

# TECHNICAL PROJECT MANUAL



## Lamar State College Port Arthur Ruby Fuller Education Building *TDLR # TABS2020015978*



**SIGMA**ENGINEERS  
Innovative Solutions | Solid Designs

SEI Project No. 19-148  
May 2020  
Set No. \_\_\_\_\_

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## **Section 010000 Miscellaneous Requirements**

### **1. Summary**

These Miscellaneous Requirements are issued as supplements to the Uniform General Conditions for Construction Contracts (UGCs) and any Special Conditions that form a part of the Contract for Construction between the Owner and the General Contractor (or Construction Manager, or Design-Build Contractor). The term “Contractor”, as used herein, is meant to refer to a General Contractor, or a Design-Build Contractor, or a Construction Manager. Should any provision of these Division 1 Specifications conflict with the Contract, the UGCs or the Special Conditions, the latter shall govern.

### **2. Removal of Debris (see Section 015240)**

The Contractor shall remove and legally dispose of all demolition debris and all unused construction materials off-site. Unless specifically noted otherwise, all excess earth and rock excavation materials shall be removed and disposed of off-site. Such demolition debris, unused construction materials and excess excavated earth and rock shall be handled, transported and legally disposed of at the Contractor’s expense.

### **3. Drawings and Specifications (also see UGC Article 6)**

3.1 The Drawings and Specifications are intended to describe and provide for a finished and complete piece of Work that meets the requirements of all the applicable governing laws, ordinances, rules, and regulations of the locality. It is mandatory that all work must meet these requirements.

3.1.1 No extra compensation will be allowed for the Contractor’s rework due to its failure to conform to any such requirements unless the original installation was directed by written order issued by the A/E or the Owner.

3.1.2 Anything mentioned in the Specifications and not shown on the Drawings, or shown on the Drawings and not mentioned in the Specifications, shall be like effect as if shown or mentioned in both. If the Contractor believes that some information is missing then that information should be requested of the Owner or A/E in writing. Should the Drawings disagree among themselves, or with the Specifications, the better quality and/or greater quantity of work and/or materials shall be included with the Contractor’s project proposed pricing. In the case where the Specifications do not fully agree with the material schedules, the material schedules shall govern.

3.1.3 The general character of the detail work is shown on Drawings, but minor modifications may be made by A/E in full size Drawings, shop drawings, or models. Contractor shall not

- attempt to execute any part of the Work requiring such drawings until he has received approved copies of same.
- 3.1.4 Where the word “similar or typical” occurs on Drawings, they shall be understood in their general sense and not as meaning identical. All details shall be worked out in relation to their location and their connection to other parts of the Work. If the Contractor finds this to be beyond its capability, interpretations and directions should be requested of the A/E.
  - 3.1.5 Small scale and large scale drawings are intended to be mutually compatible and explanatory. In case of variances, the following order of preferences is established to define the intent of the work.
    - 3.1.6 Explanatory notes on Drawings;
      - 3.1.6.1 Recorded dimensions;
      - 3.1.6.2 Large scales details;
      - 3.1.6.3 Small scale details;
      - 3.1.6.4 Scaled measurements
  - 3.2 The “Scope of Work” description placed in the front portion of each section of the Specifications is intended to designate the scope and locations of all items of Work included in that section, either generally or specifically. It is not, however, intended to limit the scope of the work where plans, schedules, or notes indicate a larger scope.

**4. Interpretations of Documents (see UGC 3.2.2)**

Whether bidding or building the Project, if there is any doubt as to the meaning of any part of the Construction Documents, the Contractor shall submit a written request to the Owner seeking an interpretation. If the question has to do with technical requirements, the Contractor should provide the A/E with a copy of the request as the Owner will typically ask the A/E for the technical interpretation. If such a request is made during bidding, it should be made at least ten days before bid opening.

Interpretations shall then be issued by written response only and during bidding only by issuing an “Addendum” to the bid documents. When in doubt during construction, the Contractor should proceed only with a written interpretation by the Owner, or in its absence, proceed only after notifying the Owner in writing about the interpretation that is being used. Failure of the Contractor to request an interpretation shall not relieve the Contractor from responsibility to complete the Work to the Owner’s satisfaction. If the Contractor does not agree that an interpretation received is satisfactory and without cost or time implications, the Owner should be notified immediately in writing of that fact.

**5. Materials and Work (see UGC 8.1)**

- 5.1 Unless otherwise specified, all materials shall be new and free of asbestos, noxious or toxic fumes, urea-formaldehyde and lead (lead in potable water system) and both workmanship and materials shall be of the best quality. If requested by the Owner, the Contractor shall furnish satisfactory evidence as to the kind and quality of his materials and workmanship. Any work installed that does not meet the requirements of the Construction Documents shall be removed and replaced with conforming Work. **(UGC 3.3.5)**
- 5.2 The Contractor and subcontractors shall be responsible for the proper care and protection of all materials and equipment furnished both during and after installation. Such materials and equipment may be staged inside the construction fence, or areas designated by the Owner, but only consistent with a Staging Plan acceptable to the Owner. All materials affected by the weather shall be covered and protected to keep them free from damage while being transported to the site. When stored on site, they shall be placed in watertight storage shed/compartments or otherwise protected from the weather. Any material damaged by water or other causes shall be removed from the site and replaced with new material.
- 5.3 When necessary to avoid delay or to protect work or equipment, provide suitable watertight coverings over windows, doors, skylights, hatchways, and such other openings admitting rain, including the Owner's materials within the building area when working on a combined effort.
- 5.4 The Contractor and subcontractors shall protect and be responsible for their Work and any damage to their Work from the date of delivery or installation until Substantial Completion when the Owner will take possession and assume responsibility. They shall make good, without cost to the Owner, any damage or loss that may occur to their Work during this period.
- 5.5 When any room in one of Owner's buildings has been provided for use as a shop, storeroom, etc., the Contractor shall restore the room to equal, or better, condition by providing repairs, patching, cleaning, and painting at its sole expense.
- 5.6 During the execution of the Work the open ends of all piping, conduit and mechanical ducts and openings in equipment shall be sealed in such a way as to prevent the entrance of foreign matter. All heating, ventilating, plumbing and electrical equipment shall be covered and protected. All plumbing fixtures shall be protected and boarded over to prevent their usage by any person. All drains shall be covered until they are placed into service.
- 5.7 The Contractor shall provide all scaffolding and ladders necessary for performing the Work. All scaffolding shall be so constructed,

anchored and braced to comply in all respects with OSHA guidelines to afford safety and protection to both workers and their Work, the inspectors and the Work of other contractors.

- 5.8 Except as otherwise specified, the Contractor shall furnish at its own cost and risk all tools, apparatus, hoists or cranes, derricks, etc. needed for the Work.
- 5.9 Temporary equipment shall be installed in such a manner that finished Work will not be damaged by smoke, falling mortar, concrete or other causes. The location and arrangement of temporary equipment shall be subject to the approval of the Owner.
- 5.10 All temporary shoring required for the installation of Work shall be provided by the Contractor who will take all responsibility.
- 5.11 The Contractor and its subcontractors shall provide on the premises, at locations approved by the Owner, suitable watertight storage sheds for the storage of tools and equipment. Such sheds shall be at least 6 inches off the ground on heavy joists. The Contractor shall maintain such sheds in good condition and remove them when directed by the Owner.
- 5.12 **Also see Sections 013100, 013523 and 015000 for related requirements.**

**6. Intent of the Documents (see UGC 11.1.2)**

- 6.1 It is the intention of the Construction Documents to describe and require the complete installation of the various systems and the Contractor is to furnish all items necessary to make the various systems complete, although each and every item required may not be specifically mentioned in the Construction Documents.
- 6.2 It is not the intent of the Construction Documents to limit materials, equipment or fixtures to the product of any particular manufacturer. Where definite materials, equipment or fixtures have been specified by name, manufacturer or catalog number, it has been done to set a quality standard, applicability, physical conformity and other characteristics. It is not the Owner's intent to discriminate against or prevent any dealer, jobber or manufacturer from furnishing materials, equipment or fixtures that meet or exceed the characteristics of the specified items. However, substitutions of materials shall not be made without a specific written request by the Contractor having been approved by the Owner in writing. **(See paragraph 18 of this Section).**
- 6.3 Any discrepancies in the Specifications must be reported to the Owner for clarification, correction and interpretation from the A/E before the work is executed.

**7. Existing Underground Utilities**

If existing underground lines occur in the site where the work is to be accomplished, such lines will be located and staked by the Contractor for the benefit of the Owner and the Contractor prior to start of the work. Contractor shall maintain these markings throughout the duration of the construction project. Prior to any excavation, the Contractor shall review with the Owner the locations of all underground utilities and receive the Owner's written permission to proceed.

**8. Pumping, Shoring, Etc.**

- 8.1. Pumping: When necessary to avoid delay or to protect the Work or the premises, provide suitable pumping equipment and keep excavations, pits and other areas involved free of water that may leak, seep, or rain in. Do not allow water to flow into excavations. Do not allow water to flow off site in quantities or at rates that exceed the quantities or rates that existed prior to the start of construction
- 8.2. Shoring: The Contractor shall provide and be responsible for all temporary shoring required for execution and protection of the work. After all construction is secure and stable, and when authorized by the Structural Engineer or Civil Engineer, the Contractor shall remove all shoring.

**9. Hazardous Materials**

- 9.1 If during the course of his work, the Contractor observes the existence of asbestos, or asbestos bearing materials, the Contractor shall immediately terminate further operations and notify Owner of the condition. The Owner will, after consultations, determine a further course of action. **(UGC 7.5)**
- 9.2 Contractor shall furnish Manufacturer's Safety Data Sheets (MSDS) on all materials and products installed by the Contractor and subcontractors on this project to indicate no asbestos-containing materials have been installed.

**10. Substantial Completion (see UGC 1.26 and 12.1.1)**

"Substantial Completion" constitutes a stage of project completion that will allow Owner beneficial occupancy for the purpose of safely installing furnishings, maintaining normal security over them, and use of the facility for its intended purpose. Substantial Completion shall not be considered as Final Completion as there may be minor correction items outstanding and there are additional completion items required to achieve Final Completion. Upon acceptance that an entire Project, or a portion of a Project, as Substantially Complete the Owner will take possession from the Contractor and assume operations, maintenance and insurance liability responsibilities for that portion of the Project.



- 11. Coordination (see UGC 3.3.6.2 and 4.4 of the CM@R contract)**  
The Contractor and subcontractors on the project shall coordinate their work with each other, advising on work schedules, equipment locations, etc. It shall be the responsibility of Contractor to assure this coordination and to schedule and supervise the work of all subcontractors performing work under this contract. Contractor shall be responsible for the proper fit of the various parts of the Work and for the coordination of operations of all trades, the subcontractors and the material suppliers engaged upon or in connection with the Work as well as those of his own employees. Contractor shall accommodate and coordinate with other independent contractors and Owner personnel on site during construction to allow them necessary access to perform their work.
- 12. Observation of Work (see UGC 8.5.1)**  
The Owner's representatives, as well as the A/E, shall have access to the work at all times wherever it is in preparation or progress. The Contractor shall provide proper and safe facilities for such access and for observation.
- 13. Cooperation with Building Officials**  
Contractor, Subcontractor and all related suppliers, vendors and employees will cooperate with applicable utility and government officials and inspectors at all times. If such official or inspector deems special inspections necessary, provide assistance and facilities that will expedite such inspection or observation.
- 14. Notification**  
The Contractor shall notify the Owner at least 48 hours in advance (Monday thru Friday) of concrete pours, roofing installation, start of each new section of classification of work, concealment of plumbing, heating, air conditioning, or electrical work.
- 15. Ongoing Operations/Construction Personnel**

  - 15.1 The facilities of the campus will only be available during the scheduled construction time-period as specified by the Owner, and if not specified, then from 8:00 a.m. until 6:00 p.m., Monday through Friday. Work during other times, including weekends, shall only be allowed with prior request and written authorization from the Owner. In addition, the Contractor shall accommodate and coordinate its construction work force and activities to allow the Owner's forces and Owner's separate contractors (i.e. telephone, data, IT, computer, and furniture installation) to enter the jobsite to perform their work.
  - 15.2 This project is surrounded by continuously functioning campus facilities, including student housing, academic and research efforts.



- The Contractor shall make every effort to avoid disruptions to ongoing campus activities and to maintain a safe environment for students, faculty, and staff in the areas adjacent to the Project.
- 15.3 Adjacent facilities will continue to be used for their intended purpose while this Project is underway and the following requirements shall apply:
- 15.3.1 Contractor, Subcontractors, Owner and A/E shall meet regularly to coordinate and schedule any construction activities affecting ongoing operations including, but not limited to: testing days, student/staff holidays, special events, etc.
- 15.3.2 The Owner may have other contractors, or its own employees, performing work on the campus and in the vicinity of the Contractor's Work. The Contractor shall not commit any act, or allow any act, that will interfere with the performance of work by these other work forces. The Contractor shall cooperate with all performing parties so that the Owner can realize the best possible outcome of all projects involved and requiring coordination.
- 15.3.3 Student, faculty and general public safety is of utmost importance. Fire and life safety exiting from buildings must be maintained at all times and closely monitored. Review and receive approval for changes in existing conditions with the local fire marshal for each phase of construction. Provide temporary signage as required by the fire marshal and/or the Owner.
- 15.3.4 Fire arms, drugs, intoxicating beverages, X-rated materials, etc. are banned from the Owner's property.
- 15.3.5 Smoking is not allowed inside any campus building or anywhere on the campus except in designated areas. Smoking will not be allowed in any enclosed area of the building(s) of this project. Enclosed, as used here, refers to erection of exterior walls and overhead structure for any portion of the project; it does not mean to limit the term to only "dried in" situations. Use of or possession of illegal drugs or alcohol on the project site or anywhere on campus is prohibited.
- 15.3.6 Construction personnel are not to communicate or interact with students and faculty on site. Only the Project Superintendent, Project Manager and/or their appointed representatives may communicate with the faculty and administrative staff on an as needed basis.
- 15.4 Campus utilities must not be interrupted except when scheduled and approved in advance through Owner-designated campus channels.

The Contractor or his personnel shall NOT open or close any valves of the central campus utility systems. Valve operation is to be done by University utilities personnel only. The Contractor shall not activate or de-activate any campus utility system or component of any system, without express written direction from the Owner.

- 15.5 Chemical cleaning of new utility additions shall be done by circulating a good non-phosphate cleaner through as much of the new system as possible. Prior to dumping the cleaning agent, the Contractor shall notify the local City/County industrial water treatment department to sample the effluent. If the City/County officials approve of dumping to drain, then the Contractor will dump into the sanitary sewer. The Contractor shall refill the new system with water and again have the City/County water treatment officials sample the effluent prior to dumping. If at any stage the City/County water treatment officials refuse to accept the effluent, then the Contractor must make special arrangements for legal disposal at its expense and provide the Owner with copies of the resulting shipping and disposal manifests.

**16. Field Measurements (see 014518 – Field Engineering)**

- 16.1 The Contractor will employ an experienced, competent staff to establish or survey the building lines, elevations, and field dimensions. Each subcontractor shall verify all existing grades, lines, levels and dimensions affected by their work.
- 16.2 Before ordering any materials or doing any work, each subcontractor shall verify all measurements and shall be responsible for their correctness. Any difference between the actual dimensions and conditions on the site and those indicated on the drawings shall be submitted to the Owner for instructions and consideration before proceeding with the work.

**17. Substitutions (see UGC 8.3.5 and 8.3.6)**

The Contractor may submit and Owner and A/E will consider substitutions that have not been submitted and approved prior to receipt of proposals. Contractor shall submit a written substitution request on an Owner approved form and the substitution shall be fully identified for product or method being replaced by substitution, including related specification section and drawing number(s) and fully documented to show compliance with the requirements of the Construction Documents. Include product data/drawings, description of methods, samples where applicable and Contractor's detailed comparison of significant qualities between the specified item and the proposed substitution. The Contractor shall include a statement of effect on construction time, coordination and other affected work, cost information or proposal and a written guarantee indicating the proposed substitution will result in overall work equal to or better than work

originally indicated. Contractor shall allow sufficient time for review and approval of such proposed substitutions.

## **Section 012000 Project Meetings**

### **1. Pre-Construction Conferences (see UGC 3.1.1 and CM@R Contract 5.1 and Exhibit G)**

- 1.1 Prior to commencing construction, the Contractor shall schedule a meeting to review all aspects of the Construction Project. The time of the Pre-Construction Conference and the attendees shall be determined through discussions between the Owner and Contractor prior to scheduling.
- 1.2 The following is a tentative agenda for the Pre-Construction Conference:
  - Critical work sequencing;
  - Designation of responsible personnel;
  - Procedures for processing submittals, substitutions, applications for payment, proposal requests, change letters and Contract Close-out procedures;
  - Parking and access to the site;
  - Office, storage areas and temporary facilities;
  - Utility information;
  - Testing procedures;
  - Procedures for maintaining record documents.
- 1.3 Minutes of the Pre-Construction Conference will be kept and distributed to all attendees and to all team members not present at the meeting. All final decisions recorded in the minutes shall become binding on the parties.

### **2. Pre-Installation Conferences**

Conduct a Pre-installation Conference at the site before each construction activity that requires extensive coordination and for those activities where a pre-installation meeting is specifically required by the specification section.

### **3. Progress Meetings (see UGC 8.5 and 8.6)**

- 3.1 The Contractor shall schedule progress meetings at regular intervals to discuss and monitor the construction project. The Contractor shall determine the meeting times and required attendees.
- 3.2 Minutes of the Progress Meeting shall be kept and distributed to all attendees and to all team members not present at the meeting.

**4. Close-out Meetings**

- 4.1 When the Contractor determines that a Project, including all punch list items, has been substantially completed and an acceptance date established, a formal project close-out meeting will be scheduled and attended by the parties designated by the Owner and A/E.
- 4.2 At the close-out meeting, upon documentation of exceptions and assignment of completion responsibilities, the close-out documents required by the Construction Documents will be released to the Owner.
- 4.3 Minutes of the Project Close-out meeting will be kept by the A/E and any exceptions identified will be recorded. Specific completion dates for the exceptions will be established and tracked by the Owner to ensure expeditious completion. Copies of the minutes will be distributed to all attendees.

**Section 013100 Project Administration**

**1. Subcontracts (see UGC 3.3.6)**

- 1.1 Contractor agrees to bind every subcontractor, and every subcontractor agrees to be bound by the terms and conditions of the Owner's contract.
- 1.2 The Contractor is required to submit a list of all first tier subcontractors to the Owner as subcontracts are executed.

**2. Flow of Communications (see UGC 3.2, 3.3.1 and 3.3.6)**

2.1 The Owner's Designated Representative (ODR) is the Owner's primary representative for the Project who will be designated to the Contractor in writing. The ODR is the only party authorized to issue written/or oral instructions directly to the Contractor that involve changes to the contract scope, cost or time of the Work, save and except those changes noted in 2.2 below. If any other party directs the Contractor to make changes to the Work that will involve scope, cost or time the Contractor should notify the ODR immediately in writing. **(see UGC 1.17)**

2.2 Normally, the Owner will also designate in writing an Owner's Designated Site Representative (ODSR). The ODSR will have the authority, delegated by the ODR, to make decisions on behalf of the Owner concerning coordination with the University of Work on the site including: traffic controls, site safety, scheduling of utility outages, and all matters within the contract that do not involve changes to the scope, cost and/or time for completion. However, ODSR shall have the authority to approve changes for cost in an amount not to exceed \$25,000.00 and execute all certificates of substantial completion. The ODSR, or a designee, will coordinate and conduct

quality inspections of the construction work as it is installed or performed, authorize payments (except first and final) and conduct final acceptance inspections. The ODSR will be the Contractor's primary point of contact on the site.

**3. Project Changes (see UGC 9.1, 9.3.3.3, 9.6.2.2 and Article 11)**

3.1 All changes to the Contract involving scope, cost, or time will be issued on the standard Texas State University System (TSUS) Change Order form. Such Change Orders are valid only if signed by either the Chancellor of the TSUS or by the Vice Chancellor for Contract Administration, except as noted in 2.2 above. A single Change Order may include several different change issues and they will not be required to be related to each other.

3.2 Prior to issuing a Change Order, the Owner must have received from the Contractor a Change Order Proposal that is complete in its description of the changes in scope and its detailed presentation of cost and time implications of the proposed change. If the Owner and Contractor do not agree on the implications of a proposed change, they will meet and discuss and resolve their differences prior to proceeding with the changes to the Work.

3.2.1 The Contractor shall summarize all costs for each change at each level of subcontractor and supplier by preparing a "Cost Analysis", and shall provide each subcontractor's cost summary as backup. Additional support documentation from both the Contractor and its subcontractors is encouraged.

3.2.2 Where the Contractor believes it is entitled to a time extension, it shall so state as part of its response to the Change Proposal, including a justification for such request. Time extensions will be granted only if a Change Order Proposal affects the activities on the Critical Path of the Owner approved Project Schedule (i.e., when the work impacts the "Contract Substantial Completion Date").

3.2.3 If the Owner and Contractor cannot mutually agree upon a fair and reasonable cost and time settlement, the Owner may: 1) Reject the quotation and void the Change Order Proposal, 2) Issue instruction to the Contractor to proceed on a time and material basis for a price to be determined later not to exceed a fixed maximum dollar and time, or 3) Issue a Unilateral Change Order.

3.2.4 The Owner may issue Field Orders directly to the Contractor for minor changes to the contract, which can be negotiated in the field. Pricing backup shall be the same as a Change Order Proposal and is to be outlined as noted above. Once the Owner and the Contractor have signed the Field Order, the work is authorized and the Field Order will be included in the next Change Order.

**1. Liquidated Damages (see UGC 9.11, 12.1.4 and 25.2)**

If assessed, liquidated damages will be withheld from progress payments beginning with the first payment after the Contract completion date and until all work of the contract is complete. The amount assessed shall be deducted from the contract price through a written Change Order.

