 150, DR18. PVC pipe shall be rubber gasketed push-on joint type and meet requirements of ASTM D1784 and D2241.
   2. All PVC pipe shall be approved by and bear the seal of National Sanitation Foundation Testing Laboratories (NSF), or other accredited laboratory for use in transportation of potable water.
   3. When non-metallic pipelines are installed, furnish and lay above pipeline a continuous strip of metallic identification tape.
   4. Tape Material:
      a. Metallic identification tape shall be at least 2 inches in width, corrosive-resistant metal, sufficient thickness to be stable and reflect electronic signals to electronic pipeline detector when buried to 24 inches below normal ground level.
      b. Metallic tape shall be painted blue on one side and with 1-inch-high letters painted continuously on same side of tape, "CAUTION: BURIED WATER LINE BELOW" or other words to this effect.
      c. Marking tape shall be "detectable Warning Tape," as manufactured by Omega Marking Company, or equal approved by Engineer.

E. Schedule 40 and 80 PVC Pipe shall be manufactured per latest edition of ASTM D2241, D1785 and shall conform to NSF standard #14 and ANSI/NSF Standard 61, using a PVC Compound having a minimum cell classification 12454B as defined by ASTM D1784. Bell ends shall conform to ASTM D2672, "Joints for PVC Pipe using Solvent Cements" when installed per ASTM D2855.

2.2 PIPE FITTINGS

A. General:
   1. Pipe fittings shall be ductile iron type and design especially suitable for use with piping installed. Fittings for PVC pipe shall also be of ductile iron. Pressure rating of fittings shall not be less than pipe.

2. All mechanical joint fittings shall be ductile iron with retainer gland. Fittings shall be produced per ANSI/AWWA C153/A21.53 and C111/A21.11, cement lined, and seal coated per ANSI/AWWA C104/A21.14. Retaining gland set screws shall be square heads with Type C knurled cup points manufactured of 4140 grade alloy steel and heat treated to Rockwell "C" 45/53 core hardness.
3. All flanged fittings shall be faced and drilled per standard drilling for ANSI B16.1, Class 125 flanges. Bolts for flanged joints shall be length and diameter required by ANSI. Bolts and nuts shall be best quality mild steel and provided with hexagonal heads. Suitable 1/8-inch-thick rubber ring gaskets provided for all flanged joints.

B. Ductile Iron Pipe Fittings:
1. Fittings shall be ductile iron and conform to AWWA C 110. Use flanged fittings for fire hydrant valve leads or where indicated on Plans. All other fittings shall be ductile iron mechanical joint or push-on joint unless otherwise shown on Drawings. All fittings shall have a pressure rating equal to pipe with used but no less than 250 psi.
2. Unless otherwise indicated, all ductile iron fittings shall have an external bituminous coating and be cement-lined per Specifications for coating and lining pipe.
3. All ductile iron fittings shall be cast from same quality metal used in casting ductile iron pipe and subjected to same test requirements. Marking and weighing shall be as required for ductile iron pipe.
4. Where flanged fittings used, flanges shall be same material as fitting. Where bell or mechanical joint fittings used, bells shall be cast integrally with fitting. Screwed-on bells not acceptable.

C. Schedule 40 and 80 Fittings shall conform to ASTM D2467, D1784, NSF Standard 61/41 Plastic Fittings for potable water. PVC material shall meet/exceed cell classification 12454, as manufactured by Spears Manufacturing Company, or approved equal.

2.3 PIPE JOINTS

A. Push-on Joints: As specified in AWWA Standard C 111.
B. Mechanical Joints: As specified in AWWA Standard C 111.
C. Flanged Joints: Shall meet requirements of AWWA C110, faced and drilled per ANSI B16.1. Bolts shall be length and diameter required by ANSI Specification for Class 125 flanges. Bolts and nuts shall be best quality mild steel and provided with hexagonal heads, except where other types of bolts specified. Suitable gaskets shall be used in all flanged joints.
D. Miscellaneous Joints: Made as specified in herein or as recommended by manufacturer. All joints shall be made using materials and methods as required to produce joints to function satisfactorily under the various conditions encountered.

2.4 VALVES

A. Valves 12 inches and smaller shall be gate valves and those 14 inches and larger shall be butterfly valves, unless otherwise noted on Plans or specified herein. All valves shall be designed for a working pressure at least 150 psi.

B. Gate Valves:
   1. All shall be resilient seat, iron body, bronze mounted throughout and meet all requirements of AWWA C 509. Valves shall be type of joint used in piping. All valves shall open by turning left, and unless otherwise specified, non-rising stem, furnished with a 2-inch operating nut when valves are outside buildings, and furnished with hand wheels when inside buildings or valve vault. Gate valves furnished with O-ring stem packing.
   2. All shall be designed to withstand a working pressure of 150 pounds per square inch. All valves shall be Mueller Company A-2370 or approved equal.
   3. Valves required in lines smaller than 3 inches in diameter, 150 psi water pressure, heavy duty, brass or bronze gate valves, double disc or wedge type, Crane, Walworth, or approved equal. Valves in copper lines shall have solder-joint ends.
   4. All interior cast iron surfaces shall be epoxy coated per details noted herein.

C. Tapping Sleeves and Valves:
   1. Tapping sleeves shall be designed for a working pressure of 150 psi, mechanical joint, or as required to make connection. Tapping sleeves shall be Mueller, ductile iron, with duck-tipped gaskets, or approved equal.
   2. All interior cast iron surfaces shall be epoxy coated per details noted herein.
   3. Tapping valves shall be resilient seat Mueller mechanical joint valves designed for a working pressure of 150 psi or approved equal.

D. Valve Boxes and Extension Stems:
   1. Extension stems furnished on buried valves where top of operating nut is more than 36 inches below finished grade. Top of extension stem shall not be more than 9 inches below top of valve box.
   2. Buried valves provided with cast iron valve boxes. Boxes shall be designed to fit over a section of 6-inch C900 PVC riser pipe used as an extension from top of valve to within 8 inches of ground surface. Box shall have a heavy, cast-iron cover. Box shall have a flange-type base, with base approximately 4 inches larger in diameter than outside diameter of box barrel. Necessary length of 6-inch C900 PVC riser pipe required for extension is considered as a part of box.

E. Internal Epoxy Coating for Valves:
   1. All interior wetted ferrous surfaces of all types of valves will be coated with an epoxy. Coating shall be a 2-part, thermal setting epoxy protective coating, and function as a physical, chemical, and electrical barrier between base metal applied and surroundings. Coating shall be nontoxic and not impart taste of water. Coating must be formulated from material deemed acceptable per Food and Drug Administration document Title 21 of the Federal Regulations on food additives, Section 121.2514 is entitled, Resin and Polymeric Coatings. Coating shall have a satin finish and suitable for field overcoating and touch-up with same coating material without sanding, special surface preparation, or application of heat in excess of room temperature. Coating shall have a successful record of performance in valves, pipe, or other allied equipment minimum 2 years. Coating adhesion to substrate shall exceed cohesion of coating film as demonstrated by:
      a. Prepare test panel and apply coating per manufacturer recommendation.
      b. After sample properly cures per manufacturer recommendation, scribe an "X" through coating to metal substrate using a sharp knife or scalpel.
      c. Juncture of 2 scribes, use knife point to attempt to lift off coating. Coating should not lift off substrate or between coats readily but break up leaving coating material on substrate of damaged area.
      d. No disbondment of film shall be noted as tested after immersion in tap water for 1,500 hours at 100 degrees F.

      Falling sand abrasion test using ASTM D968 shall produce an abrasion coefficient of 25.30 liters per mil. As an alternative, a Taber Abrader Test should find 3.5 to 3.7 milligrams of coating loss per 100 cycles when using a CSFS #10 wheel (1,000 gram weight).

2.5 FLEXIBLE COUPLINGS AND FLANGED COUPLING ADAPTERS

A. Flanged coupling adapters and flexible couplings provided at locations shown on Drawings and other locations required to install piping system. Flanged coupling adapters provided with anchoring studs. Use epoxy coated steel construction for couplings larger than 12 inches. Couplings smaller than 12-inch shall be cast iron.

2.6 FIRE HYDRANTS

A. Fire hydrants shall conform to requirements of AWWA C-502 dry-barrel type and designed for a bury length of 5 feet; however, length may vary according to field conditions and Contractor required to add extensions to position top of flange at elevation noted on Plans or as directed by Engineer. Extensions considered incidental to fire hydrant installation and no direct payment given.
B. Hydrants shall have a 5-1/4-inch valve opening, two 2-1/2-inch hose nozzles, and one 4-1/2-inch pumper nozzle. Use a swivel flange to face hydrant nozzles in any position.
C. Hose threads shall be National Standard Threads.
D. Hydrants shall be sized for 6-inch mains and with inlet connection compatible with pipe used. All gaskets, nuts, bolts, and other jointing materials shall be considered part of fire hydrant installation.

E. Operating nut shall be standard 1-1/2-inch pentagon opening counterclockwise. Hydrant shall close with pressure.
F. Hydrants shall be painted per standards of local municipality.
G. Fire hydrants shall be located at points shown on Plans, exact location of hydrant established by Engineer. All hydrants shall be set plumb to grade as established by Engineer with nozzles parallel with/at right angles to curb, pumper nozzle facing curb per details shown on Plans.
H. Support hydrants as not to cause a strain on fire hydrant lead or branch. Bowl of hydrant shall be well braced against unexcavated earth at end of trench with concrete backing. Place concrete backing so as not to interfere with hydrant drains so joints or flanges are accessible.
I. Connect each hydrant to main with 6-inch PVC branch controlled by an independent 6-inch resilient seat gate valve. Set each hydrant upon a stone or concrete slab not less than 4 inches thick nor less than 1 square foot of surface area. Where solid rock exists in bottom of trench and same is excavated to proper depth to form a foundation for hydrant, slab of stone or concrete may be omitted.
J. Place around base of hydrant no less than 7 cubic feet of sound broken stone, clean gravel, or other suitable material to provide reservoir capacity so hydrant will completely drain when closed. Gravel or broken stone shall reach from bottom of trench to at least 6 inches above waste opening in hydrant. Operate each hydrant to prove to inspector that drain hole has not been plugged with concrete or other material.
K. Hydrants shall have a breakable safety flange, located approximately 2 inches above ground, and breakable stem coupling and barrel which breaks cleanly upon impact. Main valve shall also remain closed without loss of water.
L. Hydrants shall be AWWA-improved-type hydrants and be Mueller Centurion Hydrants, or approved equal, with self-oiling reservoirs, internally epoxy coated as noted in Article 2.4.

PART 3 - EXECUTION

3.1 WATER SERVICE CONNECTIONS

A. Requirements of installing services on public right-of-way, from main line to meter box:
   1. Service Taps: Tapping saddles shall be Smith-Blair Taper Seal Style 313 or DMD Dresser Style 194 or approved equal. Service taps on PVC water lines shall be use hinge-type or double-strap saddles. Tapping saddles shall support full circumference of pipe with a bearing area of sufficient width along pipe axis to prevent pipe distortion when saddle is tightened.
   2. Polyethylene Plastic Tubing: Service lines shall be constructed with polyethylene plastic tubing as specified in ASTM D2737 with a 160-psi rating unless otherwise noted on Plans. Service line shall be pipe from water distribution line to water meter. Pipe shall be sized to match nominal water meter size.
   3. Copper Tubing: Service lines may be constructed with seamless copper water tube ASTM B88, Type K, of sizes required.

4. Meter Boxes, Meter Stop, and Corporation Stop: Meter boxes shall be corrugated metal pipe with locking cast iron lids as specified on Plans. Meter stops, corporation stops, and service clamps for service connections of various sizes shall be as specified on Plans. Corporation and meter stops shall be compatible with pipe material furnished.