**2. Site Use Issues**

- 5.1 The Contractor is responsible for the actions of its entire work force, including Subcontractor and Supplier employees, whenever they are on the campus. Harassment of any kind toward any person will not be tolerated. Offending workers will be removed from the project immediately and permanently. Harassment includes any action such as jeering, whistling, calling-out, staring, snickering, making rude or questionable comments, or similar behavior. Any offending worker or employee will be removed.
- 5.2 The Contractor shall provide and submit a program plan for worker orientation, identification and control of access to the site and for managing personnel records, including payroll records. All workers on the project shall participate in this program before beginning work of the project. This plan shall include, as a minimum:
- 5.2.1 Employee identification badges with a photo of the employee, the employer and employees' name. Badges shall be provided for all employees and produced by a system on site. This identification shall be worn at all times while on the project site. Lack of an ID badge shall be grounds for removal from the project until the badge is produced.
- 5.2.2 Identification badges for workers, busing of workers from remote parking lots, frequent written and verbal reminders to the work force of appropriate behavior and avoidance of campus facilities and publication of acceptable access and egress routes from the work site are all minimum requirements of the plan.

**3. Shop Drawings and Submittals (see UGC 8.3 and CM@R contract 4.5)**

- 6.1 Refer to the UGC for requirements not identified in this section.
- 6.2 The Contractor shall assign an identifying number to each submittal following a format to be established at the Pre-Construction Conference. The same number with a numerical or alphabetical suffix will be used to identify re-submittals.
- 6.3 The burden of timeliness to complete the submittal process is on the Contractor. The Contractor shall allow sufficient time within the construction schedule for the A/E and Owner to review and approve all submittals, including time for all re-submittals on any unaccepted/rejected submittal.
- 6.4 Any deviation from the Construction Documents shall be conspicuously noted on the submittal and the transmittal cover sheet. Failure to so note deviations will void any action taken on the submittal.

- 6.5 All manufacturers' data contained within the submittal shall have all inapplicable features crossed out or deleted in a manner that will clearly indicate exactly what is to be furnished.
- 6.6 Equipment of larger sizes than shown, even though of a specified manufacturer, will not be acceptable unless it can be demonstrated that ample space exists for proper installation, operations and maintenance.
- 6.7 The Owner will not be responsible for payment of any item that has not been submitted and approved through the established submittal process. **(UGC 10.5.1.4)**
- 6.8 The exact number of submittal copies required for distribution will be determined at the Pre-Construction Conference. The Contractor shall anticipate providing a minimum of four (4) copies of each submittal in addition to those needed by the Contractor and its subcontractors. Two (2) of the approved copies will be returned to the Contractor and one (1) shall be set aside for subsequent turn over to Owner at Project Closeout.

**4. Substitution of Materials, Labor and Equipment (see UGC 8.3.5 and 010000 paragraph 17)**

- 7.1 Refer to the UGC for requirements not identified in this section.
- 7.2 The specified products referenced in the Construction Documents establish minimum qualities for which substitutions shall at least equal to be considered acceptable. The burden of proof of equality rests with the Contractor. The Owner retains sole authority for acceptance of substitutions.
- 7.3 All substitutions shall be submitted with ninety (90) days of the Notice to Proceed for Construction and be clearly marked as such on the transmittal cover sheet for the submittal.
- 7.4 The Contractor shall allow a minimum of four (4) weeks for review of each substitution by the A/E and/or Owner in addition to the requirements identified in Section 7.3 above.
- 7.5 When requested by the A/E, the Contractor shall provide a sample of the proposed substitution item. In some cases, samples of both the specified item and the proposed item shall be required for comparison purposes.
- 7.6 Acceptance of materials and equipment will be based on the supplier/manufacturer's published data and will be tentative subject to submission of complete shop drawings and/or specifications indicating compliance with the Construction Documents. Acceptance of materials and/or equipment under this provision shall not be construed as authorizing any deviation from the Construction Documents, unless specifically directed in writing from the A/E.



- 7.7 Any and all additional costs or time resulting from the acceptance or rejection of any substitution shall be the sole responsibility of the Contractor. These include costs that are not presented at the time of the substitution request and those costs that become known after the approval of the substitution. This includes direct as well as indirect costs.
- 7.8 If a substitution is accepted, and the substitute proves defective, or otherwise unsatisfactory as determined by the Owner for the service intended within the warranty period, the substitute shall be replaced with the material or equipment specified in the Construction Documents, or as approved by the Owner, at no additional cost to the Owner.

**5. Allowances (see 13.1 and Exhibit C of CM@R contract)**

- 8.1 Allowances shall include:
- Cost of materials to Contractor.
  - Delivery to project site; handling, storage and installation at project site.
  - Protection, security, including insurance.
  - Contractor's overhead and profit and other costs.
- 8.2 At contract closeout, monies remaining in any allowance line item will be credited to the Owner by Change Order.

**6. Alternates**

- 9.1 Alternates will be exercised and added to the proposed contract sum at the option of the Owner.
- 9.2 For any or all additive alternates selected or otherwise approved for addition to the contract sum by the Owner, the Contractor shall coordinate all related work and modify the surrounding work as required to complete the work, including changes under each alternate, only if acceptance is designated in the contract.

**7. Unit Prices (see UGC 11.2 and paragraph 5.4.2 of CM@R contract)**

The Contractor shall provide unit prices for specific portions of the work identified by the Owner during the pre-bid process. Unit pricing shall include all costs of materials, including, but not limited to shipping, and their related labor cost, including, but not limited to all appropriate burdens and markups.

**8. Applications for Payment (see UGC Article 10 and 12.3 as well as Article 12 of the CM@R contract)**

- 11.1 Such requests shall be presented on the Texas State University System (TSUS) Pay Application forms. The TSUS Schedule of Values forms, which may be supplemented with columnar continuation sheets, shall



- separately identify each update to the original contract or GMP amounts.
- 11.2 The Contractor's project accounting records shall be kept on the basis of generally accepted accounting principles in accordance with cost accounting standards issued by the Federal Office of Management and Budget Cost Accounting Standards Board and organized by each pay request period.
- 11.3 Prior to the submission of the initial Application for Payment the Contractor shall submit the following documents to the A/E and Owner for review:
- 11.3.1 Contract Price of GMP Schedule of Values: A single document itemizing the breakdown of the Contract Price/GMP, including general conditions, contingencies and allowances shall be submitted using TSUS standard Schedule of Values format. The Contractor shall submit a draft breakdown and such submittal shall be a condition precedent to the processing of the first pay application. The Contractor shall submit subsequent draft copies of the Schedule of Values no later than five (5) working days prior to formal submission of each monthly pay request.
- 11.3.1.1 The breakdown shall follow the trade divisions of the specifications.
- 11.3.1.2 No adjustment to the original detailed breakdown of the contract line item shall be made once accepted by the Owner and A/E, unless such adjustment is directed by the Owner in writing.
- 11.3.1.3 Construction Manager at Risk or Design-Builders will be allowed to reallocate among General Conditions line items after consultation with, and agreement from, the Owner. In the event the contractual limit on General Conditions costs are exceeded, the overruns shall be subtracted from the Fee.
- 11.3.2 The Contractor shall not use subcontractor invoices/pay applications in lieu of a single Schedule of Values from the Contractor.
- 11.3.3 The breakdown shall anticipate future Change Orders and make provisions for incorporating all changes into the breakdown listing. If issued, Change Orders shall be identified separately and shall itemize the GMP Change Orders, Change Proposals and/or Field Orders, which are incorporated into each Change Order for payment on a line-item basis. Contracts with Guaranteed Maximum Price proposals shall repeat the process outlined in this section every time a subcontract is added to the monthly Schedule of Values for payment.

- 11.3.4 Submission and approval of Construction Staging Plans, Parking Plans, Quality Control Plans and Trenching Plans are a prerequisite for starting Work at the site and for receiving the first monthly partial payment.
- 11.4 At a minimum, the Contractor shall provide attachments to each month's payment request as follows:
  - 11.4.1 Four copies of the monthly HUB Progress Assessment reports.
  - 11.4.2 Four copies of the updated Submittal Schedule.
  - 11.4.3 Four copies of all invoices required by the contract.
  - 11.4.4 Four copies of the wage rate notification form for each member of the workforce not previously submitted.
  - 11.4.5 Four copies of the updated RFI and ASI logs.
  - 11.4.6 Four copies of the updated Work Progress Schedule as specified herein.
- 11.5 All regular monthly applications for payment shall be submitted to the Owner and A/E for review and approval in draft form no less than five working days prior to the formal submission. The Contractor shall be prepared to review the draft copy at the project site, or at such other location as may be agreed to by the parties. Failure to comply with the requirements outlined in this section shall relieve the Owner from its obligation to make payments on any/all line items until the Contractor meets all requirements.
  - 11.5.1 Payments cannot exceed the contract, work in-place, or subcontract amounts as noted on the Schedule of Values line items.
  - 11.5.2 All as-built drawings shall be up to date and available for review by the A/E and Owner.
  - 11.5.3 When requesting payment for materials stored off site, all such materials shall be specifically identified, including supporting documentation, photos and insurance. The Contractor should be available to escort the Owner to visit and personally verify the stored materials in a physically separated and secure area.
- 11.6 Request for payments in association with release of, or reduction in retainage, or completion of work have additional requirements outlined in the UGC.

**9. Procurement of Subcontracts (Applies to Construction Manager at Risk and Design-Build Contracts Only) – (see 5.6 & 5.7 of the CM@R contract)**

- 12.1 The Construction Manager at Risk (CM) or Design/Build Contract (DB) shall provide a written Bid/Proposal Package Strategy (B/PPS) for procuring subcontracts including self-performance work (other than General Conditions), prior to the approval of the Guaranteed Maximum Price, but no later than twenty calendar days prior to the

first advertisement for subcontractor proposals. The B/PPS shall be a written plan submitted to, and reviewed by the Owner.

12.1.1 The plan shall identify bid packages that are most advantageous to the Project and align with the CM/DB's HUD Good Faith Effort by providing at least three qualified respondents (including CM/DB). Each bid package shall include the UGC, Owner's Division 1 Specifications, Drawings and Specifications and any other TSUS requirements included in the CM/DB Contract pertaining to the scope of work covered in the packages.

12.1.2 The B/PPS shall include the following for each bid package contemplated:

- Anticipated scope of work to be procured;
- A current Work Progress Schedule;
- Anticipated selection criteria and questions;
- Self-perform work proposals to be submitted by the CM/DB;
- Proposed advertising dates;
- Proposed pre-proposal meeting(s) dates;
- Proposed receipt, review and award dates;
- Anticipated notice to proceed dates.

12.2 The CM/DB shall update the B/PPS monthly at a minimum, as conditions change, or as proposed dates are revised.

12.3 Per the Texas Higher Education Code 51.782: "A Construction Manager-at-Risk shall publicly advertise, in the manner prescribed by the TSUS, and receive bids or proposals from trade contractors or subcontractors for the performance of all major elements of the work other than the minor work that may be included in the general conditions".

12.4 The goal of the Project Team shall be to have all work procured through advertised competitive proposals, however, if a "minor procurement" condition arises during the process, the following procurement guidelines may be used by the CM/DB, with Owner approval, for procurement of work:

Less than \$5,000.00	No requirements
Between \$5,000.01 to \$25,000.00	Obtain three solicitations
	Greater than \$25,000.00
	Advertised competitive proposals

If the CM does not receive at least three competitive proposals on procurements over \$5,000.00, the CM shall re-package the scope and re-issue the proposal without additional cost to the Owner, or delay to the project "Substantial Completion" date. This solicitation

- requirement does not pertain to Change Orders to existing subcontracts.
- 12.5 Work shall be divided into reasonable lots; however, material and labor acquired through purchase order/vendor type contracts are subject to the entire project (i.e. Concrete material shall be procured as a unit price time an estimated total project quantity provided by the CM/DB to equal a total construction cost). Work shall not be incrementally divided for the purpose of circumventing the procurement guidelines of 12.4 above.
- 12.6 The CM/DB may establish selection criteria for each phase of work for review and approval by the Project Team. Criteria shall be qualifications based and consistent with the information needed by the CM/DB to make a proper evaluation and selection. The CM/DB shall establish a selection matrix including cost, criteria, weighting and ranking procedures for evaluation and work with the Project Team to tailor the selection criteria to be project and scope specific to ensure the questions are proper and relevant to the goals of the project. HUB participation/status cannot be used as criteria for determining “best value,” only for determining if the respondent is responsive.
- 12.6.1 The CM/DB shall establish clear criteria and questions so that those reading the Request for Proposals will understand how they will be evaluated.
- 12.6.2 If criteria are not included in the advertisement for proposals, the proposal shall be considered a lump sum bid, and the CM/DB shall award the work to the lowest qualified, responsive bidder.
- 12.6.3 After selection criteria have been established, the CM/DB shall publicly advertise the work in general circulations and trade associations in accordance with TEC 51.782 for CM, Article 7 of the current Contract for DB and the Texas Administrative Code 111.14 –“HUB” for both CM and DB. This advertisement shall include, at a minimum, the following:
- TSUS Project Number and Project Name;
  - Institution/Campus name;
  - CM/DB name and address;
  - CM/DB contract name and phone number;
  - Location for viewing of plans and specifications;
  - Date, time and location of Pre-proposal meeting(s);
  - Date, time deadlines(s), and location for receiving proposals;
  - Instruction to respondents for submitting proposals;
  - Selection criteria, questions and submittal requirements.

- 12.7 At the time and location identified in the advertisement, the CM/DB shall hold a Pre-proposal meeting(s) for all potential subcontractors with the Project Team and Owner present. The CM/DB shall review the following at a minimum:
- The general scope of the project and specific scope of work included in this package;
  - Instructions to respondents for submitting proposals;
  - Selection criteria and questions;
  - HUB Good Faith Effort requirements;
  - Project safety requirements;
  - Project schedule requirements;
  - Payment procedures and requirements, including retainage;
  - Commissioning and Close-out requirements.
- 12.8 If the CM/DB identifies any self-performance in the B/PPS (work to be performed by its own employees), the CM/DB shall submit a proposal to the Owner at least 24 hours before the advertised time and location in a manner so as not to compromise the competitive process.
- 12.9 The CM/DB shall accept all proposals at the advertised location until the advertised deadline. Upon receipt, the Owner shall be allowed to review the proposal and confirm the time and date received. Any proposals received after the deadline shall not be considered by the CM/DB, and shall be returned to the respondent unopened. Fax proposals shall not be accepted unless the ODR, prior to the initial advertisement for proposals, approves a detailed plan by the CM/DB for proper care and custody.
- 12.10 After compiling, reviewing and verifying the costs and scope associated with all proposals, the CM/DB shall provide a “bid tabulation” matrix and a proposed Schedule of Values for review by the project team.
- 12.10.1 The bid tabulation matrix shall compare all equivalent scope proposals to the CM/DB’s estimate.
- 12.10.2 Each matrix shall indicate the CM/DB estimate(s) for each scope of work and identify the respective cost savings/over-runs.
- 12.10.3 The CM/DB may use values/quantities from its own estimate to provide full scope comparisons between each respondent, however, these “plug” numbers shall be clearly identified in the matrix to the Project Team and be used only to compare various proposals.
- 12.10.4 The proposed updated Schedule of Values shall summarize all executed and recommended “best value” subcontracts to provide a current status of the Guaranteed Maximum Price Proposal.

- 12.10.5 Once the proposals are compiled into a bid tabulation matrix and the proposed Schedule of Values has been updated, the CM/DB shall request a meeting with the Project Team to review the proposals.
- 12.11 The CM/DB shall lead the proposal review meeting and identify any exclusions or conditions, identify any non-qualifying respondents and any other problems that may have occurred during the process.
  - 12.11.1 The CM/DB shall confirm that the respondents are qualified, meet the established selection criteria, and identify the amount of the proposals.
  - 12.11.2 The CM/DB shall identify the “best values” and the current status of the buyout savings to the project team. If the “best value” causes the CM/DB to exceed the Cost of Work line item, including contingencies in the GMP the CM/DB shall acknowledge that the overage will be deducted from the CM/DB’s Construction Phase Fee.
- 12.12 Once the “best value” respondent has been identified by the CM/DB, without exception by the Owner, the CM/DB shall finalize negotiations with the selected “best value” respondent. If the CM/DB is unsuccessful in its negotiations with the selected respondent, the CM/DB shall notify the ODR that it intends to begin negotiations with the second “best value” and report the cost implications to the Schedule of Values. Once negotiations are successfully completed the CM/DB shall notify the Owner in writing that it intends to write a subcontract to the selected “best value” respondent and identify the bid package number, value of the contract, along with any changes from the bid day value, changes in scope, report the current status of the GMP identifying the current savings/overages and provided a copy of the executed subcontract or purchase order prior to any request for payment by the CM/DB for applicable work.
- 12.13 The Owner reserves the right to object to the “best value” identified by the CM/DB and may conduct an evaluation of the selection process. If after evaluation the Owner disagrees with the CM/DB “best value” recommendation, the Owner may instruct the CM/DB to re-bid the scope of work or use the Owner’s “best value” selection. If the value of the Owner’s selection causes an increase in the Total Contract Price, the increase will be the responsibility of the Owner.
- 12.14 The process identified in this section shall be repeated for each bid package until the project is entirely bought-out.

**10. Contractor Daily Reports**

The Contractor shall provide the Owner with a report detailing its daily activities on the Project in a format acceptable to the Owner. All tests performed by the Contractor are to be attached to these daily reports. All



work reports required of subcontractors shall be attached to the Contractor's daily report. As a minimum, the report shall include the following information as it relates to the days activities on site: subcontractors on site, equipment on site, areas of work, type of work performed, materials received, tests performed, any injuries or accidents, any oral instructions received from the Owner or A/E, any material damage, any change in supervisory personnel and anything that might impact the projects quality or schedule. These reports shall be submitted to the Owner on a daily basis. Not receiving these reports in a timely manner may be grounds for the Owner withholding payments until they are submitted.

**11. As-Built Drawings and Record Drawings (see UGC 10.3 and 11.4 as well as paragraph 25.7 of the CM@R contract)**

- 14.1 One copy of all record documents shall be kept up to date and available at the Project Site. "As-Built" drawings, specifications, detail manuals, and submittals shall be continuously annotated by the Contractor to reflect actual record field conditions, addenda, issuance of all Change Orders and clarifications, and actual dimensional records for underground and all other services. One copy of all approved submittals and material selections shall also be kept available.
- 14.2 Maintenance of current documentation by the Contractor is required in order to process pay applications. The Owner and A/E will review the status of such documentation monthly, at a minimum. Also refer to the Commissioning Procedures and Project Close-out Procedures for detailed instructions on As-Built drawings and specifications.

**12. Utility Outages**

- 15.1 The Contractor shall notify the Owner, in writing, of any planned utility outages ten business days in advance of the anticipated outage date. The notice shall identify the utility(s) to be shutdown, the anticipated duration of the outage and the subcontractor responsible for initiating and terminating the outage. The Owner has final authority to approve or disapprove of the requested outage date and time.
- 15.2 A standard form for processing a request for utility shutdown or any other disruption shall be provided by the Owner at the Pre-Construction Conference. The Contractor shall utilize this form, with attachments as necessary, in requesting an outage.

**13. Coordination of Space (see UGC section 3.3 and 3.3.6.2 in particular. also see paragraph 4.4 of the CM@R contract)**

- 16.1 The Contractor and subcontractors should coordinate the use of Project space and sequence of installation of mechanical, electrical,

plumbing, HVAC and Communications work which is indicated diagrammatically on the drawings. The Contractor and subcontractors should follow routing shown for pipes, ducts, and conduits as closely as practicable, with due allowance for available physical space. The Contractor and subcontractors should utilize space efficiently to maximize accessibility for other and future installations, maintenance and repairs. Making adjustments due to field conditions is considered a part of the work.

- 16.2 Within finished areas all pipes, ducts and wiring should be concealed, unless otherwise directed in the plans and specifications. The Contractor and subcontractors should coordinate locations of fixtures and outlets with finish elements.
- 16.3 The Contractor and subcontractors should verify that mechanical and electrical controls, valves, cut-offs, cleanouts, switches and other items are located in such as manner as to make them readily accessible to the user.
- 16.4 In no case shall locations of equipment be established by scaling the drawings. In the event exact dimensions are not provided with the drawings either supplemental instructions should be obtained from the A/E, or approval of placement from the Owner, should be obtained prior to final placement.
- 16.5 All work should be arranged in a neat and orderly manner while maximizing clearances.
- 16.6 All operating system components which will be approved through the submittal process should be reviewed prior to submittal to confirm there is physically adequate space to accommodate the device.

**14. Repair of Damage (see UGC 3.3.11.3)**

The Contractor shall be responsible for any loss or damage caused by Contractor, his workers or his subcontractors, to the Work, materials stored on site, to tools and equipment, to adjacent property and to persons. The Contractor shall make good any loss, damage or injury at Contractor's own expense and take particular care to protect adjacent buildings, utilities, landscape and lawn sprinkler systems.

**15. Deliveries**

- 18.1 The Owner will not accept delivery of products and materials bound for the Contractor. The Owner will not be responsible for material losses, or make arrangements to have someone present for acceptance of deliveries.
- 18.2 The name and address of Owner shall not be used for delivery of materials and equipment.



18.3 The Contractor should make arrangements for deliveries in accordance with construction schedules and in ample time to facilitate inspection prior to installation without causing delay to the project.

**16. Protection of Utilities, Etc. (see UGC 3.3.11.3)**

The Contractor and all subcontractors and vendors should take precaution to protect and leave intact the streets, site and work previously accomplished, including buildings, streets, utility poles, fire hydrants, utility lines, catch basins and storm drainage systems.

**Section 013200 Project Planning and Scheduling**

**(see UGC Article 9 and Section 5.3 of the CM@R contract)**

**1. Definitions:**

- 1.1 Project Schedule (a.k.a. Work Progress Schedule) – the schedule developed, monitored and maintained by the Contractor and used by the Project Team during Pre-construction and Construction phases of the project.
- 1.2 Project Team – refers to the Owner, Architect/Engineer (A/E), Design Consultants, Users, Contractor and Subcontractors that are contracted and/or specifically assigned to the Project.
- 1.3 Work Day – refers to a day in which work is planned, excluding weekends and legally recognized state holidays.
- 1.4 Critical Path – is the sequence of activities that determines the longest duration for the project when the Total Float is equal to, or less than zero.
- 1.5 Total Float – the number of days an activity on the longest path can be delayed without delaying the Substantial Completion Date. Total float should not be shown as a single activity, but rather the relationship between the early and late finish dates or early and late start dates of each activity.