3.2 EXCAVATION, TRENCHING, AND BACKFILLING

A. Excavate trench to lines and grades as established by Engineer and as shown on Plans. Depth of cover for all pipelines on which grades and elevations not shown on Plans, shall be 42 inches. Amount of cover may vary over or under 42 inches as directed by Engineer.
B. Minimum width of trench shall be outside diameter of pipe plus 12 inches; maximum width shall be outside diameter of pipe plus 18 inches. Maintain trenching equipment on a sufficiently-level roadbed to provide substantially vertical trench walls. Maximum horizontal offset of trench wall from bottom of trench to top of trench (undercutting), shall be 4 inches.
C. Excavate trench to even grade so bottom of pipe will rest on trench bottom throughout entire length of pipe. To obtain a true even grade, fine grade trench by hand. On lines to be laid to established grades, set batter boards at 50-foot intervals and grade trench to established grade.
D. Correct any part of trench excavated below grade by filling with approved material and thorough compacting.
E. If large rock, rock fragments, or other unyielding material encountered in trench bottom trench, remove to 3 inches below grade, refill with selected material, and thoroughly compact.
F. Dig bell holes of ample dimensions at each joint to permit proper jointing of pipe, and sufficient depth to prevent bell of pipe from resting on undisturbed materials.
G. Where necessary to prevent caving, adequately brace and sheet trench.
H. In all trench excavation where depth of excavation is 5 feet or more, shore, sheet, or brace trench wall per OSHA requirements.
I. Trench digging machinery may be used to make trench excavations except where operation would cause damages to trees, buildings, or other existing structures above or below ground. Employ hand methods in such instances.
J. Pile all excavated material so as not to endanger Work or existing structures and to cause least amount of obstructions to walks and driveways.
K. No classification of excavated materials. "Excavation" includes all materials encountered in excavating trenches or structural excavations.
L. Take all necessary precautions for protecting paved areas from damage by trenching and backfilling equipment. Repair any damage done to any paved area outside of area set forth in Plans as a result of the construction Work at Contractor expense.
M. Where lines are located behind curbs, take special precautions to protect trees and shrubs. Exercise care to cause as little damage to lawns as possible. Where lines cross under curbs, gutters, or curbs and gutters, tunneling will be required.

N. As soon as practicable after laying and jointing pipe, completion of bedding and structures, backfill trench per trench backfill detail in Plans and coordinate with Section 31 23 33 "Trenching and Backfilling."

O. Metallic Tape:
   1. Backfill over non-metallic pipelines to less than 24 and not more than 12 inches from top of cut of ditch section where pipeline is laid. Stop backfilling material at a generally uniform level. All machine tamping, jetting and other compaction activities shall be accomplished up to this point of height in backfilling before marking tape placed in trench.
   2. Lay marking tape in pipe trench, held in position by spot placement of backfill materials over it to keep from sliding to sides/ blown about in ditch by wind. Lay tape with painted side, also side with the identification lettering, in "up" position. Lay tape in flat position and keep there until backfill is accomplished.
   3. Complete backfilling operation so marking tape is not cut, crimped, ruptured, or separated by backfilling Work.

3.3 PIPE INSTALLATION - WATER LINES

A. Unload, handle, lay, joint, test for defects and leakage, and disinfect all pipe and accessories as specified.

B. Inspect pipe, fittings, valves, and accessories upon delivery and during Work progress Work. Engineer shall reject any material found defective and Contractor shall remove such defective material from site of Work.

C. Responsibility for Materials: Contractor responsible for all material he furnishes and replaces, at own expense, all material found defective in manufacture or become damaged in handling after delivery.

D. Handling Pipe and Accessories:
   1. Unload all pipe, fittings, valves, and other accessories, unless otherwise directed at point of delivery, then haul to and distribute at site of Work. In loading and unloading, lift by hoists, slide, or roll on skidways to avoid shock or damage to materials. DO NOT drop. Pipe handled on skidways must not be skidded or rolled against pipe already on the ground.
   2. Place pipe, fittings, and accessories along site to keep as free as possible from dirt, sand, mud, and other foreign matter.

E. Alignment and Grade:
   1. Lay and maintain all pipe to lines and grades shown on Plans or as established on ground by Engineer.
   2. Where necessary to deflect pipe from a straight line in a vertical or horizontal plane to avoid obstructions, plumb valves, or where vertical or horizontal curves shown or permitted, degree of deflection at each joint shall not exceed half maximum deflection recommended by manufacturer of particular kind of pipe laid and degree of deflection approved by Engineer.

F. Manner of Handling Pipe and Accessories into Trench: After trench grade is completed, all bell holes dug, and the grade inspected, place pipes and accessories in trench. Carefully lower all pipe, fittings, and valves into trench, piece-by-piece, by derricks, ropes, or other suitable tools or equipment, to prevent damage to material in any way. Under no circumstances shall pipe or accessories be dropped or dumped into trench.

G. Cleaning and Inspecting:
   1. Before lowering into trench, again inspect pipe for defects and lightly hammer pipe, while suspended, to detect cracks. Reject any defective, damaged, or unsound pipe and materials.
   2. Remove all foreign matter or dirt from inside pipe and all bells, spigots, or parts of pipe used in forming joint, before lowering pipe into trench, and keep clean by approved means during and after laying.

H. Laying and Jointing PVC Pipe:
   1. Handle and install PVC pipe in strict accordance with manufacturer recommendations. Exercise special care in handling PVC pipe, preparing trench for pipe laying, and compacting and bedding under and around each side of pipe.
   2. Clean ring groove before installing rubber ring. Carefully install ring in groove as recommended by manufacturer. Wipe spigot end of pipe clean and lubricate using recommended lubricant. Carefully insert spigot end into bell end until reference mark on spigot end is flush with end of bell.
   3. Cutting o pipe for inserting valves, fittings, or closure pieces shall be neat and workmanlike without damage to pipe or cement lining.
   4. Complete jointing for all pipe laid each day, not leaving open joints in trench overnight. When not laying pipe, close open ends of pipe by approved means, and no trench water permitted to enter pipe.
   5. Do not lay pipe in water or when trench conditions/weather areas unsuitable for such Work, except by permission of Engineer.
   6. Use flanged joints where shown on Plans. Install mechanical or other approved joints with materials furnished by manufacturer per manufacturer Specifications.
   7. Bolt flanged joints, where used, with flange bolts of best quality mild steel and size and length required by American Standards Association. Bolts and nuts provided with standard hexagonal heads. Use gasket rings of best quality 1/16-inch-thick rubber composition sheet packing, or brand and quality approved by Engineer.
   8. Properly align pipe and fittings, free to move in any direction while bolting, and gradually tighten bolts at a uniform rate around entire flange.

I. Setting Valves, Valve Boxes, and Fittings:
   1. Set valves and fittings at locations shown on Plans or locations established by Engineer and set and joint to pipe as specified for pipe installations. All valves buried in the ground shall have a valve box set over valve with a concrete pad around valve box as shown on Drawings. Thoroughly inspect and check all valves for operation before installation. Provide concrete blocking for all buried valves.
   2. Firmly support and maintain valve boxes centered and plumb over wrench nut of valve, with box cover flush with surface of ground or level as directed.

J. Setting Fire Hydrants:
   1. Locate fire hydrants at points shown on Plans, exact location of hydrant established by Engineer. Set all hydrants plumb to grade as established by Engineer with nozzles parallel with/at right angles to curb, pumper nozzle facing the curb per details shown on Plans.
   2. Support hydrants as not to cause a strain on fire hydrant lead or branch. Well brace bowl of the hydrant against unexcavated earth at end of trench with concrete backing. Place concrete backing so as not to interfere with hydrant drains so joints or flanges are accessible.
   3. Connect each hydrant to main with a 6-inch PVC branch controlled by an independent 6-inch resilient seat gate valve. Set each hydrant upon a stone or concrete slab not less than 4 inches thick and not less than 1-sq. ft. of surface area. Where solid rock exists in bottom of trench and same is excavated to proper depth to form a foundation for hydrant, slab of stone or concrete may be omitted.
   4. Placed around base of hydrant, not less than 7 cu. ft. of sound broken stone, clean gravel, or other suitable material to provide reservoir capacity so hydrant will completely drain when closed. Gravel or broken stone shall reach from bottom of trench to at least 6 inches above waste opening in hydrant. Operate each hydrant to prove to inspector drain hole has not been plugged with concrete or other material.

K. Plugging Dead Ends: Insert standard plugs into bells of all dead ends and pipes, tees, or crosses and cap spigot ends. Joint plugs or caps to pipe or fittings in same manner used in jointing pipe. All plugs and caps shall have horizontal to thrust blocks.

L. Tunneling Under Utility Lines, Etc.: Where pipes, conduits or concrete curbs, gutters or other obstructions encountered in construction, cost of tunneling under such obstructions shall be included as a part of cost of pipeline, or other pay items, complete in place.

3.4 ANCHORAGE OF BENDS, TEES, AND PLUGS, ETC.

A. Apply reaction or thrust blocking to all pipelines at all tees, plugs, caps, and bends. Use concrete for blocking pipe and fittings and shall have minimum 28-day compressive strength of 2,500 psi, but otherwise conform to Item 421, Class B of the 2014 TxDOT Standard Specifications. Place blocking between solid ground and fitting anchored per details on Plans. Place blocking so pipe and fitting joints will be accessible for repair.

3.5 DISINFECTION OF PIPELINES

A. Furnish all labor, equipment, and materials necessary for disinfection of new pipelines disinfected before placing in service. Disinfect lines by applying chlorinating agent which may be a liquid chlorine, liquid chlorine gas-water mixture, or calcium hypochlorite solution, fed into lines through a suitable solution-feed device or other methods approved by Engineer. Apply chlorinating agent at or near point where line is filled. Control water used to fill line to flow into section disinfected very slowly, and rate of application of chlorinating agent shall be in proportion to rate of water entering pipe so chlorine dose applied to water entering line shall be at least 50 parts per million. Retain treated water in pipelines for not less than 24 hours. At end of retention period, thoroughly flush treated water from lines until replacement water in lines have chlorine residual not more than 0.5 parts per million; Engineer will designate blowoff valves in area around Project Site used to purge lines. Where necessary to place new lines in service in less than 24 hours, increase concentration of chlorine to 300 ppm, flush lines, and place in service in 3 hours. Disinfection procedures shall conform to AWWA C 651, latest revision.

B. After final flushing and before any section of water line placed into service, collect samples as directed by Engineer per AWWA C 651, latest revision. Collect minimum 1 bacteriological sample for each 1,000 feet of completed water line to check efficiency of disinfection procedures and repeat if contamination persists. Submit samples to an independent testing lab. Test samples per AWWA C 651, latest revision.

3.6 HYDROSTATIC TESTS

A. Test all water pipelines constructed under this Contract, before acceptance, as described herein. Test shall apply to all newly-laid pipe or any valved sections thereof. Contractor bears all costs of providing all equipment, materials, labor, and other incidentals required to test pipelines. Water of sufficient pressure to test pipelines will not be available, so Contractor provides suitable means for developing required pressure in lines.

B. Test each valved section of line for leakage as soon as practical after laying. Place sufficient backfill before testing to prevent any movement of pipe, but leave all joints exposed. Furnish water for filling line and necessary means for pressuring line. Duration of test shall be not less than 4 hours. Carefully check line for any evidence of leakage. Find cause of any leaks, correct, and retest line.

C. Test pipeline so pressure at lowest point in test section is at least 100 but not greater than 120 percent of pipe pressure class of pipe, and minimum pressure at highest point in test section is not less than 85 percent of pipe pressure class of pipe. Maximum allowable leakage for push-on joints is number of gallons per hour as determined by the following formula:

$$L = \frac{ND(P)^{1/2}}{7400}$$

Where:

L = Allowable leakage in gallons per hour.
N = Number of rubber-ring gasket joints in the length of the pipe tested.
D = Nominal diameter of the pipe in inches.
P = Average of the maximum and minimum pressures within the test section in psi.

3.7 CLEANING UP

A. After construction Work is complete and before final acceptance by Owner, remove all rubbish, excess materials, excess materials from excavations, and other debris from site of Work, and blade all trench surfaces as heretofore specified. Cost of cleanup included in the proposal prices for various units of Work.

END OF SECTION

SECTION 33 13 00 - DISINFECTING WATER UTILITY DISTRIBUTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes disinfecting potable water distribution system then testing and reporting results.
B. Related Sections:
   1. Division 01 Specification Sections apply to Work of this Section.
   2. Section 33 10 00 "Water Utilities."

1.2 REFERENCES

A. AWWA B300 - Standard for Hypochlorites.
B. AWWA B301 - Standard for Liquid Chlorine.
C. AWWA B302 - Standard for Ammonium Sulfate.
D. AWWA B303 - Standard for Sodium Chlorite.
E. AWWA C651 - Standards for Disinfecting Water Mains.

1.3 SUBMITTALS FOR INFORMATION

A. Test Reports: Indicate results comparative to specified requirements.
B. Certify cleanliness of water distribution system meets/exceeds specified requirements.

1.4 PROJECT RECORD DOCUMENTS

A. Submit test results to Engineer.
B. Disinfection report:
   1. Type and form of disinfectant used.
   2. Date and time of disinfectant injection start and time of completion.
   3. Test locations.
   4. Initial and 24-hour disinfectant residuals (quantity in treated water) in ppm for each outlet tested.
   5. Date and time of flushing start and completion.
   6. Disinfectant residual after flushing in ppm for each outlet tested.
C. Bacteriological report:
   1. Date issued, Project name, and testing laboratory name, address, and phone number.
   2. Time and date of water sample collection.
   3. Name of person collecting samples.
   4. Test locations.
   5. Initial and 24-hour disinfectant residuals in ppm for each outlet tested.
   6. Coliform bacteria test results for each outlet tested.
   7. Certification that water conforms, or fails to conform, to bacterial standards of local health department.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with AWWA C651.
B. Water Treatment Firm: Company specializing in disinfecting potable water systems specified herein with minimum 3 years' experience.
C. Testing Firm: Company specializing in examining potable water systems, approved by the State of Texas.
D. Submit bacteriologist's signature and authority associated with testing.