**2. Purpose**

- 2.1 Time is an essential part of this contract. Therefore, the timely and successful completion of the Work requires careful planning and scheduling of all activities inherent in the completion of the project.
- 2.2 The Contractor shall participate with the Owner and A/E in a project planning workshop promptly upon execution of the contract unless specified differently in the Construction Documents. The Schedule shall be coordinated with the Contract Price Breakdown, or Schedule of Values, and shall include all significant procurement actions (including long lead-time delivery items and related approval activities), all work placement activities (including start and

completion dates), identification of the timing of overhead inspections, system startup and commissioning activities, pre-final and final inspections, and punch list corrections as a minimum.

- 2.3 Acceptance of the Project Schedule; or any subsequent update thereof, by the Owner is for format and extent of detail of the Project Schedule only. Such “acceptance” does not indicate approval of the Contractor’s means or methods, or of any change to the contract terms including without limitation any required contract milestones.
- 2.4 The Project Schedule shall be developed with a certain amount of float time. This float, which shall be no less than ten percent of the total duration of the project, shall be presented in a format which facilitates reporting of progress and trends and can be used to identify risk and opportunities, project upcoming activities and forecast project milestones.
- 2.5 The Owner must be able to reasonably rely on the Contractor’s Project Schedule in order to make accurate commitments to the Project Team, campus administration and other parties as necessary.

### **3. Contractor Responsibilities**

- 3.1 The Contractor is responsible for planning, managing, coordinating and scheduling all activities from a Notice to Proceed to Final Completion of the project within the time allotted by the contract.
- 3.2 The Contractor is responsible for keeping the Owner and Project Team fully informed of schedule status and upcoming activities throughout the project.
- 3.3 The Contractor’s Pre-Construction and Construction project management personnel shall actively participate in the planning and development of the Project Schedule and shall be prepared to review such development and progress with the Owner, A/E and any other members of the Project Team so the planned sequences and procedures are clearly understood by all parties.
- 3.4 The Contractor is to plan for appropriate activity durations to allow for thorough review, procurement, submittal, installation, inspection, testing and commissioning of all work in order to confirm compliance with the project plans and specifications.

### **4. Schedule Development Requirements**

- 4.1 Appropriate logic relationships must be in place and complete, while the Project Schedule shall be free of any mandatory and/or late finish constraints, except for the Substantial Completion Date.
- 4.2 The estimated activity duration of an activity shall be expressed in work days only.
- 4.3 During Pre-Construction Services, the Project Team will establish the maximum duration for every activity included in the schedule.

- 4.4 The Project Schedule should be coordinated with the Contractor's Submittal Schedule and Schedule of Values.
- 5. Planning and Scheduling Workshop**
  - 5.1 Within fifteen calendar days after the Notice of Proceed is issued the Contractor will conduct a Planning and Scheduling Workshop with the Contractor's Project Manager, Superintendent, the Owner, A/E, User Representative and any available subcontractors prior to submitting the initial Project Schedule to the Owner.
  - 5.2 Two separate Planning and Scheduling Workshops should be held with the aforementioned parties prior to the Contractor submitting the baseline Pre-construction Project Schedule.
  - 5.3 The baseline schedule shall be submitted within 10 work days after the Planning and Scheduling Workshops are complete.
- 6. Construction Phase Baseline Schedule Submittal**
  - 6.1 The Baseline Project Schedule shall be submitted to the Owner with the required Total Float and a current data date (within five days of the date of submission). The Baseline Schedule will be updated within ten days of the date when each subcontractor is procured and brought on to the project.
  - 6.2 Once the full scope of the Project has been approved (i.e. the last stage GMP Change Order has been executed), the Project Manager shall coordinate with the Owner to reset the Baseline Project Schedule.
  - 6.3 The Owner reserves the right to withhold any and all payments related to the Project Schedule and/or General Conditions if a Baseline Project Schedule is not submitted, or is not acceptable to the Owner.
  - 6.4 The Project Schedule shall be presented in a graphic time-scaled view including all activities, early start and finish dates, estimated durations and total float, sorted by early start.
- 7. Updating the Project Schedule**
  - 7.1 Once the Baseline Project Schedule has been accepted, the Project Manager shall update the Project Schedule on at least a monthly basis and submit the updated Project Schedule with the draft application for payment.
  - 7.2 Project Schedule updates shall be based on actual work progress, current logic and remaining durations.
  - 7.3 Total Float is intended to be used proportionally with the duration of the project; therefore, there should be no remaining Total Float at the actual Substantial Completion Date.
- 8. Excusable Delays and Time Extensions**

- 8.1 Excusable delays shall be administered per the UGC.
- 8.2 If an excusable delay extends the Contract Substantial Completion Date, the ODR may extend the contract time by the number of excusable calendar days lost on the Project Schedule, or take other actions as appropriate under the terms of the contract.
  - 8.2.1 Any Change Order Proposal that the Contractor claims, or will claim, justifies an extension of contract time must contain the information necessary to justify the time extension.
  - 8.2.2 Change Order Proposals that do not affect the Critical Path for the Project and delay the Substantial Completion Date, or does not include a request for additional time prior to approval by the ODR, shall not be due a time extension.
- 8.3 Once the ODR accepts a time extension, and authorizes the Contractor to proceed with the contract change, the proposed revision shall be incorporated in the Project Schedule.

## **Section 013220 Photographic Documentation**

### **1. Photographic Media**

- 1.1 Digital Images: Provide images in uncompressed TIFF format produced with a minimum 4.0 mega pixels and image resolution of not less than 1024 by 768 pixels.
- 1.2 Videotape Format: Provide high-quality ½" VHS color videotape in full size cassettes, 90 minutes long.

### **2. Construction Photographs**

- 2.1 Take photographs using the maximum range of depth of field, and that are in focus, to clearly show the work. Photos with blurry or out-of-focus areas will not be accepted.
- 2.2 Maintain key plan with each set of construction photos that identifies each photo location.
- 2.3 Digital Images: Submit digital images exactly as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.
- 2.4 Date and Time: Include date and time filename for each image.
- 2.5 Preconstruction Photos: Before commencement of work on the project take digital photos of the project site and surrounding properties, including existing items to remain during construction, for different vantage points.
- 2.6 Take photos to show existing conditions adjacent to the project site.

### **3. Construction Videos - Preconstruction Videotapes:** Before starting construction on the project site prepare a video recording of the site and

surrounding properties from different vantage points. Show existing conditions of the site and adjacent buildings. Show protection efforts by Contractor including, but not limited to, tree protection and storm water controls.

### **Section 013520 LEED Requirements**

1. **Definitions** - LEED – Leadership in Energy and Environmental Design.
2. **Submittals** - The Contractor shall provide preliminary submittals of its LEED Action Plan, indicating how the Owner's requirements will be met, within thirty days after the Start date established by the Notice to Proceed. Submit additional LEED submittals required by other specification sections.
3. **Quality Assurance**  
LEED Coordinator: Engage an experienced LEED-Accredited Professional to coordinate LEED requirements. LEED coordinator may also serve as waste management coordinator.

### **Section 013523 Project Safety Requirements**

**(see UGC Article 7 and Section 5.8 of the CM@R contract)**

1. **Purpose**
  - 1.1 The Contractor shall bear overall responsibility for all aspects of safety at the project.
  - 1.2 The Contractor shall, at all times, provide adequate resources, equipment, training and documentation to:
    - 1.2.1 Assure compliance with all applicable regulatory and contract requirements.
    - 1.2.2 Assure a safe work environment at the Project.
    - 1.2.3 Instill a culture for safe behavior in all supervisors and workers.
    - 1.2.4 Ensure a universal understanding that safety and health issues take precedence over all other considerations at the Project.
  - 1.3 The Contractor and every subcontractor shall comply with the requirements of this section and all Federal, State, and local statutes, standards, and regulations. In any circumstance where this Section differs from, or is in conflict with any statutory requirement, the more stringent shall apply.
  - 1.4 The Owner reserves the right to have any manager, supervisor or worker removed from the project for disregarding the Project's safety requirements.
  - 1.5 The Owner reserves the right to deduct from the contract any safety related expenses that the Owner incurs as a result of the Contractor's,

or any subcontractor's, failure to comply with the requirements of this section.

- 1.6 The Owner will deny requests for time extensions and/or monetary considerations whenever the Owner intercedes on behalf of safety compliance as a result of Contractor failure to act as required by the contract.

## **2. Contractor's Project Safety Coordinator (PSC)**

- 2.1 The Contractor shall provide a Project Safety Coordinator, who shall be responsible for safety training, inspections, investigations, record keeping, reporting, incident response, and claims management, and shall serve as the technical advisor to the Contractor's Project staff for all safety issues.
- 2.2 If the contract value is less than \$3,000,000 the Contractor's project superintendent may perform these duties. If the contract value exceeds \$3,000,000 the Contractor shall furnish a construction safety specialist.

## **3. Subcontractors' Project Safety Representative (PSR)**

Every subcontractor shall identify one employee to be its Project Safety Representative who will be on-site during all the subcontractor's activities and will participate in all training activities, audits, etc. related to the safety program.

- 3.1 The PSR shall attend all safety meetings while the company is actively performing work at the project and shall be responsible for reporting all incidents to the PSC.
- 3.2 The PSR shall transport or accompany any injured co-worker that requires medical attention at facilities outside the project.
- 3.3 The PSR shall be responsible for either conducting or making arrangements for all training, equipment and materials that workers need to perform their duties in the safest possible manner.

## **4. Project Safety Program**

- 4.1 The Contractor shall develop a written, site specific, safety program. It shall be printed in English and an initial draft shall be submitted to the Owner for review and comment as a prerequisite to issuance of the Notice to Proceed with construction services'
- 4.2 The Contractor shall incorporate Owner comments into a final draft which shall be resubmitted to the Owner for concurrence.

## **5. Personal Protective Equipment (PPE)**

- 5.1 PPE shall be required for all workers in construction areas. The followings items shall be furnished, inspected, and maintained by the employer. The Contractor shall maintain an adequate inventory to furnish these items for five Owner representatives who may visit the project from time to time:

- 5.1.2 Hard Hats (safety helmets): shall be ANSI stamped (Z89.1-1997, Type I, Class E, G and C and be worn at all times while in the construction areas.
  - 5.1.3 Eye protection (safety glasses): shall be ANSI stamped Z87. If a worker wears prescription glasses (plastic lenses only) that are marked Z87, the employer shall furnish goggles or safety glasses that are designed to fit over another pair of glasses and be worn at all times while in the construction areas.
  - 5.1.4 Vests shall be at a minimum a Class II reflective traffic vests and be worn at all times while in the construction areas.
  - 5.1.5 Hand protection, Hearing Protection, Respiratory Protection, Fall Arrest Equipment, Other PPE: shall all be furnished as required to comply with OSHA Standards.
6. **Medical Equipment** - The Contractor shall maintain at least one first aid kit on the project site at all times per ANSI Z308.1.
7. **Certifications**  
Supervisors, Competent Persons, Equipment and Crane Operators, and Emergency Responders shall all be identified in lists submitted by employers to the PSC prior to commencement of work. In addition to lists, the employers shall include copies of all available training certificates or formal documentation to support the declared positions. For all operations that require a “competent person” (per OSHA definition), the PSC shall maintain a project file containing the transmittals from each employer naming each person declared to be competent for each operation. For operations requiring independent certification, a copy of the certificates shall be attached.
8. **Project Safety Signs and Posters**
- 8.1 The Contractor shall post safety regulation signs at every point of entry to the project in English and Spanish. The content of the sign should at a minimum indicate that visitors are required to check in at the project office, persons entering the construction area must be appropriately attired, no weapons, tobacco, alcohol, controlled substances and related paraphernalia may be brought onto the premises, a posted speed limit will be identified and copies of the MSDS sheets are available at the project office.
  - 8.2 The Contractor shall post emergency contacts and notification, including phone numbers, notification of insurance carrier for Worker’s Compensation Coverage and any and all other required State and Federal postings.



**9. Project Safety Training and Meetings**

- 9.1 Within fifteen days of the issuance of the Notice to Proceed the Contractor shall hold the initial safety meeting and all Project Team members are strongly encouraged to participate.
- 9.2 The PSC shall present orientation training to every person who is to be allowed into the construction area without an escort. A translator shall be present when there are workers in attendance who do not speak English.
- 9.3 The PSC shall maintain a site safety orientation log signed by all persons receiving safety training.
- 9.4 Project safety meetings will be held on a weekly basis and will be chaired by the PSC and attended by all companies' PSRs who are currently on site. The topics of discussion should focus on safety and loss control issues.
- 9.5 "Tool Box Talks" shall be conducted on a weekly basis by each PSR and will cover safety issues related to upcoming work, current site conditions and review of any recent incidents.
- 9.6 Special task training should occur when new equipment or non-routine activities are scheduled.

**10. Safety Inspections**

- 10.1 Daily – The PSC shall observe work operations in all areas of the project and note any violations in the daily progress reports.
- 10.2 Weekly – A comprehensive safety inspection shall be conducted by the PSC and each PSR for their respective work areas. A written record of the observations and recommended corrections should be made and placed in the project files.
- 10.3 Quarterly – The PSC shall facilitate an inspection which shall include, but not be limited to the following: fall arrest equipment, fire extinguishers, rigging, ladders, hand tools, power tools, cords, welding leads, hoses, alarms, respirators, ground fault circuit interrupters, first aid stations, eye wash stations, and emergency rescue equipment.
- 10.4 Semi-annually – The PSC shall facilitate an inspection of all hoists, cranes, mobile equipment, motorized lift platforms, stages, generators and compressors to assure proper operational condition.
- 10.5 The PSC shall notify the Owner within one hour of the arrival at the project site by any representative of a regulatory agency and provide the Owner with a copy of any published findings or citations issued to any employer and shall ensure that statutory posting requirements are met.

- 11. Records and Reports** - The PSC shall prepare a written report for each incident that involves any injury that may not be resolved by first aid response and/or each incident that involves damage to property or



equipment. The report should contain a list of factual details that created the incident, the responsive actions that occurred during and immediately following the incident and recommendations for modifications to prevent repetition of the incident. A copy of the report should be submitted to the Owner within 24 hours of the incident.

## **12. Construction Operations**

### **12.1 Cranes**

12.1.1 Tower cranes and related power supply equipment shall be surrounded by at least an eight foot high, 5/8" plywood enclosure with lock controlled entrance.

12.1.2 Operators of cranes, derricks and/or hoisting equipment shall possess certification from a nationally accredited training organization.

12.2 Demolition - Safe egress paths and barrier isolation of impacted areas shall be monitored and maintained to prevent entry by other trades and members of the public. This includes removal of materials and trash from elevated locations.

### **12.3 Electrical Power**

12.3.1 Ground fault circuit interruption (GFCI) shall be the primary protection from exposure to electrical current for all workers on the project. Only exit lighting and medium-high (greater than 240) voltage service will not be GFCI protected.

12.3.2 All strings of temporary lights shall be fully lamped and guarded regardless of height, and shall be continuously maintained. Adequate levels of illumination for the work operations must be maintained at all times.

12.3.3 All receptacles and switches shall have trim plates installed before they are energized.

12.3.4 All power distribution panels shall have full covers installed before primary power is brought into the panel.

### **12.4 Excavations**

12.4.1 Prior to starting, each excavation shall be reviewed with the Owner to obtain any historical knowledge about existing utilities in the area. Where applicable, "utility locates" will be called for seventy-two hours in advance of commencement of the excavation. Potholing and/or hand excavation shall be required within two horizontal feet of located centerlines and in areas where knowledge is lacking.

12.4.2 When a trench excavations cannot be backfilled in the same day as it is created, a highly visible barricade shall be erected no less than six feet from all approachable edges. All portable means of access shall be removed at the end of each workday.

12.4.3 Earth ramps that are to be used for walking access shall not exceed twenty percent in grade slope. Steeper slopes shall be gated and used for equipment only.

12.5 Fall Protection and Prevention

12.5.1 Any walking/working surface shall be defined to have a fall exposure that has one or more sides, ends or edges without a guardrail system attached or a solid continuous wall of at least forty-two inches in height above the walking/working surface, and within twelve horizontal inches from the edge. The Contractor shall require engineered or conventional fall protection measures for each and every fall exposure that involves vertical distances equal to or greater than six feet. The recognized exemptions/exceptions are as follows:

- Portable step ladders
- Extension and straight ladders
- Erection and dismantling of scaffolding
- Limited exposure for engaging and disengaging a hook
- Vertical fall exposure protected by a warning line and six foot setback

12.5.2 Provide covers over holes which are secured and clearly marked as covers.

12.5.3 Job built ramps and bridges must be covered with non-skid materials.

12.5.4 Materials, scraps, waste and tools shall never be allowed to free-fall from a height greater than twenty feet, unless it is contained within a chute or controlled by a hoist.

12.6 Fire Protection

12.6.1 The Contractor shall review fire prevention needs and procedures with the Owner and shall post appropriate information and warnings.

12.6.2 The Contractor shall maintain unobstructed access to fire extinguishers, temporary fire protection facilities, stairways and other access routes.

12.6.3 The Contractor shall provide supervision of welding operations, combustion type temporary heating units and similar sources of ignition.

12.6.4 All floors that have combustible materials present shall be accessible from ground level by a usable stair system. For structures greater than three stories in height shall have a fire sprinkler stand pipe installed and it shall be charged to within two stories (or thirty vertical feet) of all floors containing combustible materials. A Siamese connection shall be installed at every second level to provide access for fire hoses.

- 12.6.5 All fire extinguishers that are not task-specific shall be adequate in number and description to comply with OSHA declared limits for egress points, floor area and travel distances. They shall be situated in highly visible locations.
- 12.6.6 All fire extinguisher that are task specific shall be inspected and furnished in advance by the employer that will be conducting the work that requires such fire fighting provisions. Such extinguishers shall be located with twenty-five feet from the perimeter of the task operation.
- 12.7 Housekeeping - The Contractor shall ensure that all subcontractors effectively clean the project site continuously throughout each workday. Effective cleanup shall address all of the following housekeeping issues:
  - 12.7.1 All construction waste, trash, and debris shall be placed in designated receptacles. No glass bottles will be permitted on the project site.
  - 12.7.2 Stack all whole and scrap materials in locations that do not obstruct a clear pathway nor create a risk of toppling causing injury or damage to the work.
  - 12.7.3 Place all hoses, cords, cables and wires in locations that prevent them from being damaged by tires, sharp edges, or pinch points and from creating trip or hook hazards.
  - 12.7.4 Secure and effectively cover all materials on roofs and elevated levels to prevent displacement by wind.
  - 12.7.5 All materials and equipment shall be protected from the elements while staged on the project site.
  - 12.7.6 All signs, barricades, fire extinguishers, guardrails, gates, etc. are to be restored to their proper locations in sound condition after they have been moved for work purposes.
  - 12.7.7 Properly store and secure all flammable and combustible liquids and gases.
  - 12.7.8 Collect and place all cut-off or waste pieces of rolling stock into waste and scrape containers as they are created.
  - 12.7.9 Live rounds ejected from powder-actuated tools shall be immediately placed in designated containers and periodically returned to the tool dealer or law enforcement agency for proper disposal.
  - 12.7.10 All puncture and impalement exposures shall be covered or eliminated as soon as they are created.
- 12.8 Ladders
  - 12.8.1 Portable aluminum ladders are prohibited.
  - 12.8.2 Extension, straight and job built ladders shall be secured from movement at the top and bottom.

- 12.8.3 Manufactured portable ladders shall display ANSI heavy duty rating (Class 1-A) and be inspected daily.
- 12.9 Medical Assistance and Screening
  - 12.9.1 The PSC shall maintain a First Aid Log for all treatment administered on the project.
  - 12.9.2 Drug and alcohol screening shall be mandatory for every supervisor and/or worker who sustains or contributes to the cause of any injury (beyond first aid) or property damage incident.
  - 12.9.3 Minimum requirements for chemical screening shall at least match the threshold limits for a NIDA 5-panel protocol and for alcohol screening shall at least match the Texas DOT vehicle operator's limit for blood alcohol content.
  - 12.9.4 Any supervisor or worker who tests positive shall be ejected and excluded from return to work at the project. Successful completion of an acceptable rehabilitation program may be considered by the Owner for restoring a person's ability to return to the project. The final decision rest solely with the Owner.
- 12.10 Petroleum Fuel Operated Equipment
  - 12.10.1 Where possible, equipment operator cabs shall be locked during non-working hours. Only equipment operators and direct supervisors shall have access to keys.
  - 12.10.2 Any combustion engine equipment with less than ninety-eight percent clean air exhaust shall not be operated in enclosed spaces unless the exhaust is piped to outside air, and fresh air is brought into the space to replace the amount being consumed. This includes generators/welders and compressors as well as mobile equipment.
  - 12.10.3 For hose and termination fittings on air compressors, whip checks shall be used at all connection points. Emergency shut off valves shall be installed on every discharge fitting of all air compressors.
- 12.11 Public Protection - The public boundary perimeter shall be secured from public intrusion. Attractive nuisance items such as tower cranes, tall ladders, fire escapes, large excavations, etc. shall require additional and separate security measures.
- 12.12 Project Service Water
  - 12.12.1 Potable water: comply with city health requirements.
  - 12.12.2 Non-potable water: Water storage containers, hose bibs and faucet shall be posted in English and Spanish "Danger - Do Not Drink"
- 12.13 Welding and Burning

- 12.13.1 Oxygen and fuel gas cylinders shall not be stored together, including on bottle carts. At the end of any workday bottles must be moved to OSHA prescribed storage arrangements.
- 12.13.2 Anti-flashback arrestors shall be installed at the pressure regulator gauges of all Oxy-Acetylene cutting rigs.
- 12.13.3 Welding operations shall not be allowed to present an opportunity for flash burn exposures to the eyes of any workers in the vicinity. All welding operations shall provide appropriate screening measures, erected in advance to contain the high energy light.

## **Section 014200                    Reference Standards**

1.    **Governing Regulations/Authorities** - The Architect/Engineer (A/E) has contacted the appropriate authorities having jurisdiction for the listed regulations and codes to obtain information for preparation of the Construction Documents. The Contractor may contact the authorities having jurisdiction directly for information and decisions having bearing on the work. **Refer to the coversheet of the plans issued for construction to identify the appropriate authorities having jurisdiction.**
  
2.    **Standards**
  - 2.1    Reference to standards, codes, Specifications, recommendations and regulations refer to the latest edition or printing prior to the date of issue of the Construction Documents.
  - 2.2    Applicable portions of standards listed that are not in conflict with the Construction Documents are hereby made a part of the Specifications
  - 2.3    Modifications or exceptions to Standards shall be considered as amendments and unmodified portions shall remain in full effect. In cases of discrepancies between standards, the more stringent requirements shall govern.
  - 2.4    Copies of Standards: Each entity engaged in construction of the Project is required to be familiar with industry standards applicable to its respective construction activity. Copies of applicable standards are not bound with the Construction Documents. Where copies of standards are needed to perform a required construction activity, the Contractor shall obtain copies directly from the publication source.
  
3.    **Schedule of Standards**  
  

<b>AA</b>	Aluminum Association 1525 Wilson Blvd. Suite 600 Arlington, VA 22209 703.358.2960
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Fax 703.358.2961  
[www.aluminum.org](http://www.aluminum.org)

- AABC** Associated Air Balance Council  
1518 K St. NW  
Washington, DC 20005  
202.737.0202  
[www.aabchq.com](http://www.aabchq.com)
- AAMA** American Architectural Manufacturers Assoc.  
1827 Walden Office Square, Suite 550  
Schaumburg, IL 60173-4268  
847.303.5664  
Fax 847.303.5774  
[www.aamanet.org](http://www.aamanet.org)
- AAN** American Association of Nurserymen  
1250 Eye St., NW, Suite 500  
Washington, DC 20005  
202.789.2900
- ANLA** American Nursery and Landscape Association  
1000 Vermont Ave., NW, Suite 300  
Washington, DC 20005-4914  
202.789.2900  
[www.anla.org](http://www.anla.org)
- AASHTO** American Association of State Highway and Transportation  
Officials  
444 North Capitol St., Suite 225  
Washington, DC 20001  
202.624.5800  
[www.transporation.org](http://www.transporation.org)
- ACI** American Concrete Institute  
38800 Country Club Dr.  
Farmington Hills, MI 48331  
248.848.3700  
Fax 248.848.3701  
[www.aci-int.org](http://www.aci-int.org)
- ACIL** American Council on Independent Laboratories  
1629 K St. NW  
Washington, DC 20006

202.887.5872

[www.acil.org](http://www.acil.org)

- ACPA** American Concrete Pipe Association  
1303 West Walnut Hill Lane, Suite 305  
Irving, TX 75038-3008  
972.506.7216  
Fax 972.506.7682  
[www.concrete-pipe.org](http://www.concrete-pipe.org)
- ADC** Air Diffusion Council  
1901 N. Roselle Rd., Suite 800  
Schaumburg, IL 60195  
847.706.6750  
Fax 847.706.6751  
[www.flexibleduct.org](http://www.flexibleduct.org)
- AF&PA** American Forest & Paper Products  
(Formerly National Forest Products Assoc. (NFPA))  
1111 Nineteenth St., NW, Suite 800  
Washington, DC 20036  
800.878.8878  
Fax 202.463.2700  
[www.afandpa.org](http://www.afandpa.org)
- AI** Asphalt Institute  
2696 Research Park Dr.  
Lexington, KY 40512-4052  
606.288.4960  
<http://www.washpaltinstitute.org>
- AIA** American Institute of Architects  
1735 New York Ave. NW  
Washington, DC 20006  
202.626.7300  
[www.aia.org](http://www.aia.org)
- AIHA** American Industrial Hygiene Assoc.  
P 2700 Prosperity Ave., Suite 250  
Fairfax, VA 22031  
703.849-888  
[www.aiha.org](http://www.aiha.org)
- AISC** American Institute of Steel Construction

One East Wacker Dr., Suite 3100  
Chicago, IL 60601-2001  
312.670.2400  
[www.aisc.org](http://www.aisc.org)

- AISI** American Iron and Steel Institute  
1140 Connecticut Ave., NW, Suite 705  
Washington, DC 20036  
202.452.7100  
[www.steel.org](http://www.steel.org)
- AITC** American Institute of Timber Construction  
7012 S. Revere Parkway, Suite 140  
Centennial, CO 80112  
303.792.9559  
303.792.0669  
[www.aitc-glulam.org](http://www.aitc-glulam.org)
- ALI** Associated Laboratories, Inc.  
500 S. Vermont St.  
Palatine, IL 60067  
800.685.0026  
[www.associatedlabs.org](http://www.associatedlabs.org)
- ALSC** American Lumber Standards Committee  
P.O. Box 210  
Germantown, MD 20875  
301.972.1700  
[www.alsc.org](http://www.alsc.org)
- AMCA** Air Movement and Control Assoc.  
30 W. University Dr.  
Arlington Heights, IL 60004-1893  
847.394.0150  
[www.amca.org](http://www.amca.org)
- ANSI** American National Standards Institute  
1819 L St., NW, 6<sup>th</sup> Fl.  
Washington, DC 20036  
202.293.8020  
Fax 202.293.9287  
[www.ansi.org](http://www.ansi.org)
- APA** American Plywood Assoc.



7011 S. 19<sup>th</sup>  
Tacoma, WA 98466  
253.565.6600  
Fax 253.565.7265  
[www.apawood.org](http://www.apawood.org)

**ARI** Air Conditioning and Refrigeration Institute  
4100 North Fairfax Dr., Suite 200  
Arlington, VA 22203  
703.524.8800  
Fax 703.528.3816  
[www.ari.org](http://www.ari.org)

**ARMA** Asphalt Roofing Manufacturers Assoc.  
Public Information Dept.  
1156 15<sup>th</sup> St., NW, Suite 900  
Washington, DC 20005  
202.207.0917  
Fax 202.223.9741  
[www.asphaltroofing.org](http://www.asphaltroofing.org)

**ASA** Acoustical Society of America  
2 Huntington Quadrangle, Suite 1N01  
Melville, NY 11747-44502  
516.576.2360  
Fax 516.576.2377  
[www.asaa.aip.org](http://www.asaa.aip.org)

**ASC** Adhesive and Sealant Council  
7979 Old Georgetown Rd. Suite 500  
Bethesda, MA 20814  
301.986.9700  
Fax 301.986.9795  
[www.ascouncil.org](http://www.ascouncil.org)

**ASHRAE** American Society of Heating, Refrigerating and Air-  
Conditioning Engineers  
1791 Tullie Circle, NE  
Atlanta, GA 30329  
404.636.8400  
Fax 404.321.5478  
[www.ashrae.org](http://www.ashrae.org)

**ASME** American Society of Mechanical Engineers

Three Park Ave.  
New York, NY 10016-5990  
800.843.2763  
[www.asme.org](http://www.asme.org)

**ASPE** American Society of Plumbing Engineers  
8614 Catalpa Ave., Suite 1007  
Chicago, IL 60656-1116  
773.693.2773  
Fax 773.695.9007  
[www.aspe.org](http://www.aspe.org)

**ASSE** American Society of Sanitary Engineers  
901 Canterbury, Suite A  
Westlake, OH 44145  
440.835.3040  
Fax 440.835.3488  
[www.asse-plumbing.org](http://www.asse-plumbing.org)

**ASTM** American Society for Testing and Materials  
100 Barr Harbor Dr.  
West Conshohocken, PA 19428-2959  
610.832.9500  
Fax 610.832.9555

**AWCMA** American Window Covering Manufacturers Assoc.  
355 Lexington, AVE, 17<sup>th</sup> Fl.  
New York, NY 10017  
212.297.2122  
Fax 212.370.9047  
[www.wcmanet.org](http://www.wcmanet.org)

**AWI** Architectural Woodwork Institute  
46179 Westlake Dr., Suite 120  
Potomac Falls, VA 20165  
571.323.3636  
Fax 571.323.3630  
[www.awinet.org](http://www.awinet.org)

**AWPA** American Wood-Preservers' Assoc.  
P.O. Box 361784  
Birmingham, AL 35236-1784  
205.733.4077  
[www.awpa.com](http://www.awpa.com)

- AWPB** American Wood Preservers Bureau  
4 D. Washington, St  
Newnan, GA 30263  
404.254.9877
- AWS** American Welding Society  
50 N.W. LeJeune Rd.  
Miami, FL 33126  
800.443.9353  
Fax 305.443.9353  
[www.aws.org](http://www.aws.org)
- BHMA** Builder's Hardware Manufacturers Assoc.  
355 Lexington Ave., 15<sup>th</sup> Fl.  
New York, NY 10017  
212.297.2122  
Fax 212.370.9047  
[www.buildershardware.com](http://www.buildershardware.com)
- BIA** The Brick Industry Association  
1850 Centennial Park Dr., Suite 301  
Reston, VA 20191  
703.620.0010  
Fax 703.620.3928  
[www.bia.org](http://www.bia.org)
- BIFMA** Business and Institutional Furniture Manufacturers Assoc.  
2680 Horizon, Dr., SE, Suite A-1  
Grand Rapids, MI 49546-7500  
616.285.3963  
Fax 616.285.3765  
[www.bifma.org](http://www.bifma.org)
- CFFA** Chemical Fabrics & Film Assoc., Inc.  
c/o Thomas Assoc., Inc  
1300 Sumner Ave.  
Cleveland, OH 44115-2851  
216.241.7333  
[www.chemicalfabricsandfilm.com](http://www.chemicalfabricsandfilm.com)
- CISCA** Ceiling and Interior Systems Construction Assoc.  
5700 Old Orchard Rd., 1<sup>st</sup> Fl.  
Skokie, IL 60077

708.965.2776  
[www.cisca.org](http://www.cisca.org)

**CISPI** Cast Iron Soil Pipe Institute  
5959 Shallowford Rd., Suite 419  
Chattanooga, TN 37421  
615.892.0137  
Fax 615.892.0817  
[www.cispi.org](http://www.cispi.org)

**CRI** Carpet and Rug Institute  
P.O. Box 2048  
Dalton, GA 30722  
706.278.8835  
Fax 706.278.8835 [www.carpet-rug.org](http://www.carpet-rug.org)

**CRSI** Concrete Reinforcing Steel Institute  
933 North Plum Grove Rd.  
Schaumburg, IL 60173-4758  
847.517.1200  
Fax 847.517.1206  
[www.crsi.org](http://www.crsi.org)

**CTIOA** Ceramic Tile Institute of America  
12064 Jefferson, Blvd.  
Culver City, CA 90230-6219  
310.574.7800  
Fax 310.821.4655  
[www.ctioa.org](http://www.ctioa.org)

**DHI** Door and Hardware Institute  
14150 Newbrook Dr., Suite 200  
Chantilly, VA 20151  
703.222.2010  
Fax 703.222.2410  
[www.dhi.org](http://www.dhi.org)

**ETL** ETL Testing Laboratories, Inc.  
P.O. Box 2040  
Route 11, Industrial Park  
Cortland, NY 13045  
607.753.6711  
[www.etl.com](http://www.etl.com)

- ECDS** Energy Conservation Design Standards for New State Buildings  
State Energy Conservation Office  
Texas Facilities Commission  
P.O. Box 13047  
Austin, TX 78711-3047
- FGMA** Flat Glass Marketing Assoc.  
(The Flat Glass Marketing Assoc. included Glass Tempering Association, and members of the Laminators Safety Glass Association consolidated to form the Glass Assoc. of North America)  
2495 SW Wanamaker Dr., Suite A  
Topeka, KS 66614  
785.271.0208  
Fax 785.271.0166  
[www.glasswebsite.com](http://www.glasswebsite.com)
- FM** Factory Mutual Research Organization  
500 River Ridge  
P.O. Box 9102  
Norwood, MA 02062  
617.762.4300
- GA** Gypsum Association  
810 First St., NE #510  
Washington, DC 20002  
202.289.5440  
Fax 202.289.3707  
[www.gypsum.org](http://www.gypsum.org)
- HMA** Hardwood Manufacturers Assoc.  
400 Penn Center Blvd., Suite 350  
Pittsburg, PA 15235  
412.829.0770  
Fax 412.829.0844  
[www.hmamembers.org](http://www.hmamembers.org)
- HPMA** Hardwood Plywood Manufacturers Assoc.  
1825 Michael Farraday Dr.  
Reston, VA 20190  
703.435.2900  
Fax 703.435.2537  
[www.hpva.org](http://www.hpva.org)

- IBC** International Building Code  
International Code Council  
500 New Jersey Ave., NW 6<sup>th</sup> Fl.  
Washington, DC 20001-2070
- IBD** Institute of Business Designers  
341 Merchandise Mart  
Chicago, IL 60654  
312.647.1950
- ICC** International Code Council  
500 New Jersey Ave., NW, 6<sup>th</sup> Floor  
Washington, DC 20001  
888.422.7233  
Fax 202.783.2348  
[www.iccsafe.org](http://www.iccsafe.org)
- IECC** International Energy Conservation Coder  
[www.iccsafe.com](http://www.iccsafe.com)
- IEEE** Institute of Electrical and Electronic Engineers  
3 Park Ave., 17<sup>th</sup> Fl.  
New York, NY 10016-5997  
212.419.7900  
Fax 212.752.4929  
[www.ieee.org](http://www.ieee.org)
- IESNA** Illuminating Engineering Society of North American  
120 Wall Street, Fl. 17  
New York, NY 10005  
212.248.5000  
Fax 212.248.5017  
[www.iesna.org](http://www.iesna.org)
- IFC** International File Code  
[www.iccsafe.org](http://www.iccsafe.org)
- IGCC** Insulating Glass Certification Council  
c/o ETL Testing Laboratories, Inc.  
P.O. Box 9  
Henderson Harbor, NY 13651  
315.646.2234  
Fax 315.646.2297  
[www.igcc.org](http://www.igcc.org)

- ILI** Indiana Limestone Institute of American  
400 Stone City Bank Bldg.  
Bedford, IN 47421  
812.275.4426  
Fax 812.279.8682  
[www.iliai.com](http://www.iliai.com)
- IPC** International Plumbing Code  
[www.iccsafe.org](http://www.iccsafe.org)
- ISA** Instrument Society of America  
67 Alexander Dr.  
Research Triangle Park, NC 27709  
919.549.8411  
Fax 919.549.8288  
[www.isa.org](http://www.isa.org)
- LIA** Lead Industries Assoc., Inc.  
Sparta, New Jersey  
[www.leadinfo.com](http://www.leadinfo.com)
- LPI** Lightning Protection Institute  
25475 Magnolia Dr.  
P.O. Box 99  
Maryville MO 64468  
800.488.6864  
[www.lightning.org](http://www.lightning.org)
- MBMA** Metal Building Manufacturers Assoc.  
1300 Sumner Ave.  
Cleveland OH 44115-2851  
216.241.7333  
Fax 216.241.0105  
[www.mbma.com](http://www.mbma.com)

**MCAA** Mechanical Contractors Assoc. of America

1385 Piccard Dr.  
Rockville, MD 20850  
301.869.5800  
Fax 301.990.9690  
[www.mcaa.org](http://www.mcaa.org)

**MFMA** Maple Flooring Manufacturers Assoc.

60 Revere Dr., Suite 500  
Northbrook, IL 60062  
888.480.9138  
Fax 847.480.9282  
[www.maplefloor.org](http://www.maplefloor.org)

**MIA** Marble Institute of America

28901 Clemens Rd., Suite 100  
Cleveland, OH 44145  
440.250.9222  
Fax 440.250.9223  
[www.marble-institute.com](http://www.marble-institute.com)

**ML/SFA**

Metal Lath/Steel Framing Assoc.  
(A Division of the National Association of Architectural Metal  
Manufacturers)  
800 Roosevelt Rd., Bldg. C, Suite 312  
Glen Ellyn, IL 60137  
630.942.6591  
Fax 630.7903095  
[www.naamm.org](http://www.naamm.org)

**NAAMM**

National Association of Architectural Metal Manufacturers  
800 Roosevelt Rd., Bldg. C, Suite 312  
Glen Ellyn, IL 60137  
630.942.6591  
Fax 630.7903095  
[www.naamm.org](http://www.naamm.org)

**NAIMA**

North American Insulation Manufacturers Assoc,  
44 Canal Center Plaza, Suite 310  
Alexandria, VA 22314  
703.684.0084  
Fax 703.684.0427  
[www.naima.org](http://www.naima.org)



**NAPA** National Asphalt Pavement Association  
NAPA Building  
5100 Forbes Blvd.  
Lanham, MD 20706  
888.468.6499  
[www.hotmix.org](http://www.hotmix.org)

**NCMA** National Concrete Masonry Assoc.  
13750 Sunrise Valley Dr.  
Herndon, VA 20171-4662  
703.713.1900  
Fax 703.713.1910  
[www.ncma.org](http://www.ncma.org)

**NEC** National Electrical Code (NFPA)

**NECA** National Electrical Contractors Assoc.  
3 Bethesda Metro Center, Suite 1100  
Bethesda, MD 20814  
301.657.3110  
Fax 301.215.4500  
[www.necanet.org](http://www.necanet.org)

**NEII** National Elevator Industry, Inc.  
1677 County Route 64  
P.O. Box 838  
Salem, NY 127865-0838  
518.854.3100  
Fax 518.854.3257  
[www.neii.org](http://www.neii.org)

**NEMA** National Electrical Manufacturers Assoc.  
1300 North 17<sup>th</sup> St., Suite 1752  
Rosslyn, VA 22209  
703.841.3200  
Fax 703.841.5900  
[www.nema.org](http://www.nema.org)

**NFPA** National Fire Protection Assoc.  
1 Batterymarch Park  
Quincy, MA 02169-7471  
617.770.3000  
Fax 617.770.0700

[www.nfpa.org](http://www.nfpa.org)

- NHLA** National Hardwood Lumber Assoc.  
6830 Raleigh-LaGrange Rd.  
Memphis, TN 38184-0518  
901.377.1818  
[www.natlhardwood.org](http://www.natlhardwood.org)
- NLGA** National Lumber Grades Authority  
#302 960 Quayside Dr.  
New Westminister, BC V3M 6G2 Canada  
604.524.2393  
Fax 604.524.2893  
[www.nlga.org](http://www.nlga.org)
- NPA** National Particleboard Assoc.  
18928 Premiere Court  
Gaithersburg, MD 20879-1569  
301.670.0604  
Fax 301.840.1252  
[www.pbmdf.org](http://www.pbmdf.org)
- NPCA** National Paint and Coatings Assoc.  
1500 Rhode Island Ave., NW  
Washington, DC 20005  
202.462.6272  
Fax 202.462.8549  
[www.paint.org](http://www.paint.org)
- NRCA** National Roofing Contractors Assoc.  
10255 W. Higgins Rd., Suite 600  
Rosemont, IL 60018-5607  
708.299.9070  
Fax 847.299.1183
- NTMA** National Terrazzo and Mosaic Assoc.  
201 North Maple, Suite 208  
Purcellville, VA 20132  
540.751.0930  
Fax 540.751.0935  
[www.ntma.com](http://www.ntma.com)
- NWWDA** National Wood Window and Door Assoc.  
1400 E. Touhy Ave.

Des Plains, IL 60018  
800.223.2301  
Fax 708.299.1286

- PCA** Portland Cement Assoc.  
5420 Old Orchard Rd.  
Skokie, IL 60077  
847.966.6200  
Fax 847.966.8389  
[www.cement.org](http://www.cement.org)
- PCI** Precast/Prestressed Concrete Institute  
209 W. Jackson Blvd. #500  
Chicago, IL 60606  
312.786.0300  
Fax 312.786.0353  
[www.pci.org](http://www.pci.org)
- RFCI** Resilient Floor Covering Institute  
401 E. Jefferson St., Suite 102  
Rockville, MC 20850  
301.340.8580  
Fax 301.340.7283  
[www.rfci.com](http://www.rfci.com)
- RMA** Rubber Manufacturers Assoc.  
1400 K St., NW, Suite 900  
Washington DC 20005  
202.682.4800  
[www.rma.org](http://www.rma.org)
- SDI** Steel Deck Institute  
P.O. Box 25  
Fox River Grove, IL 60021  
847.458.4647  
Fax 847.458.4648
- SECO** State Energy Conservation Office  
LBJ State Office Bldg.  
111 E. 17<sup>th</sup> St., Rm 1114  
Austin, TX 78701  
512.463.1931  
Fax 512.475.2569  
[www.seco.cpa.stat.tx.us](http://www.seco.cpa.stat.tx.us)

- SGCC** Safety Glazing Certification Council  
P.O. Box 730  
Sackets Harbor, NY 13685  
315.646.2234  
Fax 315.646.2297  
[www.sgcc.org](http://www.sgcc.org)
- SIGMA** Sealed Insulating Glass Manufacturers Assoc.  
401 N. Michigan  
Chicago, IL 60611  
312.644.8610  
[www.sigmaonline.org](http://www.sigmaonline.org)
- SJI** Steel Joist Institute  
3127 Mr. Joe White Ave.  
Myrtle Beach, SC 29577-6760  
843.626.1995  
Fax 843.626.5565  
[www.steeljoist.org](http://www.steeljoist.org)
- SMACNA** Sheet Metal and Air Conditioning Contractors National Assoc.  
4201 Lafayette Center Dr.  
Chantilly, VA 20151-1209  
703.803.2980  
703.803.3732  
[www.smacna.org](http://www.smacna.org)
- SPIB** Southern Pine Inspection Bureau  
P.O. Box 10915  
Pensacola, FL 32524-0915  
850.434.2611  
Fax 850.433.5594  
[www.spib.org](http://www.spib.org)
- SPRI** Single Ply Roofing Institute  
77 Rumford Ave., Suite 3B  
Waltham, MA 02453  
781.647.7026  
Fax 781.647.7222  
[www.spri.org](http://www.spri.org)
- TCA** Tile Council of America  
100 Clemson Research Blvd.