1.6 REGULATORY REQUIREMENTS

A. Conform to applicable code or regulation for performing Work herein.
B. Provide certificate of compliance from authority having jurisdiction indicating approval of water system.

PART 2 - PRODUCTS

2.1 DISINFECTION CHEMICALS

A. Chemicals: AWWA B300, Hypochlorite, AWWA B301, Liquid Chlorine, AWWA B302, Ammonium Sulfate, and AWWA B303, Sodium Chlorite.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify piping system has been cleaned, inspected, and pressure tested.
B. Perform scheduling and disinfecting activity with start-up, testing, adjusting, and balancing, demonstration procedures, including coordination with related systems.

3.2 EXECUTION

A. Provide and attach required equipment to perform the Work of this Section.
B. Introduce treatment into piping system.
C. Maintain disinfectant in system for 24 hours.
D. Flush, circulate, and clean until required cleanliness is achieved; use municipal domestic water.
E. Replace permanent system devices removed for disinfection.
F. Pressure test system to 150 psi. Repair leaks and retest.

3.3 FIELD QUALITY CONTROL

A. Test samples in accordance with AWWA C651.

END OF SECTION

SECTION 33 31 00.10 - SANITARY AND STORM UTILITY SEWERAGE PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. All sanitary sewer lines, manholes, service stubouts, service connections, and appurtenances constructed under this Project. Sanitary sewer lines shall be constructed per Specifications, at locations and conforming to lines, grades and dimensions shown on Plans or as required by Engineer. Manholes shall be constructed per details shown on Plans and specified herein.
2. This Section also covers all storm drain lines, manholes, and appurtenances constructed under this Project. Storm drain lines shall be constructed per Specifications at locations and conforming to lines, grades, and dimensions shown on Plans or as directed by Engineer. Manholes shall be constructed per details shown on Plans and as specified herein.
3. Contractor shall furnish all materials, equipment, tools, labor, superintendence, and incidentals required for construction of these items as shown on Drawings and specified herein. Reference to standard Specification numbers for materials and testing shall include latest revision of that Specification.

B. Related Sections:
1. Division 01 Specification Sections apply to Work of this Section.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Gravity Sewer Pipe:
1. All 4- to 15-inch gravity sewer pipe shall be polyvinyl chloride (PVC), except as otherwise specified.
2. Storm sewer pipe shall be high-density polyethylene (HDPE) or concrete.

B. PVC Pipe and Fittings: Sewer pipe and fittings shall be SDR-35 (greater than 3 or less than 12 feet of cover) or SDR-26 (less than 3 or greater than 12 feet of cover) for 4- to 15-inch pipe diameters and meet requirements of ASTM D3034 and PVC Material 12454-B. All sewer pipe joints shall be integral bell, bell, and spigot type with rubber gasket joints manufactured to conform to ASTM D1784 or D3139 and PVC Material 12454-B and ASTM F477 rubber gaskets.

C. HDPE Pipe and Fittings shall meet:
1. ASTM F405, Standard Specification for Corrugated Polyethylene Pipe and Fittings.
2. ASTM F667, Standard Specification for Large Diameter Corrugated Polyethylene Pipe and Fittings.
3. AASHTO M 252, Standard Specification for Polyethylene Corrugated Drainage Pipe.

4. AASHTO M 294, Standard Specification for Corrugated Polyethylene Pipe, 12-inch to 36-inch diameter.
5. Joint watertightness required to inhibit groundwater infiltration/effluent exfiltration. Watertight joints shall be sealed with an elastomeric gasket to meet/exceed performance requirements of ASTM F477. Diameters 24 inches and smaller shall meet ASTM D3212. Pipe shall be smooth interior Advanced Drainage Systems (ADS) N-12 or approved equal.

D. Concrete Storm Sewer Pipe shall meet requirements of Class III - Wall B and conform to AASHTO M170 or ASTM C76. Pipe shall be Gifford Hill Tongue and Groove C-76 or approved equal.

E. Service Sewers and Fittings shall be same material and Specification as line connected unless otherwise noted. All service sewer laterals shall be connected to mainline with tees, wyes, etc. that are bell and spigot with rubber gaskets. All service sewer taps shall use an approved gasketed fitting in conjunction with a full circle repair sleeve coupling unless otherwise noted.

F. Manholes shall be constructed of fiberglass as indicated in Proposal. Sewer manholes shall be constructed per design, size, details, and locations shown on Plans. Fiberglass-reinforced polyester manhole shall be manufactured from commercial-grade polyester resin or other suitable polyester or vinyl ester resins, with fiberglass reinforcements. Manhole shall be a
1-piece unit manufactured to meet/exceed all Specifications of ASTM D3753, latest edition, as manufactured by L.F. Manufacturing, Inc., Giddings, Texas, or approved equal.

G. Fiberglass Manhole Materials:
1. Resin used shall be a commercial-grade, unsaturated-polyester resin or other suitable polyester or vinyl ester resin.
2. Reinforcing Materials shall be commercial Grade E-type glass in continuous and chop roving, with coupling agent to provide a suitable bond between glass reinforcement and resin.
3. Interior Surfacing Material: Inner surface exposed to chemical environment shall be a resin-rich layer of 0.010-0.020-inch thick. Inner surface layer exposed to corrosive environment shall be followed with minimum 2 passes of chopped roving minimum 0.5-inch length to maximum 2.0-inch length and applied uniformly to equivalent weight of 3 oz/ft^2. Well roll each pass of chopped roving before application of additional reinforcement. Combined thickness of inner surface and interior layer shall not be less than 0.10-inch.
4. Wall Construction Procedure: After inner layer is applied, construct manhole wall with chop and continuous strand filament wound manufacturing process which insures continuous reinforcement and uniform strength and composition. The cone section, if produced separately, shall be affixed to barrel section at the factory with resin-glass reinforced joint resulting in a 1-piece unit. Seams shall be fiber-glassed inside and outside using same glass-resin jointing procedure. Field joints shall not be acceptable by anyone except manufacturer.
5. Exterior Surface: For UV inhibiter, resin on exterior surface of manhole shall have gray pigment added for minimum .125-inch thickness.