Anderson, SC 29625  
864.646.8453  
Fax 864.646.2821  
[www.tileusa.com](http://www.tileusa.com)

- TIMA** Thermal Insulation Manufacturers Assoc.  
29 Bank St.  
Stanford, CT 06901  
203.324.7533  
(Standards now issued by NAIMA, [www.naima.org](http://www.naima.org))
- UFAC** Upholstered Furniture Action Council  
Box 2436  
High Point, NC 27261  
919.885.5065  
[www.ufac.org](http://www.ufac.org)
- UL** Underwriters Laboratories, Inc.  
333 Pfingsten Rd.  
Northbrook, IL 60062-2096  
847.272.8800  
Fax 847.272.8129  
[www.ul.com](http://www.ul.com)
- WSFI** Wood and Synthetic Flooring Institute  
4415 W. Harrison St., Suite 242-C  
Hillside, IL 60162  
708.449.2933
- WWPA** Western Wood Products Assoc.  
522 SW Fifth Ave., Suite 500  
Portland, OR 97204-2122  
503.224.3930  
Fax 503.224.3934  
[www.wwpa.org](http://www.wwpa.org)
- W.W.P.A.** Woven Wire Products Assoc.  
2515 N. Nordica Ave.  
Chicago, IL 60635  
312.637.1359  
[www.wovenwire.org](http://www.wovenwire.org)

**Government Agencies**

- CPSC** Consumer Products Safety Commission  
4330 E. West Highway  
Bethesda, MD 20814  
301.504.7923  
Fax 301.504.0124  
[www.cpsc.gov](http://www.cpsc.gov)
- CS** Commercial Standard  
(U.S. Department of Commerce)  
1401 Constitution Ave., NW  
Washington, DC 20230  
202.482.2000  
[www.commerce.gov](http://www.commerce.gov)
- DOC** U.S. Department of Commerce  
1401 Constitution Ave., NW  
Washington, DC 20230  
202.482.2000  
[www.commerce.gov](http://www.commerce.gov)
- EPA** Environmental Protection Agency  
1445 Ross Ave., Suite 1200  
Dallas, TX 75202  
214.665.6444  
[www.epa.gov](http://www.epa.gov)
- FS** Federal Specifications (from GSA Specifications Unit WFSIS)  
7<sup>th</sup> and D St., SW  
Washington DC 20407  
202.708.9205  
[www.apps.fss.gsa.gov/pub/fedspecs](http://www.apps.fss.gsa.gov/pub/fedspecs)
- GSA** General Services Administration  
1800 F. St., SW  
Washington DC, 20405  
202.708.9205  
[www.gsa.gov](http://www.gsa.gov)

**GSC** Texas Building and Procurement Commission  
1711 San Jacinto  
Austin, TX 78701  
512.463.6363  
[www.tbpc.state.tx.us](http://www.tbpc.state.tx.us)

**NIST** National Institute of Standards and Technology  
100 Bureau Dr., Stop 1070  
Gaithersbury, MD 20899-1077  
301.975.6478  
Fax 301.975.8295  
[www.nist.gov](http://www.nist.gov)

**OSHA** Occupational Safety and Health Administration  
Federal Office Building  
1205 Texas Ave., Rm 806  
Lubbock, TX 79401  
806.472.7681  
Fax 806.472.7686  
[www.osha.gov](http://www.osha.gov)

**PS** Product Standard of NBS  
(U.S. Department of Commerce)  
Washington, DC 20230  
202.482.2000  
[www.thenbs.com](http://www.thenbs.com)

**USDA** U.S. Department of Agriculture  
1400 Independence Ave., SW  
Washington, DC 20250  
202.447.2791  
[www.usda.gov](http://www.usda.gov)

## **Section 014300 Quality Assurance**

### **1. General Requirements**

1.1 The Contractor is responsible for controlling the quality of the Work of its forces and its subcontractors and all of the Work of the Project in general and as set forth in the Construction Documents. The Contractor shall provide qualified personnel, approved by the Owner, to perform daily supervision, reviews and inspections of subcontractor work to insure quality, accuracy, completeness and compliance.

- 1.2 The Owner will employ a testing laboratory and/or geotechnical engineering service to perform quality assurance test and to transmit copies of test reports to the Contractor. Sampling and testing that the Owner may require is specified in this section and in the various technical sections requiring quality assurance testing. The Contractor shall cooperate with the Owner's testing personnel, provide access to the work, to manufacturer's and fabricator's operations, furnish incidental labor and facilities and samples for test and inspection as specified.
  - 1.2.1 Employment of the testing laboratory to perform quality assurance tests is for the benefit of Owner in confirming that performance and quality of the work is in conformance with the Construction Documents.
  - 1.2.2 Employment of the testing laboratory by Owner in no way relieves Contractor's obligation to perform the work in accordance with the Construction Documents and Owner's testing laboratory shall not be the same as Contractor's testing laboratory.
  - 1.2.3 The testing firm shall make all inspections and perform all tests in accordance with the rules and regulations of the building code, local authorities, the specifications of the ASTM and these Construction Documents.
  - 1.2.4 Any costs incurred by the Owner due to re-testing of materials or re-inspection of work due to non-compliance with the Construction Documents by the contractor shall be at the expense of the Contractor and shall be deducted from the next pay request accordingly.
- 1.3 Limits of testing laboratory authority: Laboratory is not authorized to:
  - 1.3.1 Approve or reject any portion of the work.
  - 1.3.2 Perform any duties of the Contractor and subcontractors.
  - 1.3.3 Revoke, alter, relax, expand, or release any requirement of the Construction Documents or to approve or accept any portion of the Work, except where such approval is specifically called for in the specifications.
  - 1.3.4 Work will be checked as it progresses, but failure to detect any defective work or materials shall not, in any way, prevent later rejection when such defect(s) are discovered.
- 1.4 When requested by the Owner, the Contractor will demonstrate a material's compliance with the specifications in one of the following ways:
  - Manufacturer's Certificate of Compliance
  - Mill Certificate
  - Testing Laboratory Certifications



- Report of actual test results from Owner's designated laboratory, or a laboratory satisfactory to the Owner. Materials so tested shall be provided by the Contractor and selected by the Owner, or in the presence of the Owner, and the method of testing shall comply with the professional societies' standard specifications.
- 1.5 The Owner may require Special Inspections, Testing or Approval of certain materials or Work in addition to those clearly specified in the Construction Documents. Upon notification by the Owner of such requirements, the Contractor shall promptly arrange for such Special Inspections, Testing and Approval procedures. The costs associated with these efforts shall be borne by the Owner, except that if such materials or Work fail the initial Owner-paid inspections, tests and approvals, then subsequent tests required to prove the materials or Work suitable for inclusion in the Project Work shall be borne by the Contractor.
- 1.6 If the Contractor covers any of the Work that is required to be inspected, tested or approved by the Construction Documents, then that Work shall be uncovered, inspected, tested or approved and then recovered at the Contractor's sole expense.
- 1.7 The Contractor shall have the right to have tests performed on any material at any time for its own information and job control so long as the Owner is not charged for these tests or forced to rely on these tests when appraising quality of the materials. The tests specified in the Construction Documents for a specific material shall take precedence over any testing initiated by and paid for by the Contractor.
2. **Below Grade Inspections** - Before covering or backfilling of any improvement below grade, cover up inspections will be conducted to see that all items meet the plans and specifications. Only after all the deficiencies have been corrected will the Contractor be allowed to install any backfill.
3. **Concrete Inspections** - Before the placing of any cast-in-place concrete structure, an inspection will be conducted to see that all items meet the intent of the Construction Documents. Only after all deficiencies have been corrected will the Contractor be allowed to proceed.
4. **Wall Closure/Above-Ceiling Inspections** - Before the installation of any ceiling or the closing of walls chases, an inspection will be conducted to see that all items fully meet the contract document requirements before being covered. Only after all the deficiencies have been corrected will the Contractor be allowed to install the ceiling or close-up the wall. As a

minimum, the following should be in place before an above-ceiling inspection is scheduled:

- All light fixtures installed and working;
- All plumbing installed and insulation complete;
- All rigid and flexible ducts installed;
- All required valve identification tags installed;
- All air devices installed and connected;
- All control wiring and devices installed and connected;
- The ceiling support structure installed.

**5. Substantial Completion Inspection (see UGC 12.1.1)**

When the Contractor feels that the work is complete and ready for the Owner's intended use, it will notify the A/E and Owner at least seven days prior to the date the Contractor is ready for a Substantial Completion Inspection. The A/E and appropriate members of the design team along with the Owner will perform a detailed inspection of the all work and furnish the Contractor with a list of incomplete or unsatisfactory items. When the Contractor has completed all the work related to these items the Pre-Final Inspection will be complete.

**6. Final Inspection & Acceptance (see UGC 12.1.2 & 12.3)**

Upon verification by the A/E and Owner that the deficiencies found during the Pre-Final Inspection have been corrected, and the work is ready for Final Inspection and Acceptance, the A/E and Owner will schedule a Final Inspection. When the work is found to be acceptable under the Construction Documents without exception and the contract is fully performed, then a Final Acceptance Notice will be issued by the A/E.

**7. One-year Warranty Inspection**

Within thirty-days prior to the expiration of the one year anniversary of the Substantial Completion date the Owner shall prepare a list of deficiencies related solely to the workmanship and material warranties provided by the Contractor through the Construction Documents. The Contractor shall make the necessary repairs and replacements and notify the Owner that all work is complete and Owner shall review and approve the work and provide written acceptance.

**8. Execution**

**8.1 Pier Drilling Operations**

- 8.1.1** A representative of the soils testing laboratory shall make continuous inspections to determine that proper bearing stratum is obtained and utilized for bearing and that shafts are properly clean and dry before pouring concrete.

- 8.1.2 Soils testing laboratory shall furnish complete pier log showing the diameter, top and bottom elevations of each pier, casing required or not required, bell size, actual penetration into bearing stratum, elevation of top of bearing stratum, and volume of concrete used.
- 8.2 Reinforcing Steel Mechanical Splices
  - 8.2.1 Visually inspect and report on the completed condition of each mechanical splice of reinforcing steel.
  - 8.2.2 Each mechanical splice shall be visually inspected to ensure compliance with building code and the manufacturer's published criteria for acceptable completed splices.
  - 8.2.3 Special emphasis shall be placed on inspection of the end preparation of each bar to be spliced.
  - 8.2.4 Submit copies of manufacturer's published criteria for acceptable completed splices prior to observing mechanical splices.
  - 8.2.5 Reports on each splice shall indicate location, size of bars and acceptability or rejection of splice. Reasoning for rejection shall be provided in the report.
- 8.3 Reinforcing Steel and Embedded Metal Assemblies - Inspect all concrete reinforcing steel for compliance with Construction Documents and approved shop drawings prior to placing concrete. All instances of noncompliance shall be immediately brought to the attention of the Contractor for correction and then, if not corrected, reported to the A/E. Observe and report on the following:
  - Number and size of bars;
  - Bending and lengths of bars;
  - Splicing;
  - Clearance to forms including chair heights;
  - Clearance between bars or spacing;
  - Rust, form oil and other contaminants;
  - Grade of steel;
  - Securing, tying and chairing of bars;
  - Excessive congestion of reinforcing steel;
  - Installation of anchor bolts and placement of concrete around such bolts;
  - Fabrication of embedded metal assemblies, including visual inspection of all welds;
  - Visually inspect studs and deformed bar anchors on embedded assemblies for compliance with the Construction Documents.
- 8.4 Concrete Inspection & Testing
  - 8.4.1 Receive, evaluate and certify all proposed concrete mix designs submitted by the Contractor which comply with the

Construction Documents. Mix designs not complying shall be returned by the laboratory as unacceptable.

- 8.4.2 Secure composite samples of concrete at the jobsite and perform the appropriate tests as specified in the Construction Documents. Test results will be provided to the appropriate design team members, the Contractor and the Owner.
- 8.4.3 Inspect the application of curing compounds and monitor all curing conditions to assure compliance with the Construction Documents.
- 8.5 Post-tensioning of Concrete
  - 8.5.1 Verify certification of calibration of jacking equipment used in the post-tensioning operations.
  - 8.5.2 Observe and report on placement and anchorage of tendons immediately prior to placement of concrete.
  - 8.5.3 Provide a registered professional engineer experienced in post-tension operations to observe and report on the placement, post-tensioning and elongation measurement of each tendon.
  - 8.5.4 Observe and report on grouting of tendons noted to be bonded.
- 8.6 Masonry
  - 8.6.1 Provide a qualified inspector to inspect all structural masonry work on a periodic basis.
  - 8.6.2 Inspect the following:
    - Preparation of masonry prisms for testing;
    - Placement of reinforcing;
    - Grout spaces;
    - Mortar mix operations;
    - Bedding of mortar for each type of unit and placing of units;
    - Grouting operations;
    - Condition of units before laying for excessive absorption.
  - 8.6.3 Provide a report of each inspection.
- 8.7 Structural Steel
  - 8.7.1 Inspect all structural steel during and after erection for conformance with the Construction Documents and shop drawings. Any cases of insufficient bracing or guying, or other unsafe conditions shall be immediately called to the attention of the Contractor and reported to the A/E and Owner.
  - 8.7.2 Inspect the following:
    - Proper erection of all pieces;
    - Proper installation of all bolts;
    - Plumbness of structure and proper bracing;
    - Proper field painting;
    - Visual examination of all field welding;

- Inspect all shop fabricated members, upon arrival at the jobsite, for defects;
  - Inspection of shop and field welding shall be in accordance with the AWS Structural Welding Code – Steel, latest edition;
  - Inspection of bolted construction shall be in accordance with AISC specifications for structural steel buildings;
  - Inspection of stud field welding shall be in accordance with AWS structural welding code latest edition.
- 8.8 Expansion Bolt Installations
- 8.8.1 Inspect the drilling of holes and installation of expansion bolts for compliance with the Construction Documents and shop drawings.
- 8.8.2 Verify the installation torque of the expansion bolts for compliance with the manufacturer’s installation instructions.
- 8.9 Metal Floor Deck - Field inspection shall consist of the following:
- Check types, gauges and finishes for conformance with Construction Documents and shop drawings;
  - Exam for proper erection of all metal deck, fastenings, reinforcing of holes, deck reinforcing, miscellaneous deck supports, hanger tabs, shear studs, deck closures, painting and other coatings.
- 8.10 Metal Roof Deck - Field inspection shall consist of the following:
- Check types, gauges and finishes for conformance with Construction Documents and shop drawings;
  - Exam for proper erection of all metal deck, fastenings, reinforcing of holes, deck reinforcing, miscellaneous deck supports, hanger tabs, shear studs, deck closures, painting and other coatings.

## **Section 014339 Site Mock-ups (see UGC 8.4)**

### **1. General**

- 1.1 The Contractor shall direct all the appropriate subcontractors in the construction of all site mock-ups for review by the Owner and Architect/Engineer (A/E) as required by the Construction Documents.
- 1.2 The mock-up(s) when approved by the A/E and Owner shall become the site reference for quality of the incorporated features of materials and workmanship.
- 1.3 The mock-up shall not be part of the work and shall remain in place until Substantial Completion, or otherwise directed by the Owner.

## **Section 014500 Quality Control (see 014000)**

### **1. General Requirements**

- 1.1 Quality control shall be the sole responsibility of the Contractor, unless specifically noted otherwise. The Contractor shall be responsible for all testing, coordination, start-up, operational checkout and commissioning of all items of work included in the project. All costs for these services shall be included in the Contractor's cost of work and general conditions.
- 1.2 Specific quality control requirements for individual construction activities are specified in sections that govern those activities.
- 1.3 The Contractor employed testing agency shall comply with the requirements of ASTM C - 1021, 1077, 1093, E - 329, 543 and 548.
- 1.4 The Contractor shall develop design mixes for products to be used and have the appropriate test performed by the Contractor's employed testing agency at its own expense.

## **Section 014518 Field Engineering**

1. **Quality Assurance** - Surveyor Qualifications: Engage a land surveyor, registered in the State of Texas, to perform required land surveying services.
2. **Examination** - Verify layout information shown on the construction documents, in relation to the property survey and existing benchmarks and building locations and finish floor elevations before proceeding to lay out the work. Protect existing benchmarks and control points. Preserve permanent reference points during construction.
  - 2.1 Do not change or relocate benchmarks or control points without prior written approval from the Owner.
  - 2.2 Establish and maintain a minimum of two permanent benchmarks on the site.
3. **Performance**
  - 3.1 Work from lines and levels established by the Construction Documents. Calculate and measure required dimensions with indicated and recognized tolerances. Do not scale drawings to determine dimensions.
  - 3.2 Record deviations from required lines and levels and advise A/E immediately when deviations exceed indicated or recognized tolerances.

- 3.3 Furnish information necessary to adjust, move, or relocate existing structures, utility poles, lines services, or other appurtenances located in or affect by construction.
- 3.4 The as-built documents shall include a final Title I property survey.

**Section 015000 Construction Facilities and Temporary Controls**  
(see UGC 3.3.4, 8.1 & 13.1; also see 5.6.8, 5.8.2 13.13 & 13.1.4 of the CM@R contract)

**1. General Requirements**

- 1.1 Contractor shall provide all construction facilities and temporary controls specified in this section and as necessary for the proper and expeditious prosecution of the work. The Contractor will be provided with a description of the Project Site and the Limits of Construction either by the Construction Documents, or by the Owner. At any time such a description has not been provided, the Contractor should request it of the Owner in writing.
- 1.2 The Contractor shall erect a wire mesh fence around the Project Site. The Contractor and all its personnel, assigns, material suppliers and subcontractors shall confine and limit their work to the Project Site and shall confine their construction activities to within the Limits of Construction. All areas beyond these defined areas are patrolled either by the Campus Police or by the Police Department of the City. All public and University laws, ordinances, rules and regulations shall be obeyed. No tools, construction vehicles or construction materials shall be permitted to be outside the Project Site. Loitering of construction-related personnel in areas outside the Project Site is strongly discouraged and it will be discontinued if it becomes persistent, or otherwise a nuisance to the ordinary and normal functioning of the campus. **(UGC 3.3.11)**
- 1.3 All campus roads, drives, fire lanes and sidewalks/pedestrian routes (other than those specifically given over to the Contractor for its use) must be kept open and clean at all times. The Contractor shall make advanced preparations for, and obtain security clearance for, all significant materials and equipment movements that will disrupt traffic and pedestrian flows. The Contractor shall provide all traffic controls, warning signs, barricades and flag persons needed to minimize disruptions during such approved movements. When such movements cause damage or leave debris, the Contractor shall immediately repair and clean up afterwards. **(UGC 3.3.11.3)**
- 1.4 Contractor shall pay all charges for all connections to and distribution from existing services and sources of supply.



- 1.5 Requirements of service and utility companies relating to the work shall be ascertained by Contractor, and the Contractor shall comply with all requirements, including those relating to continued protection and maintenance until completion of the work.
- 1.6 Materials and construction for construction facilities and temporary controls may be new or used, must be in adequate capacity, must not create unsafe conditions and shall not be unsightly.
- 1.7 Contractor shall relocate temporary services and facilities at its own expense, as required by progress of construction. **(see UGC 7.2.1)**
- 1.8 Contractor shall remove all temporary services and facilities when their use is no longer required or at completion of the project. **(see UGC 3.3.11)**
- 1.9 Contractor shall clean and repair damage caused by temporary services and facilities to new condition for new work and to a condition as good as or better than existing prior to start of work for existing construction projects. **(see UGC 3.3.11.3)**

## 2. **Yard Repairs**

Where compaction of the soil has occurred in turf or other plant material areas within the limits of construction, the areas shall be rejuvenated by deep cultivation of the compacted soil. After completion of construction, the Contractor shall scarify the construction site within the limits of construction to a minimum depth of eight inches, except within thirty feet of trees where it shall be a six inch depth. The Contractor will either place sod or hydro mulch on the rejuvenated areas, as may be mutually agreed to between the Owner and the Contractor, depending on the season and availability of irrigation.

## 3. **Temporary Utilities and Services**

- 3.1 The Contractor shall provide for all necessary and appropriate temporary utilities and services for execution and protection of the work.
- 3.2 Schedule of Costs and Fees for Utility Services are different on different campuses. The Contractor must review the Construction Documents carefully and communicate with the Owner to determine the status on each Project.
  - 3.2.1 **Temporary Water** – The Contractor shall provide and install temporary lines for all water required for the Work and will arrange with the Owner’s Utility Department for connection to the campus system and for services.
  - 3.2.2 **Temporary Electrical** – The Contractor shall arrange with the local Utility Company for temporary power and for metering. When using this temporary power, the Contractor shall be responsible for all related costs, including energy costs and fuel costs. If such power is available from the campus power



systems, then the Contractor will make the same arrangements, but the Owner will pay for the power used unless the Contractor wastes energy and is not consuming it in a reasonable and prudent manner. The Contractor shall not energize the permanent power on the Project it is constructing until the Owner specifically approves.

3.2.3 **Temporary Heating, Cooling and Ventilation** – If temporary heating/cooling/ventilation is required for the protection of the Work or the work forces, the Contractor shall provide, at its cost, Owner-approved apparatus.

3.2.4 **Temporary Lighting** – The Contractor shall provide adequate temporary lighting to facilitate quality workmanship and appropriate inspection of the Work. Temporary lighting provided by the Contractor also must be adequate for site security, inspections of excavations, night work if pursued and for personal and general safety of operations. Provide the following minimum standards:

3.2.4.1 Provide and maintain lighting for construction operations to achieve a minimum lighting level of two watts per square foot.

3.2.4.2 Provide and maintain one watt per square foot lighting for exterior staging and storage areas after dark for security purposes.

3.2.4.3 Provide and maintain one-quarter watt per square foot lighting to interior work areas after dark for security purposes.

3.2.4.4 Permanent building lighting may be utilized during construction.

3.2.5 **Temporary Services Provided by Owner** – When approved by the Owner, the Contractor may request that Project mechanical and electrical systems be put into service prior to Substantial Completion, even if only to facilitate Contractor operations. However, the Contractor shall NOT open or close any valve connecting to the campus systems without specific Owner approval. During operation of the equipment prior to Substantial Completion the Contractor shall keep the equipment in good operating condition, properly and legally flushed with chemical treatment systems, properly started and stopped, properly maintained, including regular replacement and/or cleaning of filters. Without exception the filters will be newly replaced just prior to turning the equipment over to the Owner for operation. The actual warranty periods will not

start until the equipment is officially turned over to the Owner at Substantial Completion.

- 3.2.6 **Temporary Facilities/Equipment Removal** – Prior to turning the Project over to the Owner for operation and maintenance, the Contractor shall completely remove all temporary facilities and equipment from the Project Site and shall repair or replace any material, equipment, finished surfaces or landscaping that has been damaged by its activities on the site.

**4. Construction Aids**

- 4.1 Material and Personnel Hoists: The Contractor shall provide material and personnel hoist as required for normal use by all trades without charge. All necessary guards, signals and safety devices required for safe operation of these hoists shall be provided and properly maintained at all times.
- 4.2 Stairs: Provide temporary protective treads, handrails and wall coverings at stairways.

**5. Barriers and Enclosures**

- 5.1 Contractor shall construct temporary barricades, warning signs, hazard and warning lights, walks, passage-ways and similar temporary barriers and enclosures that are necessary to protect persons and property from hazards or damage due to construction operations, and required by the Owner, city, state or federal laws, ordinances or codes.
- 5.2 Contractor shall furnish and install construction fences and gates within the limits of construction, prior to beginning any other work on the project.
- 5.3 Contractor shall furnish and install movable fences as may be necessary and appropriate to facilitate execution of the work.
- 5.4 The Contractor shall be responsible for the protection of existing building surfaces (both interior and exterior), utilities, exterior structures, pavements, sidewalks, landscape, vegetation and irrigation systems. Any damage to existing areas will be repaired by the Contractor at its expense and to the satisfaction of the Owner. Such needed repairs that are not timely undertaken or completed by the Contractor may, at the Owner's sole discretion, be repaired by the Owner and the related expenses deducted from the Contract Amount by change order.
- 5.5 All existing trees, shrubs or endangered plants within the Project Site or near access ways to the Project Site, shall be protected by the Contractor as indicated on the Drawings and maintained in sound condition unless ordered by the Owner to remove them. Contractor

shall furnish and install barricades, fences and guards as necessary to prevent damage to existing trees, shrubs or endangered plants indicated to remain after construction is completed. Contractor shall not remove, cut or trim any tree, shrub or endangered plant before first notifying the Owner and receiving prior approval for the action. The Contractor will be responsible for repair or replacement in kind of damaged vegetation including watering and maintenance until fully restored.

- 5.6 All fencing, gates, barricades and guards shall be maintained to be straight, level and having a neat and uniform appearance while in place. Upon removal all holes and damage caused by the placement and use of the fences shall be repaired to its original condition.
- 5.7 Contractor shall provide temporary roofing and weather tight insulated closures for openings in exterior surfaces as required to maintain specified working conditions and moisture content of all project materials.

## **6. Security**

- 6.1 The Contractor shall provide security and facilities to protect the Work, materials and equipment from unauthorized entry, vandalism, or theft until Substantial Completion has been achieved. If deemed necessary the Contractor may, at its own expense, employ unarmed security personnel. The Contractor must first must notify the Owner and provide particulars about the security firm and its personnel prior to its employment.
- 6.2 The Campus Police will not provide security for the Project Site or the areas that are given over to the Contractor's control.

## **7. Temporary Controls**

- 7.1 Cleaning during construction: Contractor at all time shall keep the premises free from accumulation of waste materials and rubbish caused by operations for the work. Provide a collection can at each area used for eating. Pick up garbage daily. Keep project site free of garbage, trash, vermin and rodent infestation. Require each subcontractor to collect and deposit waste and rubbish caused by subcontractor operations at designated locations. Clean interior areas prior to start of finish work and maintain areas free of dust and other contaminates during finishing operations. Protect installed equipment and seal installed ductwork and piping to prevent intrusion of dust. When the Work is within or adjacent to existing spaces that continue to be occupied, protect finishes, seal off occupied spaces and open ductwork and piping. The Contractor shall provide personnel for janitorial work to clean up (both on the Project Site and

in adjacent spaces) any dust or debris that results from its operations.  
**(see UGC 3.3.8)**

- 7.2 Noise control: In and around occupied areas, minimize use of noise producing equipment and sequence the Work to minimize its affect of occupants. Work with noise producing equipment adjacent to occupied spaces will be coordinated with the Owner. Curtail such use to accommodate specific meetings or activities when requested by the Owner.
- 7.3 Water control: Provide methods to control surface water to prevent damage to the project and adjoining properties. Control fill, grade and ditch to direct surface drainage away from excavations, pits, tunnels and other construction areas. Direct runoff to proper runoff paths.
- 7.4 Storm Water Pollution Prevention Plan (SWPPP): Contractor shall be responsible for securing the appropriate SWPPP permit and paying all related fees, penalties, fines, etc., related thereto, from Texas Commission on Environmental Quality (TCEQ). The Contractor shall implement the SWPPP plan and insure that all devices and structures are properly maintained through the course of the project. Upon completion of the project the Contractor shall provide TCEQ with a Notice of Termination within thirty days of final stabilization achievement. Refer to SWPPP for additional requirements and to ensure compliance with its requirements.
- 7.5 Pollution controls: Provide methods, means and facilities required to prevent contamination of soil, water, or atmosphere by discharge of noxious or hazardous substances from construction operations. The Contractor shall notify the Owner immediately of all pollutant spills. The Contractor shall be solely responsible for cleaning up and properly disposing of, in accordance with applicable laws and regulations, all spilled pollutants brought to the Site as a part of the Work including oil, paint, fuels, antifreeze, solvents, etc. The Contractor must keep accurate records of these clean up and disposal actions.
- 7.6 Protection of installed work: **(see UGC 10.3.4.1)**
  - 7.6.1 Protect installed work and provide special protection where specified in individual specification sections.
  - 7.6.2 Provide temporary and removable protection of installed products and control activity in the immediate area to prevent damage.
  - 7.6.3 Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.
  - 7.6.4 Protect finished floors, stairs and other surfaces from dirt traffic, wear, damage, or movement of heavy objects.

- 7.6.5 Prohibit traffic or storage upon waterproofed or roofed surfaces, or in the alternative obtain the manufacturer's recommendations for protection.
- 7.6.6 Prohibit traffic from landscaped areas.

**8. Parking: (see UGC 3.3.11.1)**

- 8.1. Parking for workmen employed on the site shall be provided within the Limits of Construction or on such remote site as may be designated by the Owner from time to time. Any costs involved in Contractor parking shall be borne by the Contractor. The Contractor's forces shall not park on campus in areas outside the Project Site.
- 8.2. In some, but not all circumstances, Owner may provide remote parking spaces near the campus. In these cases the parking may be available for Contractor use at no cost, but permits issued by the campus police will be necessary to use this parking. In providing remote parking the Owner will not take on any responsibility for the vehicles, or contents of the vehicles, when they are parked in the remote locations provided.
- 8.3. The contractor shall provide adequate reserved parking for the Owner's and the A/E's Project Team members who regularly visit the Project Site.
- 8.4. The Contractor shall be responsible for restoration of all pavement, curbs, signage, sidewalks, etc., damaged by the construction operations and/or the workmen.

**9. Field Offices and Sheds**

- 9.1. The office shall be weather tight, with lighting, electrical outlets, high-speed internet connection, telephone, heating, cooling and ventilation and equipped with sturdy furniture, a drawing table and plan racks.
- 9.2. Provide adequate space for projects meetings.

**10. Temporary Toilets (see UGC 3.3.4)**

- 10.1 Provide, maintain and pay for required temporary sanitary facilities and enclosures. Provide at time of project mobilization and do not remove until Substantial Completion. Locate these facilities away from public view as much as practical.
- 10.2 Clean and empty these facilities at least weekly unless it is needed more often to keep them sanitary. Post notices, remove deposited debris and take all steps necessary to keep the facilities clean and sanitary.
- 10.3 Do not use the Owner's toilet facilities, unless specifically approved by the Owner.

## Section 015010 Project Signage

### 1. Installation of Temporary Project Signage

- 1.1 When permitted by the Owner, an exterior construction project sign shall be installed immediately after contract award. The sign will make specific reference to the Texas State University System and to the Component Institution in whose behalf the project is being constructed.
- 1.2 Prior to any construction or installation of the sign, submit to the Owner for approval a quarter scale drawing, complete with all graphics and lettering.
- 1.3 The Contractor shall ensure the exterior construction project signage is properly set-back from all street intersections and pedestrian walkways such that it does not conflict with or impede fields of view necessary to vehicular and pedestrian traffic circulation.
- 1.4 The Contractor may install one sign bearing the company name, logo, project address and point of contact.
- 1.5 The sign shall remain the property of the Contractor and shall be removed from the Project Site and legally disposed of at the completion of the Work.

2. **Signage Dimensions and Materials** - The exterior construction project sign shall be constructed of a single four foot by eight foot sheet of three-quarter inch thick marine plywood placed on two four inch by four inch treated posts. The Architect/Engineer (A/E) shall provide the Contractor with the lettering, font background and rendering of the project, which will be installed by a professional sign company. All related costs shall be included in the General Conditions costs of Construction Manager at Risk and Design-Build contracts.

## Section 015240 Construction Waste Management

### 1. Definitions

- 1.1 Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.
- 1.2 Disposal: Removal off-site of demolition and construction waste and deposited in landfill or incinerator acceptable to authorities having jurisdiction.
- 1.3 Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.
- 1.4 Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.

- 1.5 Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the work.
2. **Performance Goals** - The Contractor shall develop a waste management plan that will result in end of project rates for salvage/recycling as directed by the Owner during the Pre-construction conference.
3. **Quality Assurance** - The Contractor shall continuously monitor the disposal, recycling, salvage and reuse of materials generated by the Project to confirm compliance with the waste management plan and provide a report to the project team at each progress meeting.
4. **Waste Management Plan** - The Contractor shall develop a plan consisting of waste identification, waste reduction work plan and cost/revenue analysis. The plan should include separate sections for demolition and construction waste.
5. **Salvaging Demolition Waste**
  - 5.1 Salvage of items for sale or donation by the Contractor or subcontractors is not permitted.
  - 5.2 Salvaged items for Owner's use:
    - 5.2.1 Clean salvaged items;
    - 5.2.2 Pack or crate items and properly identify contents on the container;
    - 5.2.3 Store items in a secure area until delivery to Owner;
    - 5.2.4 Transport items to Owner's designated storage area.
6. **Recycling Demolition and Construction Waste, General** - Separate recyclable waste by type at project site to maximum extent practical.
  - 6.1. Provide appropriately marked containers or bins for controlling recyclable waste until they are removed from the project site.
  - 6.2. Remove recyclable waste off Owner's property and transport to recycling receiver or processor within a reasonable time after an appropriate amount has been accumulated.

## **Section 017000 Contract Close-out**

1. **General (see UGC Article 12)**
  - 1.1 Project closeout is hereby defined to include requirements near the end of the contract time, in preparation for Substantial Completion acceptance, occupancy by Owner, release of retainage, final acceptance, final payment and similar actions evidencing completion of the work.



- 1.2 Time of closeout is directly related to completion and acceptance and may either be a single time period for the entire project, or a series of times for individual portions or phases of the project that have been certified as substantially complete at different times.
  - 1.3 If the project is to be accepted in phases, whether by originally specified project scope or by subsequent agreement between the parties, then the project closeout requirements shall pertain to each separately accepted portion or phase of the project. All required documentation for the portion of the project to be occupied early shall be furnished by the Contractor to the Owner on, or before, the date of early occupancy by the Owner. Such early occupancy of any portion of the Work will not waive the Contractor's obligations to complete the remaining Work within the Contract Time specified in the contract.
- 2. Record Documents (see UGC 6.2)**
- 2.1 Record documents for project closeout shall include, but not necessarily limited to the following, which are required for substantial completion:
    - As-built record drawings;
    - As-built record specifications;
    - Operating & maintenance manuals;
    - Record approved submittals and samples;
    - Certificate of no asbestos products incorporated in project;
    - Completed punch lists.
- 3. Required Documents**
- 3.1 Required documents for final payment to be released included final versions of all of the above and the following:
    - Final release of claims and liens; **(see 12.3.5 through 12.3.8 of the CM@R contract)**
    - Affidavit of payment of debts and claims;
    - Consent(s) of surety;
    - Completed SWPPP documents and Notice of Termination;
    - Completed commissioning and closeout manuals.
- 4. Requirements for Substantial Completion (see UGC 12.1.1)**
- 4.1 Prior to requesting Architect/Engineer (A/E) and Owner to schedule a Substantial Completion, or Pre-Final inspection, the Contractor shall complete the following and list known exceptions in the request:
    - 4.1.1 Contractor's payment request should reflect a minimum of 95% completion for all applicable work.
    - 4.1.2 Provide A/E and Owner with a complete copy of the Contractor's most current punch list.



- 4.1.3 Submit to the A/E for review a full set of as-built record drawings and specifications.
  - 4.1.4 Submit to the A/E for review preliminary copies of the operating and maintenance manuals.
  - 4.1.5 Submit release enabling Owner's full and unrestricted use of the work and access to service and utilities, including operating certificates and similar releases.
  - 4.1.6 Contractor shall make provisions for final changeover of locks with the Owner's personnel.
  - 4.1.7 Complete initial clean up requirements as described in the specifications.
  - 4.2 The Contractor shall ensure that the work is ready for inspection and/or re-inspection. If the work is found not to be as stated in the Contractor's punch list or the items have not been substantially corrected/completed; the inspection will be terminated.
- 5. Requirements for Final Acceptance (see UGC 12.1.2)**  
Prior to requesting A/E and Owner to schedule final inspection for the project, the Contractor shall complete the following:
- 5.1 Prepare draft payment request showing 100% completion for each line item on the schedule of values, including all appropriate releases and supporting documentation.
  - 5.2 Submit a copy of the pre-final punch list which includes evidence that each item has been completed or otherwise resolved.
  - 5.3 Submit final meter readings for utilities as of the time when the Owner took possession.
  - 5.4 Transmit completed commissioning and close-out manuals to the Owner.
  - 5.5 Complete final cleaning and touch-up.
  - 5.6 Submit final payment request.
  - 5.7 Submit evidence of final and continuing insurance coverage complying with applicable insurance requirements.
- 6. Operating and Maintenance Manuals (see UGC 6.2.3 & 6.2.4)**
- 6.1 Contractor shall organize operating and maintenance manual information into suitable sets of manageable size, and bind into individual binders properly tabbed and indexed. Two complete copies of each bound operating and maintenance manual shall be provided to the Owner and one complete copy for the A/E.
  - 6.2 The requirements of this section are separate, distinct and in addition to product submittal requirements that may be established by this and other sections of the specifications.
  - 6.3. Material and equipment data required by this section is intended to include all data necessary for the proper installation, removal, normal

operation, emergency operation, startup, shutdown, maintenance, cleaning, adjustment, calibration, lubrication, assembly, disassembly, repair, inspection, trouble shooting and service of the equipment or materials.

#### **7. Record Product Submittals**

During progress of the work, maintain approved copies of each product data submittal and shop drawings, and mark-up significant variations in the actual work in comparison with submitted information. A separate binder with one copy of all MSDS sheets for any and all products incorporated into the project shall be maintained during the course of the project, this binder shall be included in the record submittal documents.

#### **8. Record Sample Submittals**

Immediately prior to the date(s) of Substantial Completion, arrange for A/E and Owner to meet with Contractor at the project site to determine which (if any) of the submitted samples or mock-ups maintained by Contractor during progress of the work are to be transmitted to Owner for record purposes.

#### **9. Commissioning and Close-out Manual**

The Contractor shall incorporate all commissioning and closeout documentation and/or verification not included in the operating and maintenance manuals, into a manual for transmittal to the Owner

### **Section 019100 General Commissioning Requirements**

#### **1. Scope of Work Included**

- 1.1 It is of primary concern that all operable systems installed in the project perform in accordance with the Construction Documents and the specified Owner's operational needs. This is particularly critical for systems affecting life safety, building controls, plumbing, HVAC, lighting and power delivery systems. The process of assuring such performance is achieved is commonly referred to as "Commissioning".
- 1.2 This section establishes minimum general and administrative requirements pertaining to start-up and commissioning of equipment, devices, and building systems. Additional technical and operational requirements for particular systems and components are established in the various technical sections of the specifications. The Contractor is solely responsible for the Commissioning process.

#### **2. Commissioning Plan**

- 2.1 The Contractor shall prepare a detailed commissioning plan to identify the following:
  - 2.1.1 Project commissioning team members;

- 2.1.2 Commissioning activities;
  - Pre-functional tests;
  - Start-up tests;
  - Functional tests;
  - System integration testing.
- 2.1.3 The Contractor shall properly document the results of each phase of the commissioning plan and notify Architect/Engineer (A/E) and Owner of any failures to achieve the specified performance levels.
- 2.2 The Contractor shall incorporate the commissioning plan into the project baseline schedule to reflect dates and durations of all commissioning activities.

### **3. Equipment Documentation Requirements**

The Contractor shall develop a complete equipment matrix/list of all equipment, devices and systems which will be presented to the project commissioning team at the Pre-commissioning conference. The following information should be included on the matrix/list:

- Brief equipment identification text;
- Equipment or device i.d. number;
- Start-up inspection required;
- Associated building system;
- Governing specification section;
- Appropriate submittal reference number(s);
- Installation location (room number or column coordinates).

### **4. Test Equipment**

- 4.1 The Contractor and subcontractors shall provide all specialized tools, test equipment and instruments required to execute start-up, checkout and functional performance testing of equipment under their contracts.
- 4.2 Test equipment shall be of sufficient quality and accuracy to test and/or measure system performance within tolerances specified. A testing laboratory shall have calibrated the test equipment within the previous twelve months. Calibration shall be NIST traceable and in accordance with the manufacturer's recommendations.

### **5. Pre-commissioning Meeting**

- 5.1 The Contractor shall conduct the Pre-commissioning meeting and review all aspects of the commissioning plan. All documentation will be discussed and test procedures will be reviewed for approval by the Owner.

- 5.2 The Contractor shall establish target dates for each of the commissioning activities and these will be discussed at all future project progress meetings.
6. **Pre-installation Meeting** - The Contractor shall schedule a pre-installation meeting for the work of each major building system. This meeting shall be scheduled following approval of system submittals and prior to commencement of system installation work.
7. **Contractor's Verification of Installation**  
The Contractor shall perform a review of all tests to confirm completion and compliance with the specified performance specifications. The Contractor shall verify:
- Each component device has been properly installed;
  - All shop drawings and product data submittals have been approved;
  - All valve charts, wiring diagrams, control schematics, electrical panel directories, etc. have been submitted, approved and properly installed;
  - All tabulated data has been submitted for each system and/or device as required by the specifications;
  - All test reports and/or certifications required have been submitted and accepted;
  - Any and all deficiencies have been corrected and re-tested to conformance with the specifications.
8. **Contractor's Operational Testing**
- 8.1 The Contractor shall operate, or cause to be operated each system, device or equipment item, both intermittently and continuously, for the appropriate duration as set forth in the specifications and/or in accordance with the manufacturer's recommendations. These operations will be documented as a functional test.
- 8.2 Each component device and each building system shall be exercised to the full extent of its capability, from minimum to maximum, and under automatic control, where it is applicable, as well as checking manual operation.
9. **Integrated System Demonstration**
- 9.1 After successful completion and subsequent documentation of all system operations, the Contractor shall schedule a meeting with the project commissioning team to review the demonstration of all integrated systems within the facility.
- 9.2 The demonstration(s) shall included not only normal operating conditions over the entire operating range, but also failure modes such as major component failure and loss of power.

**10. Owner Training**

- 10.1 Training shall consist of classroom type sessions followed by on-site demonstrations of system operations.
- 10.2 The Contractor shall provide a minimum of eight hours of video recording of the training, with audio. The Owner will designate which portions of the training will be recorded. The video shall be produced in a professional manner.

**END OF CONSTRUCTION PROJECT DIVISION 1 SPECIFICATIONS**



**2005 Uniform General Conditions**

The seal of the State of Texas is a large, faint watermark in the background. It features a five-pointed star in the center, surrounded by a wreath of olive and live oak branches. The words "THE STATE OF TEXAS" are written in a circular border around the star.

**Uniform General Conditions  
for  
Construction Contracts**

**August 17, 2005**

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## Uniform General Conditions

## 2005 Edition Uniform General Conditions

### Article 1. Definitions

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

- 1.1 *Architect/Engineer (A/E)* means a person registered as an architect pursuant to Tex. Occ. Code Ann., Chapter 1051, as a landscape architect pursuant to Tex. Occ. Code Ann., Chapter 1052, a person licensed as a professional engineer pursuant Tex. Occ. Code Ann., Chapter 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.
- 1.2 *Change Order* means a written modification of the Contract between the Owner and Contractor, signed by the Owner, the Contractor and the Architect/Engineer.
- 1.3 *Change Order Proposal* means a Contractor-generated document in response to a Change Order Request (COR).
- 1.4 *Change Order Request (COR)* means a document which informs the contractor of a proposed change in the Work, and appropriately describes or otherwise documents such change.
- 1.5 *Close-out documents* means the product brochures, product/equipment maintenance and operations instructions, manuals, and other documents/warranties, as-built record documents, affidavit of payment, release of lien and claim, and as may be further defined, identified, and required by the Contract Documents.
- 1.6 *Contract* means the entire agreement between the Owner and the Contractor, including all of the Contract Documents.
- 1.7 *Contract Date* is the date when the agreement between the owner and the contractor becomes effective.
- 1.8 *Contract Documents* means those documents identified as a component of the agreement (contract) between the owner and the contractor. These may include, but are not limited to, Drawings, Specifications, General, Supplementary and Special Conditions, and all pre-bid and/or pre-proposal addenda.
- 1.9 *Contractor* means the individual, corporation, 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

## Uniform General Conditions

General or Prime Contractor. The contract documents refer to *Contractor* as if singular in number.

- 1.10 *Contract Sum* means the total compensation payable to the Contractor for completion of the Work in accordance with the terms of the contract.
- 1.11 *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 Change Order.
- 1.12 *Date of Commencement* means the date designated in the Notice to Proceed for the Contractor to commence the Work.
- 1.13 *Day* means a calendar day, unless otherwise specifically stipulated.
- 1.14 *Drawings* means that product of the Architect/Engineer which graphically depicts the Work.
- 1.15 *Final Completion* means the date determined and certified by the Architect/Engineer and Owner on which the Work is fully and satisfactorily complete in accordance with the Contract.
- 1.16 *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 the Owner.
- 1.17 *Owner's Designated Representative (ODR)* means the individual assigned by the Owner to act on its behalf, and to undertake certain activities as specifically outlined in the Contract. The ODR is the only party authorized to direct changes to the scope, cost, or time of the contract.
- 1.18 *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.
- 1.19 *Samples* means 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.
- 1.20 *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 Architect/Engineer.
- 1.21 *Shop Drawings* means the drawings, diagrams, illustrations, schedules, performance charts, brochures and other data prepared by the Contractor or its agents, which detail a portion of the Work.
- 1.22 *Site* means the geographical area of the location of the Work.
- 1.23 *Special Conditions* means the documents containing terms and conditions, which may be unique to the project. Special Conditions are a

## Uniform General Conditions

part of the Contract Documents and have precedence over the Uniform General Conditions.