6. Stubouts and Connections: Stubouts shall be factory installed. Install SDR PVC sewer pipe by sanding, priming, and using resin fiber-reinforced hand layup. Resin and fiberglass shall be same type and grade used in fabrication of fiberglass manhole. Inserta-Tee fittings or Kor-N-Seal boots may be installed by manhole manufacturer using fiberglass reinforced pipe stubout for Kor-N-Seal boot sealing surface.
7. Manhole Bottom: Fiberglass manholes may be open-bottom and utilize cast-in-place concrete bottoms per Plans and Specifications.
8. Fillers and Additives: Fillers, when used, shall be inert to environment and manhole construction. Sand is not accepted as approved filler. Additives, (thixotropic agents, catalysts, promoters, etc.), may be added as required by specific manufacturing process used to meet requirements of this standard. Resulting reinforced-plastic material must meet Specification requirements.
9. Manufacture: Manhole cylinders, manway reducers, and connectors shall be produced from glass fiber-reinforced polyester resin using a combination of chop and continuous filament wound process. All manholes shall be designed so a ladder or step system can be supported by installed manhole. Manway reducers will be concentric with respect to larger portion of manhole diameters through 60 inches. Larger manholes may have concentric or eccentric manway reducer openings. Manhole shall provide an area to support a typical ring and cover plate without damage to manhole.
10. Exterior Surface shall be relatively smooth with no sharp projections. Handwork finish is acceptable if enough resin present to eliminate fiber show. Exterior surface shall be free of blisters larger than 0.5-inch in diameter, delamination, or fiber show.
11. Interior Surface shall be resin rich with no exposed fibers. Surface shall be free of crazing, delamination, blisters larger than 0.5-inch in diameter and wrinkles 0.1256-inch or greater in depth. Surface pits permitted if less than 0.75-inch in diameter and less than 0.0625-inch deep. Voids that cannot be broken with finger pressure and entirely below resin surface permitted if less than 0.5-inch in diameter and less than 0.0625-inch thick. Any manhole repair is required to meet all Specification requirements. Manhole lengths shall be in 6-inch increments $\pm$2 inches. Tolerance of inside diameter shall be ±1 percent of required manhole diameter.
12. Load Rating: The complete manhole shall have minimum dynamic-load rating of 16,000 lbf. when tested per ASTM 3753 8.4 (Note 1). To establish rating, complete manhole shall not leak, crack, or suffer other damage when load tested to 40,000 lbf., nor deflect vertically downward more than 0.25-inch at point of load application when loaded to 24,000 lb.

13. Stiffness: Manhole cylinder shall have minimum pipe-stiffness values shown in this table when tested per ASTM 3753 8.5 (Note 1):

Manhole Length in Feet	PSI
3 - 6.5	0.75
7 - 12.5	1.26
13 - 20.5	2.01
21 - 25.5	3.02
26 - 35	5.24

14. Soundness: To determine soundness, apply an air or water pressure test to manhole test sample. Test pressure shall not be less than 3 or greater than 5 psig. While holding at established pressure, inspect entire manhole for leaks. Any leakage through laminate is cause for failure of the test. Refer to ASTM 3753 8.6.
15. Chemical Resistance: When tested per ASTM 3753 8.7, percent-retention log of each property after immersion testing when platted against immersion time log extrapolated to 100,000 hours, shall assure retention of at least 50 percent of initial properties.
16. Physical Properties: All tests shall be performed as specified in ASTM 3753, latest addition, Section 8, Test Methods D790 and D695:

	Hoop Direction (psi)	Axial Direction (psi)
Tensile Strength	18,000	5,000
Tensile Modules	0.6×10^6	0.7×10^6
Flexural Strength	26,000	4,500
Flexural Modules	1.4×10^6	0.7×10^6
Compressive (psi)	18,000	10,000

17. Quality Control: Examine each completed manhole for dimensional requirements, hardness, and workmanship. Complete all required ASTM 3753 testing, keep records of all testing, and present copies of test records to Engineer upon formal written request. Manufacturer shall provide an independent certification indicating manhole was sampled, tested, and inspected per provisions herein and meets all requirements.
18. Shipping and Handling: Do not drop or impact fiberglass manhole. Lift fiberglass manhole by inserting a 4- by 4- by 30-inch timber into top of manhole with cable attached, sling, or choker connection around center of manhole. Lift as required. Use of chains or cables in contact with manhole surface is prohibited.

19. Concrete Bottom: Lower manhole into wet concrete until it rests at proper elevation, with minimum 4 inches of fiberglass manhole inserted into wet concrete below flow line, then move manhole to plumb. Concrete shall extend minimum 1-foot from outside wall of manhole and minimum 6 inches above incoming lines. Inside, concrete shall form invert area and rise minimum 4 inches above incoming lines. If required by Engineer, concrete may be used around reducer Section buoyancy.
20. Grade Adjustment Rings: Perform all final grade adjustment of manhole metal cover and frame assemblies utilizing injection-molded HDPE-grade adjustment rings as manufactured by LADTECH, Inc., 651.415.1252, 877.ADJ-RING, or approved equal. Use instead of concrete grade adjustment rings. Grade adjustment rings shall be manufactured from polyethylene plastic as identified in ASTM D1248 Standard Specification for Polyethylene Plastic Molding and Extrusion Materials. Test and qualify material properties for usage per ASTM D1248. Test grade adjustment rings to assure compliance with impact and loading requirements per AASHTO Standard Specification for Highway Bridges.
21. Completely install grade adjustment rings per manufacturer recommendations and "Fiberglass Manhole Details" in Drawings. Seal space between rings, fiberglass, manhole, and metal cover frame utilizing an approved, all-weather, preformed joint sealant made of butyl rubber to bond properly between HDPE-grade adjustment rings, fiberglass manhole, and metal cover frame.

PART 3 - EXECUTION

3.1 PIPE INSTALLATION

A. Pipe Trench Excavation:
1. Excavate pipe trenches to lines and grades shown on Drawings or as established by Engineer. Before excavation begins in paved areas, cut, or saw existing pavement to a neat line, meeting Engineer approval. Maximum width of trench below top of pipe shall be outside diameter of pipe plus 24 inches with pipe centered in trench. Maintain trenching equipment on a sufficiently-level roadbed to provide substantially vertical trench walls. Maximum horizontal offset of trench wall from bottom of trench to top of trench (undercutting), shall be 4 inches. Where necessary to stay within maximum width limits at top of pipe or maintain a relatively-straight trench wall to remain within available right-of-way, adequately brace and sheet trench. Trench wall is not allowed to slope at a greater than 1:1 slope, above top of pipe. Contractor is fully responsible for any damage to private property or existing facilities from inadequate trench sheeting.
2. Excavate trench to an even grade so pipe can be laid to true line and grade. To obtain a true even grade, fine grade, and shape trench to fit details as shown on Plans. Correct any part of trench excavated below grade by filling with approved material and thoroughly compacting. If clay, rock, or other unyielding material encountered in bottom of trench, remove to 6 inches below grade, refill with selected material, and thoroughly compact to grade.

3. Dig bell holes of ample dimensions at each joint to permit proper jointing and bedding pipe.
4. Before next phase of construction above trench bottom excavated to proposed subgrade of specified class of bedding, shape, and grade earth subgrade. Earth subgrade for bedding shall be free of surface water, firm, solid, and stable before specified class of bedding/pipe material laid.
5. If encountering ground water and cannot maintain a firm, solid, and stable earth subgrade, free of surface water, dewater trench.
6. Dewater by a well point system or other suitable means. Maintain dewatering until trench is satisfactorily backfilled then dewatering means systematically removed to allow ground water to gradually rise in trench. Arrange for disposal of ground water.
7. Use trench-digging machinery to make trench excavations except where operations cause damage to existing structures above or below ground. Employ hand methods in such instances. Locate all existing underground lines, of which you are advised whether or not shown on Drawings, sufficiently in advance of trenching operations to prevent any damage thereto. Use extreme care to prevent such damage and Contractor is fully responsible for damage to any such lines.
8. No classification of excavated materials. Excavate all materials encountered as required. Protect adjacent structures from damage by construction equipment. Place all excavated material along trench or haul away from Work area where required, not endangering Work. Remove all excess material from job site.

B. Granular Bedding and Backfill:
1. Lay all sewer pipe in prepared crushed rock bedding material and backfill as detailed on Plans. Granular bedding used around pipe shall be ASTM C33, Grade No. 8 or approved equal. Shovel slice crushed stone bedding around pipe haunches. Place bedding material in 6-inch maximum lifts per standard details in Plans. Lay first lift in pipe trench, shape and smooth to grade, and thoroughly consolidate by tamping. Check bedding material for grade and dig bell holes for pipe before laying pipe. If additional bedding required to bring first lift to grade, add and compact additional bedding before laying pipe. After pipe is laid, lay second lift of bedding around haunch of pipe, and thoroughly consolidate by shovel slicing and tamping. Add subsequent 6-inch lifts of bedding to spring line of pipe per standard details in Plans.
2. Granular encasement material used in pipe zone shall be ASTM C33, Grade No. 8 or approved equal. Place granular encasement backfill material in 6-inch maximum lifts and compact.
3. Backfill material used above the pipe zone shall be:
    a. Rock crusher fines;
    b. Cement stabilized backfill; or
    c. Approved trench spoil material.

4. Rock Crusher Fines used for backfill operations shall be sharp, grained particles of crushed stone and meet the following gradation:

Sieve Size	Percent Passing
2"	100
#4	35-100
#10	20-100
#40	5-35
#200	4-10

5. Install all crushed stone per details shown on Plans and consolidate in place by rolling.
6. Uniformly wet crushed stone screenings (crusher fines) throughout with sufficient moisture to assure proper compaction before placing material in pipe trench. Place material in 12-inch loose lifts and compact in place using approved compaction equipment. Backfill all approved backfill material placed in top 4 feet of trench located in a public right-of-way, parking lot, or where, in Engineer opinion, excessive settlement would jeopardize a future structure, in 12-inch loose lifts and compact to 95-percent density as determined by ASTM D698. Place all other approved backfill material in 12-inch loose lifts and compacted to 90 percent density as determined by ASTM D698. All areas in public rights-of-way where grass will be planted shall have topsoil placed in top 12 inches.
7. Portland cement stabilized backfill shall consist of caliche base material, blow sand, or native soil stabilized by addition of Portland cement. DO NOT use crushed stone or concrete aggregate.
8. Submit a mix design prepared by approved commercial laboratory to produce a minimum 7-day compressive strength of 150 psi. In no case shall minimum cement content of mix be less than 1 sack per cu. yd.
9. Cement used in Portland cement stabilized backfill shall be Types I/II conforming to requirements of ASTM C150.
10. Caliche used for Portland cement stabilized backfill shall be crushed material conforming to Texas State Department of Highways and Transportation 1982 Standard Specifications for Construction of Highways, Streets and Bridges Item 248 Type F, Grade 2.
11. Blow sand used for Portland cement stabilized backfill shall be clean, free from organic matter, clay lumps, rock, and other deleterious matter.
12. Native soil used for Portland cement stabilized backfill shall be clean, free from clods and organic matter, and rock in excess of 2 inches.
13. Portland cement stabilized caliche backfill or Portland cement stabilized native soil backfill may be constructed using either dry or wet method.

14. Dry method of stabilized backfill construction consists of dry mixing cement and caliche, sand, or soil to produce a homogenous mixture then adding and mixing sufficient water for proper compaction and hydration of cement. Water content of mixture will be approximately 1-2 percent above optimum moisture for soil compaction. Mix by using batch mixers, on job site by blade mixing, or other suitable method to produce desired backfill material. Place mixed material in lifts, up to maximum 12 inches and compacted to 95-percent modified proctor density by suitable compacting equipment.
15. In wet method of cement stabilized backfill construction, mix materials in approved concrete batching plant or mixer to consistency of concrete and place as concrete is placed. Slump of backfill material shall so all voids will be filled, approximately 4-6 inches. Consolidate backfill by rodding or mechanical vibrators.
16. Mix design used must be for method of placement chosen.
17. Mix Portland cement stabilized blow sand backfill and place by wet method.
18. Minimum number of compaction tests conducted on backfilled material shall be 1 test per 40 cu. yds. of backfill or 1 test per 150 linear feet of trench.
19. All pipe bedding and backfill material shall be crushed and have at least 2 broken faces. Pea gravel will not be allowed.
20. Approved trench spoil material shall meet the following criteria:
    a. Screen trench cuttings to obtain a uniformly-graded crushed stone with no rock larger than 2 inches.
    b. Liquid Limit shall not be greater than 30.
    c. Plasticity Index shall not be greater than 10.
    d. Use of trench spoil material as backfill shall be preceded by on-site sampling, testing, and approval of material.
    e. Provide equipment and personnel as required to obtain minimum 1 representative trench spoil sample at a location and depth representative of Project. This sample shall be tested by a geotechnical laboratory to determine parameters required. Project Engineer and the City of Hutchins will review test results for suitability. During Project, notify Engineer if materials encountered which differ appreciably from those tested.