- 1.24 *Specifications* means the written product of the Architect/Engineer 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.
- 1.25 *Subcontractor* means a business entity that enters into an agreement with the Contractor to perform part of the Work or to provide services, materials or equipment for use in the Work.
- 1.26 *Substantial Completion* means the date determined and certified by the Contractor, Architect/Engineer 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.
- 1.27 *Supplementary General Conditions* means procedures and requirements that modify the Uniform General Conditions. Supplementary General Conditions, when used, have precedence over the Uniform General Conditions.
- 1.28 *Unit Price Work* means Work or a portion of the Work paid for based on incremental units of measurement.
- 1.29 *Unilateral Change Order (ULCO)* means a Change Order issued by the Owner without the agreement of the Contractor.
- 1.30 *Work* means the administration, procurement, materials, equipment, construction and all services necessary for the Contractor, and/or its agents, to fulfill the Contractor's obligations under the Contract.

## Article 2. Laws Governing Construction

- 2.1. Environmental Regulations. The 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, the Owner is responsible for obtaining and maintaining permits related to stormwater run-off. The Contractor shall conduct operations consistent with stormwater run-off permit conditions. Contractor is responsible for all items it brings to 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 the Contractor. The 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. The Contractor shall not pay less than the wage scale of the various classes of labor as shown on the "Prevailing Wage Schedule" provided by the Owner. The specified wage rates are minimum rates only. The Owner is not bound 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. The Contractor shall notify each worker, in writing, of the following as they commence work on the contract: the worker's job classification, the established minimum wage rate requirement for that classification, as well as the worker's actual wage. The notice must be delivered to and signed in acknowledgement of receipt by the employee and must list both the wages and fringe benefits to be paid or furnished for each classification in which the worker is assigned duties. When requested by the Owner, the Contractor shall furnish evidence of compliance with the Texas Prevailing Wage Law.
- 2.2.1.1 Submit a copy of each worker wage-rate notification to the ODR with the application for progress payment for the period during which the worker was engaged in activities on behalf of the project.
- 2.2.1.2 The "Prevailing Wage Schedule" is determined by the Owner in compliance with Tex. Gov't Code, Chapter 2258. Should the Contractor at any time become aware that a particular skill or trade not reflected on the Owner's Prevailing Wage Schedule will be or is being employed in the Work, whether by the Contractor or by a subcontractor, the Contractor shall promptly inform the ODR of the proposed wage to be paid for the skill along with a justification for same. The 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.

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

2.2.1.4 Complaints of Violations

2.2.1.4.1 Owner's Determination of Good Cause. Upon receipt of information concerning a violation of Tex. Gov't Code, Chapter 2258, the Owner will, within 31 days, make an initial determination as to whether good cause exists that a violation occurred. The Owner will send documentation of the initial determination to the Contractor against whom the violation was alleged, and to the worker involved. Upon making a good-cause finding, the 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, such amounts being subtracted from successive progress payments pending a final decision on the violation.

2.2.1.4.2 If the Contractor and claimant worker reach an agreement concerning the claim, the contractor shall promptly notify the Owner in a written document countersigned by the worker.

2.2.1.4.3 Arbitration Required. If the violation is not resolved within 14 days following initial determination by the Owner, the Contractor and the claimant worker must participate in binding arbitration in accordance with the Texas General Arbitration Act, Tex. Civ. Prac. & Rev. Code, Chapter 171. For a period not to exceed 10 days, after which, if no agreement reached, a district court may be petitioned by any of the parties to the arbitration to appoint an arbitrator whose decision will be binding on all parties.

2.2.1.4.4 Arbitration Award. If an arbitrator assesses an award against the Contractor, the Contractor shall promptly furnish a copy of said award to the Owner. The Owner may use any amounts retained under Article 2.2.1.4.1 to pay the worker the amount as designated in the arbitration award. If the retained funds are insufficient to pay the worker in accordance with the arbitration award, the worker has a right of action against the Contractor, and/or the surety to receive the amount owed, plus attorneys' fees and court costs. The Owner has no duty to release any funds to either the claimant or the Contractor until

## Uniform General Conditions

it has received the notices of agreement or the arbitration award.

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

- 2.3. Venue for Suits. The venue for any suit arising from this contract will be in a court of competent jurisdiction in Travis County, Texas, or as may otherwise designated in the Supplementary General Conditions.
- 2.4. Licensing of Trades. The 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 the Contractor, or one of its Subcontractors, loses its license during the term of performance of the Contract, the Contractor shall promptly hire or contract with a licensed provider of the service at no additional cost to the Owner.
- 2.5. Royalties, Patents & Copyrights. The Contractor shall pay all royalties and license fees, defend all suits or claims for infringement of any patent rights and shall save the Owner harmless from loss on account thereof.
- 2.6. State Sales and Use Taxes. The Owner qualifies for exemption from certain State and Local Sales and Use Taxes pursuant to the provisions of Tex. Tax Code, Chapter 151. The Contractor may claim exemption from payment of applicable State taxes by complying with such procedures as prescribed by the State Comptroller of Public Accounts.

### **Article 3. General Responsibilities of Owner & Contractor**

- 3.1. Owner's General Responsibilities. The 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 the Owner, Contractor, Architect/Engineer (AE) 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 the Owner's Designated Representative (ODR), who has the express authority to act and bind the 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, the ODR is the single point of contact between the Owner and Contractor. Notice to the ODR, unless otherwise noted, constitutes notice to the Owner under the Contract.
    - 3.1.2.2 All directives on behalf of the Owner will be conveyed to the Contractor by the ODR in writing.
  - 3.1.3 Owner Supplied Materials and Information.
    - 3.1.3.1 The Owner will furnish to the 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 The Owner will provide information, equipment, or services under the Owner's control to the Contractor with reasonable promptness.
  - 3.1.4 Availability of Lands. The 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 the Contractor. The Contractor shall comply with all Owner identified encumbrances or restrictions specifically related to use of lands so furnished. The Owner will obtain and pay for easements for permanent structures or permanent changes in existing facilities, unless otherwise required in the Contract Documents.

3.1.5 Limitation on Owner's Duties

3.1.5.1 The 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. The Owner is not responsible for any failure of Contractor to comply with laws and regulations applicable to the Work. The Owner is not responsible for the failure of Contractor to perform or furnish the Work in accordance with the Contract Documents. Owner are 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 the Contractor.

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

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

3.2.1 Site Visits

3.2.1.1 The AE will make visits to the site at intervals as provided in the AE's contract agreement with the Owner, to observe the progress and the quality of the various aspects of Contractor's executed Work and report findings to the Owner.

3.2.1.2 The AE has the authority to interpret Contract Documents and inspect the Work for compliance and conformance with the Contract. Except as referenced in Article 3.1.5.2, the 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 the ODR such clarifications or interpretations will be provided by the AE consistent with the intent of the Contract Documents. The AE will issue these clarifications with reasonable promptness to the Contractor as Architect'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, the Contractor shall so notify the Owner in accordance with the provisions of Article 11.

3.2.3 Limitations on Architect/Engineer Authority. The AE is not responsible for:

- 3.2.3.1 The Contractor's means, methods, techniques, sequences, procedures, safety, or programs incident to the Project nor will the AE 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 The Contractor's failure to perform or furnish the Work in accordance with the Contract Documents.
- 3.2.3.4 Acts or omissions of the Contractor, or of any other person or organization performing or furnishing any of the Work.

3.3 Contractor's General Responsibilities. The 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. The Contractor is solely responsible for all construction means, methods, techniques, safety, sequences, coordination and procedures.

- 3.3.1 Project Administration. The 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 the AE and ODR in accordance with these General Conditions and provisions of Division 1 Specifications, and as outlined in the Pre-construction Conference.
- 3.3.2 Contractor's Superintendent. Employ a competent resident superintendent who will be present at the Project Site during the progress of the Work. The superintendent is subject to the approval of the ODR. Do not change approved superintendents during the course of the project without the written approval of the ODR unless the superintendent leaves the employ of the Contractor.
- 3.3.3 Labor. Provide competent, suitably qualified personnel to survey, lay-out, and construct the Work as required by the Contract Documents. Maintain good discipline and order at the Site at all times.

## Uniform General Conditions

- 3.3.4 Services, Materials, and Equipment. Unless otherwise specified, 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 Non-Compliant Work. Should the AE and/or the ODR identify Work as non-compliant with the Contract Documents, the ODR will communicate the finding to the Contractor and the Contractor will correct such Work at its expense. The approval of Work by either the AE or ODR does not relieve the Contractor from the obligation to comply with all requirements of the Contract Documents.
- 3.3.6 Subcontractors. Do not employ any Subcontractor, supplier or other person or organization, whether initially or as a substitute, against whom the Owner may have reasonable objection. The Owner will communicate such objections in writing. The Contractor is not required to employ any Subcontractor, supplier or other person or organization to furnish any of the work to whom the Contractor has reasonable objection. The Contractor will not substitute Subcontractors without the acceptance of the Owner.
- 3.3.6.1 All Subcontracts and supply contracts shall be consistent with and bound to the terms and conditions of the Contract Documents including provisions of the Agreement between the Contractor and the Owner.
- 3.3.6.2 The 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 the Contractor. Require all Subcontractors, suppliers and such other persons and organizations performing or furnishing any of the Work to communicate with Owner only through the Contractor. Furnish to the Owner a copy of each first-tier subcontract promptly after its execution. The Contractor agrees that the Owner has no obligation to review or approve the content of such contracts and that providing the Owner such copies in no way relieves the 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 the Contractor in the same manner in which the Contractor is bound to the Owner.
- 3.3.7 Continuing the Work. Carry on the Work and adhere to the progress schedule during all disputes, disagreements or alternative resolution processes with the Owner. Do not delay or postpone any Work

because of the pending resolution of any disputes, disagreements or processes, except as the Owner and the Contractor may agree in writing.

- 3.3.8 Cleaning. 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. The 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.
- 3.3.9 Acts and Omissions of Contractor, its Subcontractors and Employees. The Contractor is responsible for acts and omissions of his employees and all its subcontractors, their agents and employees. The Owner may, in writing, require the Contractor to remove from the Project any of Contractor's or its subcontractor's employees that the ODR finds to be careless, incompetent, or otherwise objectionable.
- 3.3.10 Indemnification of Owner. The Contractor covenants and agrees to FULLY INDEMNIFY and HOLD HARMLESS, the Owner and the elected officials, employees, officers, directors, volunteers, and representatives of the Owner, individually or collectively, from and against any and all costs, claims, liens, damages, losses, expenses, fees, fines, penalties, proceedings, actions, demands, causes of action, liability and suits of any kind and nature, including but not limited to, personal or bodily injury, death and property damage, made upon the Owner directly or indirectly arising out of, resulting from or related to Contractor's activities under this Contract, including any acts or omissions of Contractor, any agent, officer, director, representative, employee, consultant or the Subcontractor of Contractor, and their respective officers, agents, employees, directors and representatives while in the exercise of performance of the rights or duties under this Contract. The indemnity provided for in this paragraph does not apply to any liability resulting from the negligence of the Owner, officers or employees, separate Contractors or assigned contractors, in instances where such negligence causes personal injury, death or property damage. IN THE EVENT CONTRACTOR AND OWNER ARE FOUND JOINTLY LIABLE BY A COURT OF COMPETENT JURISDICTION, LIABILITY WILL BE APPORTIONED COMPARATIVELY IN ACCORDANCE WITH THE LAWS OF THE STATE OF TEXAS, WITHOUT WAIVING ANY GOVERNMENTAL IMMUNITY AVAILABLE TO THE STATE UNDER TEXAS LAW AND WITHOUT WAIVING ANY DEFENSES OF THE PARTIES UNDER TEXAS LAW.
- 3.3.10.1 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.

## Uniform General Conditions

- 3.3.10.2 Promptly advise the Owner in writing of any claim or demand against the Owner or the Contractor known to the Contractor related to or arising out of the Contractor's activities under this Contract.
- 3.3.11 Ancillary Areas. Operate and maintain operations and associated storage areas at the site of the Work in accordance with the following:
  - 3.3.11.1 Confine all Contractor operations, including storage of materials and employee parking upon the Site of Work, to areas designated by the Owner.
  - 3.3.11.2 The 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 the Contractor requests and the Owner provides written consent that it may abandon such buildings and utilities in place.
  - 3.3.11.3 Use only established roadways or construct and use such temporary roadways as may be authorized by the 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 the Contractor.
  - 3.3.11.4 The Owner may restrict the Contractor's entry to the site to specifically assigned entrances and routes.
- 3.3.12 Separate Contracts. Additional Contractor responsibilities when the Owner awards separate Contracts
  - 3.3.12.1 The Owner reserves the right to award other contracts in connection with other portions of the Project under these or similar contract conditions.
  - 3.3.12.2 The Owner reserves the right to perform operations related to the Project with the Owner's own forces.
  - 3.3.12.3 Under a system of separate contracts, the conditions described herein continue to apply except as may be amended by change order.

## **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, Chapter 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 per 1 Texas Administrative Code (TAC) §111.13 are: 11.9 percent for heavy construction other than building contracts, 26.1 percent for all building construction, including general contractors and operative builders contracts, 57.2 percent for all special trade construction contracts, 20 percent for professional services contracts, 33 percent for all other services contracts and 12.6 percent for commodities contracts.
  - 4.1.1 State agencies are required by statute to make a good faith effort to assist HUBs in participating in contract awards issued by the State. 1 TAC §111.11-111.28, outline the state's policy to encourage outreach to and potential utilization of HUBs in state contracting opportunities through race, ethnic and gender neutral means.
  - 4.1.2 A Contractor who contracts with the State in an amount of \$100,000 is required to make a good faith effort to award subcontracts to HUBs in accordance with 1 TAC §111.14 by submitting a HUB Subcontracting Plan at the time of bidding and complying with the HUB Subcontracting Plan after it is accepted by the Owner and during the term of the contract.
- 4.2. 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:
  - 4.2.1 Prior to substituting a Subcontractor, promptly notify the Owner in the event a change is required for any reason to the accepted HUB Subcontracting Plan.
  - 4.2.2 Conduct the good faith effort activities required and provide the Owner with necessary documentation to justify approval of a change to the approved HUB Subcontracting Plan.
  - 4.2.3 Cooperate in the execution of a Change Order or such other approval of the change in the HUB Subcontracting Plans as the Contractor and Owner may agree to.
  - 4.2.4 Maintain and make available to Owner upon request business records documenting compliance with the accepted HUB Subcontracting Plan.
  - 4.2.5 Upon receipt of payment for performance of Work, submit to Owner a compliance report, in the format required by the Owner that demonstrates Contractor's performance of the HUB Subcontracting Plan.

## Uniform General Conditions

- 4.2.6 Promptly and accurately explain and provide supplemental information to Owner to assist in the Owner's investigation of the Contractor's good faith effort to fulfill the HUB Subcontracting Plan and the requirements under 1 TAC §111.14.
- 4.3. 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, the Owner may, in addition to all other remedies available to it, report the failure to perform to the Texas Building and Procurement Commission Vendor Performance and may bar the Contractor from future contracting opportunities with the Owner.

## Article 5. Bonds & Insurance

### 5.1. Construction Bonds.

The Contractor is required to tender to Owner, prior to commencing the Work, performance and payment bonds, as required by Tex. Gov't Code, Chapter 2253.

- 5.1.1. A Performance Bond is required if the Contract Price is in excess of \$100,000. The Performance Bond is solely for the protection of the 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 Attorney General of Texas. The Performance Bond shall be effective through the Contractor's warranty period.
- 5.1.2. 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 the Owner solely for the protection and use of payment bond beneficiaries who have a direct contractual relationship with the Contractor or a Subcontractor. The form of the bond shall be approved by the Attorney General of Texas.
- 5.1.3. 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 the Owner, on the Owner's form, and in compliance with the relevant provisions of the Texas Insurance Code. If any bond is for more than 10 percent of the surety's capital and surplus, the 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 10 percent of its capital and surplus. If a surety upon a bond loses its authority to do business in the State, the Contractor shall, within thirty (30) days after such loss, furnish a replacement bond at no added cost to the Owner.
- 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, Chapter 2253. IF FOR ANY REASON A STATUTORY PAYMENT OR PERFORMANCE BOND IS NOT HONORED BY THE SURETY, THE CONTRACTOR SHALL FULLY INDEMNIFY AND HOLD THE 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 the 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 the Contractor on such Contract, and that reliance on notices sent to the Owner may result in loss of their rights against the Contractor and/or his surety. The 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 the Owner and the Contractor is less than \$25,000.00. These provisions set out the requirements for filing a valid lien on funds unpaid to the Contractor as of the time of filing the claim, actions necessary to release the lien and satisfaction of such claim.
- 5.1.9 Sureties shall be listed on the US Department of the Treasury's Listing Approved Sureties stating companies holding Certificates of Authority as acceptable sureties on Federal Bonds and acceptable reinsuring companies (Department Circular 570).

5.2. Insurance Requirements.

The Contractor shall carry insurance in the types and amounts indicated in this Article for the duration of the Contract. The required insurance shall include coverage for Owner's property in the care, custody and control of Contractor prior to construction, during construction and during the warranty period. The insurance shall be evidenced by delivery to the 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, the Owner, and/or its agents, shall be entitled to receive without expense, copies of the policies and all endorsements. The 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 the Owner.

- 5.2.1. The Contractor shall provide and maintain the insurance coverage with the minimum amounts described below until the end of the warranty period unless otherwise stated in Supplementary General Conditions. Failure to maintain insurance coverage, as required, is grounds for Suspension of Work for Cause pursuant to Article 14. The Contractor will be notified of the date on which the Builder's Risk insurance policy may be terminated through Substantial Completion Notices, Acceptance Notices and/or other means as deemed appropriate by the Owner.

Uniform General Conditions

5.2.2. 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 otherwise acceptable to Owner.

5.2.2.1. Insurance coverage required includes:

5.2.2.1.1. Workers' Compensation. Insurance with limits as required by the Texas Workers' Compensation Act, with the policy endorsed to provide a waiver of subrogation as to the Owner, Employer's Liability insurance of not less than:

\$100,000 each accident

\$100,000 disease each employee

\$500,000 disease policy limit

5.2.2.1.2. Commercial General Liability Insurance. Including 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 (or Subcontractors) liability for bodily injury and property damage with a combined bodily injury (including death) and property damage minimum limit of :

\$1,000,000 per occurrence

\$1,000,000 general aggregate

\$1,000,000 products and completed operations aggregate

Coverage shall be on an "occurrence" basis.

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

5.2.2.1.3. 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.

If this contract is for asbestos abatement only, the All-Risk Builder's Risk or All-Risk Installation Floater (e) is not required.

- 5.2.2.1.4. Comprehensive Automobile Liability Insurance, covering owned, hired, and non-owned vehicles, with a combined bodily injury (including death) and property damage minimum limit of \$1,000,000 per occurrence. No aggregate shall be permitted for this type of coverage. Such insurance is to include coverage for loading and unloading hazards.
- 5.2.2.1.5. All Risk Builder's Risk Insurance (or All Risk Installation Floater for instances in which the project involves solely the installation of equipment). Coverage shall be All-Risk, including, but not limited to, Fire, Extended Coverage, Vandalism and Malicious Mischief, Flood, Earthquake, Theft and damage resulting from faulty workmanship, design or materials. If Builder's Risk, limit shall be equal to 100 percent of the contract. If Installation Floater, limit shall be equal to 100 percent of the contract cost. The policy shall be written jointly in the names of the Owner, the Contractor, Subcontractors and, Subcontractors shall be named as additional insured. The policy shall have endorsements as follows:
- 5.2.2.1.5.1. This insurance shall be specific as to coverage and not contributing insurance with any permanent insurance maintained on the property.
- 5.2.2.1.5.2. This insurance shall not contain an occupancy clause suspending or reducing coverage should the Owner occupy, or begin beneficial occupancy before the Owner has accepted final completion.
- 5.2.2.1.5.3. Loss, if any, shall be adjusted with and made payable to the Owner as Trustee for the insureds as their interests may appear; the right of subrogation under the Builder's Risk policy shall be waived as to the Owner. The Owner shall be named as Loss Payee. For renovation projects or projects that involve portions of work contained within an existing structure, refer to Special Conditions for possible additional Builder's Risk insurance requirements.
- 5.2.2.1.6. "Umbrella" Liability Insurance. The Contractor shall obtain, pay for and maintain umbrella liability insurance during the contract term, insuring the Contractor (or Subcontractor) 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.

If this contract is for asbestos abatement only, the "Umbrella" Excess Liability is not required

5.2.3. Policies must include the following clauses, as applicable:

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

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

5.2.3.3. The 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 the Owner. The additional insured status must cover completed operations as well. This is not applicable to the workers' compensation policy.

5.2.3.4. The workers' compensation and employers' liability policy will provide a waiver of subrogation in favor of the Owner.

5.2.4. Without limiting any of the other obligations or liabilities of the Contractor, the Contractor shall require each Subcontractor performing work under the Contract, at the 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, the Contractor may include its Subcontractors as additional insureds on its own coverage as prescribed under these requirements. The Contractor's certificate of insurance shall note in such event that the Subcontractors are included as additional insureds and that Contractor agrees to provide Workers' Compensation for the Subcontractors and their employees. The Contractor shall obtain and monitor the certificates of insurance from each Subcontractor in order to assure compliance with the insurance requirements. The Contractor must retain the certificates of insurance for the duration of the Contract plus 5 years and shall have the responsibility of enforcing these insurance requirements among its subcontractors. The Owner shall be entitled, upon request and without expense, to receive copies of these certificates.

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- 5.2.5. Workers' Compensation Insurance Coverage must meet the statutory requirements of the Tex. Lab. Code, §401.011(44) and specific to construction projects for public entities as required by Tex. Lab. Code, §406.096.