3.2 SANITARY SEWER AND STORM DRAINPIPE INSTALLATION

A. Unload, handle, lay, joint, and test all sewer pipe and fittings for defects as specified.
B. Inspection:
    1. Inspect pipe and fittings upon delivery and during Work progress. Reject any material found defective and remove such defective material from site of Work.
    2. Contractor is responsible for all materials he furnishes and shall replace, at his own expense, all material found defective in manufacture or damaged in handling after delivery.

C. Pipe Laying:
   1. After trench is properly fine graded and bedded, lay pipe per Specifications. Inspect each length of pipe for defects and thoroughly clean inside and outside spigot before lowering into trench. Pipe laying shall proceed up-grade with spigot ends pointing in direction of flow. Lay all pipe true to lines and grades established by Engineer. Use a properly-calibrated laser instrument to lay pipe on grade. Dig bell holes at each joint sufficient depth to allow entire length of pipe barrel to rest on bottom of trench and allow ample space for properly jointing pipe.
   2. Complete jointing for all pipe laid each day, not leaving open joints in trench overnight. When not laying pipe, properly plug open ends of pipe. DO NOT lay pipe in water or when trench conditions/weather is unsuitable for such Work.
   3. If water gets in trench before joint is completed or pipe is disturbed from line and grade after laid, take up pipe, clean joints, and re-lay pipe.
   4. Place plugs in lines at locations shown on Plans or as directed by Engineer.
   5. Work shall be watertight at all joints and any leaks or defects immediately repaired. Take up any pipe disturbed from any cause after laying in final position, clean joint, and properly re-lay pipe.
   6. Take precautions necessary to protect sewer pipe that is laid. At end of day or when necessary, plug all exposed ends of sewer pipe (main line or interconnects) to prevent inflow of stormwater or other objectionable materials, animals, and humans. Prevent these flows from damaging or entering the sewer pipe. Installation of PVC pipe shall conform to ASTM D2321-72 Underground Installation of Flexible Thermoplastic Sewer Pipe, recommended practice of pipe manufacturer, and/or as specified herein per details on Plans.

D. Sanitary Sewer Service Connections:
   1. By definition, a sewer service connection is that part of an individual sewer lateral located on City property from the tee in main line out to property line of residence or business. All Work shall meet minimum requirements of the City of Florence, Texas.
   2. Requirements for bedding, laying, and backfilling sewer service connections shall be the same as required for main sewer line.
   3. Sanitary Sewer Service Connections on Existing Sewer Lines: New sewer service connection taps to existing lines shall use a gasketed fitting in conjunction with full-circle repair sleeve coupling. Cut clay pipe using a 4-inch core-cutting machine to remove coupon from pipe. DO NOT hammer, chisel, etc. hole in clay pipe.

E. Backfill:
   1. As soon as practicable after laying and jointing pipe, completion of bedding and structures, backfill trench per trench backfill detail in Plans.
   2. After completion of trench backfill in streets, alleys, driveways, etc. complete base replacement per details shown on Plans. Maintain and repair base surface/trench backfill as necessary to provide safe driving conditions for the public until surface is restored by others.

F. Maintaining Existing Sewer System in Operation:
   1. At several locations as shown on Plans, proposed sewer will be interconnected to existing sewer system. At all times provide adequate means to insure continuous operations of existing sewer system during construction operations. This may require blocking existing line at a manhole and pumping sewage around construction area. All pumping or diversion shall be Contractor responsibility and included in price bid for various pipeline items.
   2. Schedule Work to minimize interruption time to existing services along proposed sewer line.

3.3 MANHOLES

A. General:
   1. Construct manholes at locations shown on Plans, directed by Engineer, and per details shown on Plans and specified herein. After excavation is complete, grade, level, and consolidate subgrade for manhole base by tamping to achieve minimum 90 percent density. Test as outlined in AASHTO Method T180; method selected by testing laboratory and approved by Engineer. Lay minimum 6 inches of rock bedding on prepared subgrade and allow precast base section to sit in place level and plumb. With precast base online and at grade, riser Work may proceed.
   2. Fill all lift holes with approved bitumastic material before final acceptance. Grout voids in invert around sewer pipe inside wall of manholes with 2,000 psi concrete, to conform with rest of wash, per standard manhole details.
   3. Connecting Sanitary Sewer Service into Existing Manhole shall be per design, size, details, and at locations shown on Plans. Make connection by coring a hole inside of existing manhole and installing a Kor-N-Seal boot or other approved equal.

B. Backfill around manholes shall be per details shown on Plans.

3.4 LEAKAGE

A. Perform leakage tests on all sewer lines and manholes after installation. Test sewer lines on Sections of pipe between manholes. Test each Section of sewer line using Air Test Methods, per ANSI/ASTM C828 (latest revision).

B. Use a water test to check leakage in a manhole. Leakage in manhole tested shall not exceed allowable leakage for smallest diameter pipe connected into manhole tested.

C. If a test fails to meet minimum allowable requirements of test, immediately determine cause, make necessary repairs, and retest. All testing and repair Work is at Contractor expense.

D. DO NOT perform leakage testing until all backfill material required is placed and densified for 30 days, unless specifically authorized by Engineer.

3.5 DEFLECTION TEST

A. Make a deflection test on all flexible sewer pipe. DO NOT test on a section of sewer until all backfill on that section is placed and densified for 30 days, unless otherwise authorized by Engineer.
B. Run deflection test using a rigid Go No-Go mandrel with a diameter equal to 95 percent of base inside diameter of pipe. Submit Shop Drawings of mandrel to Engineer for approval before using mandrel for testing.
C. Perform test without mechanical-pulling devices. Where possible and practical, initiate testing at a downstream manhole and proceed upstream.
D. No pipe shall exceed a 5 percent deflection of base inside diameter of pipe. Correct all excess deflections. Excavate to point of excess deflection, correct deficiency, and retest pipe. If pipe retest fails 5 percent allowable deflection, replace pipe.
E. All testing and repair Work shall be at Contractor expense.

3.6 CLEANING UP

A. After construction Work is completed and before final acceptance by Owner, remove all rubbish, excess pipe materials, and other debris from Work site then blade all trench surfaces as heretofore specified. Stockpile excess earth materials resulting from trench excavations near Project Site as coordinated with Owner. Cost of cleanup included in Bid prices for various units of Work.

END OF SECTION