## **Article 6. Contract Documents**

### **6.1. Drawings and Specifications**

- 6.1.1 Copies Furnished. The Contractor will be furnished, free of charge, the number of complete sets of the Drawings and Specifications 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 one requesting such additional sets.
- 6.1.2 Ownership of Drawings and Specifications. All Drawings, Specifications and copies thereof furnished by the AE are to remain A/E's property. These documents are not to be used on any other project, and with the exception of one Contract set for each party to the Contract, are to be returned to the Architect/Engineer, upon request, following completion of the Work.
- 6.1.3 Interrelation of Documents. The Contract Documents as referenced in the Agreement between the Owner and the 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 between and/or within the Contract Documents, the higher quality, greater quantity, more restrictive, and/or more expensive requirement shall be the basis of Contractor pricing, and the Contractor shall notify the AE and the 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 pricing or commencing the Work, the Contractor shall examine and compare the Contract Documents, information furnished by the Owner, relevant field measurements made by the 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 the ODR and to the AE 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 the 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 the 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 or a Construction Manager-at-Risk.

- 6.1.6.4 When performing as a Design-Build firm, the 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, the Contractor has a shared responsibility for discovery and resolution of discrepancies, errors, and omissions in the Contract Documents. In such case, the Contractor's responsibility pertains to review, coordination, and recommendation of resolution strategies within budget constraints, but does not establish a liability for design.
- 6.1.6.6 The Contractor has no liability for errors, omissions, or inconsistencies unless the Contractor knowingly failed to report a recognized problem to the Owner or the Work is executed under a Design-Build or Construction Manager-at-Risk contract as outlined above. Should the Contractor fail to perform the examination and reporting obligations of these provisions, the Contractor is responsible for avoidable costs, direct, and/or consequential damages.

## 6.2 Requirements for Record Documents

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 AE access to these documents.

- 6.2.1 Maintain this record set of Drawings and Specifications which reflect the "As Constructed" 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 the Owner and its representatives and agents.
- 6.2.2 Update the "As-Constructed" Drawings and Specifications monthly prior to submission of periodic partial pay estimates. Failure to maintain such records constitutes cause for denial of a progress payment otherwise due.
- 6.2.3 Prior to requesting Substantial Completion Inspection by the ODR and AE, furnish a complete set of the marked up "As-Constructed" set maintained at the site and one photocopy of same. Concurrently with furnishing these record drawings, furnish a preliminary copy of each operating and maintenance manual (O&M) required by the Contract Documents, for review by the AE and the ODR.

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- 6.2.4 Once determined acceptable, provide mylar prints of professionally drafted "As-Constructed" drawings, along with electronic copy on CD, "As-Constructed" specifications in bound volume(s) along with electronic copy on CD, two sets of photocopies or prints of the mylar "As-Constructed" drawings, two sets of operating and maintenance manuals, two sets of approved submittals, and other record documents as required elsewhere in the Contract Documents.



## **Article 7. Safety**

- 7.1. General. It is the duty and responsibility of the Contractor and all of its Subcontractors to be familiar with, enforce and comply with all requirements of Public Law 91-596, 29 U.S.C. §§651 et. seq., the Occupational Safety and Health Act of 1970, (OSHA) and all amendments thereto. The Contractor shall prepare a Safety Plan specific to the Project and submit it to the ODR and AE prior to commencing Work. In addition, the 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. The 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 MSDS for all materials in use on site throughout the construction phase and make such file available to the Owner and its agents as requested.
- 7.3. Emergencies. In any emergency affecting the safety of persons or property, the 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 anytime 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 the ODR and AE 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 the Owner within 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 the 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 the ODR

## Uniform General Conditions

and other parties as may be directed within twenty-four (24) hours of the event.

- 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 the ODR and AE with an incident report no later than 36 hours after the occurrence of the event. In the event of a catastrophic incident (one fatality or three 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 week after occurrence, unless otherwise directed by legal counsel. Contractor shall provide the 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 the ODR immediately.
  - 7.5.1 Bind all Subcontractors to the same duty.
  - 7.5.2 Upon receiving such notice, the 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, the ODR will issue a written report to the 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 The Owner may hire third-party contractors to perform any or all such steps.
  - 7.5.4 Should compliance with the ODR's instructions result in an increase in the Contractor's cost of performance, or delay the Work, the Owner will make an equitable adjustment to the Contract price 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 feet, or results in any worker's upper body being positioned below grade level, the Contractor is required to submit a trenching plan to the ODR prior to commencing trenching operations. The plan is required to be prepared and sealed by a professional engineer registered in the State of Texas, and employed by the Contractor. Said engineer cannot be anyone who is otherwise either directly or indirectly engaged on this project

## Article 8. Quality Control

8.1. Materials & Workmanship. The Contractor shall execute Work in a good and workmanlike matter in accordance with the Contract Documents. The Contractor shall develop and provide a Quality Control Plan specific to this project and acceptable to the 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 Contractor Testing. The Contractor is responsible for coordinating and paying for all routine and special tests required to confirm compliance with quality and performance requirement of the Contract Documents. This “quality control” testing shall include any particular testing required by the Specifications and the following general tests.

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 Routine, 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 Owner Testing. The Owner reserves the right to subject materials and systems incorporated into the Project to routine tests as may be specified or as deemed necessary by the ODR or the AE to insure compliance with the quality and/or performance requirements of the Contract Documents and/or with laws, ordinances, rules, regulations and/or orders of any public authority having jurisdiction. The results of such “quality assurance” testing will be provided to the Contractor and, to the extent provided, the Contractor may rely on findings.

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

8.2.4 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 the Contractor, subject to:

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- 8.2.4.1 Contractor selection and submission of the laboratory for Owner acceptance.
- 8.2.4.2 Acceptance by the Owner of the quality and nature of tests.
- 8.2.4.3 All tests taken in the presence of the Architect/Engineer and/or ODR, or their representatives.
- 8.2.4.4 If tests confirm that the material/systems comply with Contract Documents, the Owner will pay the cost of the test.
- 8.2.4.5 If tests reveal noncompliance, the 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.
- 8.2.4.6 Proof of noncompliance with the Contract Documents will make the Contractor liable for any corrective action which the ODR determines appropriate, including complete removal and replacement of non-compliant work or material.
- 8.2.5 Notice of Testing. The Contractor shall give the ODR and the AE timely notice of its readiness and the date arranged so the ODR and AE may observe such inspection, testing or approval.
- 8.2.6 Test Samples. The 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.
- 8.2.7 Covering Up Work - If the Contractor covers up any Work without providing the Owner an opportunity to inspect, the Contractor shall, if requested by ODR, uncover and recover the work at Contractor's expense.

### 8.3 Submittals

- 8.3.1 Contractor's Submittals. 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, the Contractor shall review each submittal for compliance with Contract Documents and certify by approval stamp affixed to each copy. Submittal data presented without the Contractor's certification will be returned without review or comment, and any delay resulting from such certification is the Contractor's responsibility.
  - 8.3.1.1 Within twenty-one (21) calendar days of the effective date of the Notice To Proceed with construction, submit to the ODR, and the AE, a submittal schedule/register, organized by specification section, listing all items to be furnished for review and approval by the Architect/Engineer 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 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 the Architect/Engineer 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. Show and allow a minimum of thirty (30) calendar days duration after receipt by the Architect/Engineer and ODR for review and approval. If re-submittal required, allow a minimum of an additional fifteen (15) calendar days for review. Submit the updated submittal register with each request for progress payment. The Owner may establish routine review procedures and schedules for submittals at the preconstruction conference and/or elsewhere in the Contract Documents.
- 8.3.1.3 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. Revise and/or update both schedules monthly to ensure consistency and current project data. Provide to the ODR the updated submittal register and schedule with each application for progress payment. Refer to requirements for the Work Progress Schedule for inclusion of procurement activities therein. Regardless, 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, the Contractor represents and certifies that they have 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.
- 8.3.2 Review of Submittals. AE and ODR review is only for conformance with the design concept and the information 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 the Contractor of responsibility for any deviation from the requirements of the Contract unless the Contractor informs the AE and ODR of such deviation in a clear, conspicuous, and written manner on the submittal transmittal and at the time of submission, and obtains the Owner's written specific approval of the particular deviation. -

- 8.3.3 Correction and Resubmission. Make any corrections required to a submittal and resubmit the required number of corrected copies promptly so as to avoid delay, until submittal approval. Direct attention in writing to the AE and the ODR, when applicable, to any new revisions other than the corrections requested on previous submissions.
- 8.3.4 Limits on Shop Drawing Approvals. The Contractor shall not commence any Work requiring a submittal until approval of the submittal. Construct all such work in accordance with approved submittals. Approval of Shop Drawings and Samples is not authorization to Contractor to perform extra work or changed work unless authorized through a Change Order. The AE's and ODR's approval, 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.
- 8.3.5 No Substitutions Without Approval. The ODR and the AE may receive and consider the Contractor's request for substitution when the Contractor agrees to reimburse the Owner for review costs and satisfies 8.3.5.1, 8.3.5.2, and 8.3.5.3 in combination with one or more of the items in 8.3.5.4 through 8.3.5.11 of the following conditions, as determined by the Owner. If the Contractor does not satisfy these conditions, the ODR and AE will return the request without action except to record noncompliance with these requirements. The Owner will not consider the request if the Contractor cannot provide the product or method because of failure to pursue the Work promptly or coordinate activities properly.
- 8.3.5.1 The Contract Documents do not require extensive revisions.
- 8.3.5.2 Proposed changes are in keeping with the general intent of the Contract Documents and the design intent of the AE and do not result in an increase in cost to the Owner.
- 8.3.5.3 The request is timely, fully documented, and properly submitted.
- 8.3.5.4 The Contractor cannot provide the specified product, assembly or method of construction within the Contract Time.
- 8.3.5.5 The request directly relates to an "or-equal" clause or similar language in the Contract Documents.
- 8.3.5.6 The request directly relates to a "product design standard" or "performance standard" clause in the Contract Documents.
- 8.3.5.7 The requested substitution offers the Owner a substantial advantage in cost, time, energy conservation or other considerations, after deducting additional responsibilities the Owner must assume.
- 8.3.5.8 The specified product or method of construction cannot receive necessary approval by an authority having jurisdiction, and the ODR can approve the requested substitution.

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- 8.3.5.9 The Contractor cannot provide the specified product, assembly or method of construction in a manner that is compatible with other materials and where the Contractor certifies that the substitution will overcome the incompatibility.
  - 8.3.5.10 The Contractor cannot coordinate the specified product, assembly or method of construction with other materials and where the Contractor certifies they can coordinate the proposed substitution.
  - 8.3.5.11 The specified product, assembly or method of construction cannot provide a warranty required by the Contract Documents and where the Contractor certifies that the proposed substitution provides the required warranty.
  - 8.3.6 Unauthorized Substitutions at Contractor's Risk. The Contractor is financially responsible for any additional costs or delays resulting from using materials, equipment or fixtures other than those specified. The Contractor shall reimburse the Owner for any increased design or contract administration costs resulting from such unauthorized substitutions.
- 8.4 Field Mock-up
- 8.4.1 Mockups 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. Mockups 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 the ODR. If mock-ups are freestanding, they shall remain in place until otherwise directed by the Owner.
    - 8.4.1.3 The Contractor shall include field mock-ups in their Work Progress Schedule and shall notify the ODR and Architect/Engineer of readiness for review sufficiently in advance to coordinate review without delay.
- 8.5 Inspection During Construction
- 8.5.1 The 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 the Owner and its agents.
  - 8.5.2 The Contractor shall not cover up any work with finishing materials or other building components prior to providing the Owner and its agents an opportunity to perform an inspection of the Work.

## Uniform General Conditions

- 8.5.2.1 Should corrections of the Work be required for approval, do not cover up corrected Work until the Owner indicates approval.
- 8.5.2.2 Provide notification of at least five (5) working days or otherwise as mutually agreed, to the ODR of the anticipated need for a cover up inspection. Should the ODR fail to make the necessary inspection within the agreed period, the 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 and Final Completion. The Contract Time can be modified only by Change Order. Failure to achieve Substantial Completion within the Contract Time, Final Completion within thirty (30) days following Substantial Completion or as otherwise agreed to in writing will cause damage to the Owner and may subject the Contractor to Liquidated Damages as provided in the Contract Documents.
- 9.2. Notice to Proceed. The Owner will issue a Notice to Proceed which shall state the dates for beginning Work and for achieving Substantial Completion and Final Completion of the Work.
- 9.3. Work Progress Schedule. Refer to Special Conditions and Division 1 General Administration Specifications 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 the ODR and the AE. . Unless otherwise indicated in the Contract Documents, the Work Progress Schedule shall be computerized Critical Path Method (CPM) with full reporting capability. This initial schedule shall indicate the dates for starting and completing the various aspects required to complete the Work, including mobilization, procurement, installation, testing, inspection, and acceptance of all the Work of the Contract. When acceptable to the Owner, the initially accepted schedule shall be the Baseline Schedule for comparison to actual conditions throughout the contract duration.
- 9.3.1 Schedule Requirements. 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 the Contractor's actual plans for its completion. 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 Re-submit initial Schedule as required to address review comments from AE 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 the Contractor's representation to the Owner of the accurate depiction of all progress to date and that the Contractor will follow the schedule as submitted in performing the Work.
- 9.3.2 Schedule Updates. Update the Work Progress Schedule and the Submittal Schedule monthly, as a minimum, to reflect progress to date

and current plans for completing the Work, and submit paper and electronic copy of the update to the AE and ODR as directed. The 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. The Contractor may revise the Progress Schedule logic only with the Owner's concurrence when in the Contractor's judgment it becomes necessary for the management of the Work. Identify all proposed changes to schedule logic to Owner and to the AE via an Executive Summary accompanying the updated schedule for review prior to implementation of revisions.

9.3.3 The Work Progress Schedule is for the Contractor's use in managing the Work and submittal of the Schedule, and successive updates or revisions, is for the information of the Owner and to demonstrate that the Contractor has complied with requirements for planning the Work. The Owner's acceptance of a schedule, schedule update or revision constitutes the Owner's agreement to coordinate its own activities with the 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 the 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 the Owner's consent, alter the terms of the Contract, or waive either the Contractor's responsibility for timely completion or the Owner's right to damages for the Contractor's failure to do so.

9.3.3.3 The Contractor's scheduled dates for completion of any activity or the entire Work do not constitute a change in terms of the contract. Change Orders are the only method of modifying the completion Date(s) and Contract time.

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

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

9.5.1 If, in the judgment of the 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, the Contractor, when so informed by the Owner, shall immediately take action to increase the rate of work placement by:

## Uniform General Conditions

- 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) calendar days after such notice from the ODR, the Contractor shall notify the ODR in writing of the specific measures taken and/or planned to increase the rate of progress. Include an estimate as to the date of scheduled progress recovery and an updated Work Progress Schedule illustrating the Contractor's plan for achieving timely completion of the project. Should the ODR deem the plan of action inadequate, take additional steps or make adjustments as necessary to its plan of action until it meets with the ODR's approval.
- 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 When a delay defined herein as excusable prevents the Contractor from completing the Work within the Contract Time, the Contractor is entitled to an extension of time. The Owner will make an equitable adjustment and extend the number of calendar days lost because of excusable delay, as measured by the Contractor's progress schedule. All extensions of time will be granted in calendar 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 completion date.
- 9.6.2.1 "A Weather Day" is a day on which the Contractor's current schedule indicates Work is to be done, and on which inclement weather and related site conditions prevent the Contractor from performing seven continuous hours of Work 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, immediately notify the ODR for confirmation of the conditions. At the end of each calendar month, submit to the ODR and AE a list of Weather Days occurring in that month along with documentation of the impact on critical activities. Based on confirmation by the ODR, any time extension granted will be issued by Change Order. If the Contractor and Owner cannot agree on the time extension, the Owner may issue a ULCO for fair and reasonable time extension.

## Uniform General Conditions

- 9.6.2.2 Excusable Delay. The Contractor is entitled to an equitable adjustment of time, issued via change order, for delays caused by the following:
- 9.6.2.2.1 Errors, omissions and imperfections in design which the AE corrects by means of changes in the drawings and specifications.
  - 9.6.2.2.2 Unanticipated physical conditions at the Site which the AE corrects by means of changes to the drawings and specifications or for which the ODR directs changes in the Work identified in the Contract Documents.
  - 9.6.2.2.3 Changes in the Work that effect activities identified in the Contractor's schedule as "critical" to completion of the entire Work, if such changes are ordered by the ODR or the AE.
  - 9.6.2.2.4 Suspension of Work for unexpected natural events (sometimes called "acts of God"), civil unrest, strikes or other events which are not within the reasonable control of the Contractor.
  - 9.6.2.2.5 Suspension of Work for convenience of the ODR, which prevents Contractor from completing the Work within the Contract Time.
- 9.6.3 The Contractor's relief in the event of such delays is the time impact to the critical path as determined by analysis of the Contractor's schedule. In the event that the Contractor incurs additional direct costs because of the delay, they are to be determined pursuant to the provisions of Article 11.
- 9.7 No Damages for Delay. The Contractor has no claim for monetary damages for delay or hindrances to the work from any cause, including without limitation any act or omission of the Owner.
- 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, the Contractor may not be entitled to a time extension for the period of concurrent delay
- 9.9 Other Time Extension Requests. Time extensions requested in association with changes to the Work directed or requested by the Owner shall be included with the Contractor's proposed costs for such change. Time extensions requested for inclement weather are covered by paragraph 9.6.2.1 above. If the 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 the ODR written notice, stating the nature of the delay and the activities potentially affected, within five (5) calendar days after the onset of the event or circumstance giving rise to the excusable delay. 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 calendar days.

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- 9.9.1 Within ten (10) calendar days after the cessation of the delay, the 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 the 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. 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. 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 the 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 the Contractor's Work Progress Schedule, and any concurrent delays.
- 9.9.3.3 Description and documentation of steps taken by the 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. The Owner will respond to the Time Extension Request by providing to the 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 the Contractor.
- 9.9.4.1 The Owner will not grant time extensions for delays that do not affect the Contract Completion Date.
- 9.9.4.2 The Owner will respond to each properly submitted Time Extension Request within fifteen (15) calendar days following receipt. If the Owner cannot reasonably make a determination about the Contractor's entitlement to a time extension within that time, the Owner will notify the Contractor in writing. Unless otherwise agreed by the Contractor, the Owner has no more than fifteen (15) additional calendar days to prepare a final response. If the Owner fails to respond within forty-five (45) calendar days from the date the Time Extension Request is received, the Contractor is entitled to a time extension in the amount requested.
- 9.10 Failure to Complete Work Within the Contract Time. **TIME IS OF THE ESSENCE OF THIS CONTRACT.** The Contractor's failure to substantially complete the Work within the Contract Time or to achieve final completion as required will cause damage to the Owner. These damages are liquidated

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by agreement of the Contractor and the Owner, as set forth in the Contract Documents. -

- 9.11 Liquidated Damages. The Owner may collect Liquidated Damages due from the Contractor directly or indirectly by reducing the contract sum in the amount of Liquidated Damages stated in the Contract Documents.

## Article 10. Payments

10.1. Schedule of Values. The Contractor shall submit to the ODR and the AE for acceptance a Schedule of Values, or Work Breakdown, accurately itemizing material and labor for the various classifications of the Work based on the organization of the specification sections and using the same activity names and terms as the Work Progress Schedule. 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 the ODR, and submitted not less than twenty-one calendar (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 costs for general conditions, 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.

10.1.2 The 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 the ODR at the time of Contract execution. Thereafter grant the Owner during normal business hours access to said notarized 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. The Contractor will receive periodic progress payments for Work performed, materials in place, suitably stored on site, or as otherwise agreed to by the Owner and the Contractor. Payment is not due until receipt by the ODR or his designee of a correct and complete Pay Application in electronic and/or hard copy format as set forth in Supplementary General Conditions, Special Conditions or Division 1 Specifications, and certified by the AE. Progress payments are made provisionally and do not constitute acceptance of work not in accordance with the Contract Documents. The 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 the Architect/Engineer and the ODR a complete, clean copy of a preliminary pay worksheet or Preliminary Pay Application, to include the following:

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

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- 10.2.1.2 An updated Work Progress Schedule including the Executive Summary and all required schedule reports.
  - 10.2.1.3 HUB Subcontracting Plan reports.
  - 10.2.1.4 Such additional documentation as Owner may require as set forth in the Supplementary General Conditions or elsewhere in the Contract Documents.
- 10.2.2 Contractor's Application for Progress Payment. As soon as practicable, but in no event later than seven days after receipt of the Preliminary Pay Worksheet, the AE and ODR will meet with the Contractor to review the Preliminary Pay Worksheet and to observe the condition of the Work. Based on this review, the ODR and the AE may require modifications to the Preliminary Pay Worksheet prior to the submittal of an application for progress payment, and will promptly notify the Contractor of revisions necessary for approval. As soon as practicable, the Contractor shall submit its Invoice on the appropriate and completed form, reflecting the required modifications to the Schedule of Values required by the AE and/or ODR. Attach all additional documentation required by the ODR and/or AE, as well as an affidavit affirming that all payrolls, bills for labor, materials, equipment, subcontracted work and other indebtedness connected with the Contractor's invoice are paid or will be paid within the time specified in Tex. Gov't Code, Chapter 2251. No invoice is complete unless it fully reflects all required modifications, and attaches all required documentation including the Contractor's affidavit.
- 10.2.3 Certification by Architect/Engineer. Within five days or earlier following the AE's receipt of the Contractor's formal invoice, the AE will review the application for progress payment for completeness, and forward to the ODR. The AE will certify that the application is complete and payable, or that it is incomplete, stating in particular what is missing. If the Invoice is incomplete, the Contractor shall make the required corrections and resubmit the Invoice for processing.
- 10.3 Owner's Duty to Pay. The Owner has no duty to pay the Contractor except on receipt by the ODR of; 1) a complete Invoice certified by the AE and 2) the Contractor's updated Work Progress Schedule, and 3) confirmation that the Contractor's as-built documentation at the site is kept current.
- 10.3.1 Payment for stored materials and/or equipment confirmed by the Owner and AE to be on-site or otherwise properly stored is limited to 85 percent of the invoice price or 85 percent of the scheduled value for the materials or equipment, whichever is less.
  - 10.3.2 Retainage. The Owner will withhold from each progress payment, as retainage, 5 percent of the total earned amount, the amount authorized by law, or as otherwise set forth in the Supplementary General Conditions. - Retainage is managed in conformance with Tex. Gov't Code, Chapter 2252, Government Code, subchapter B.



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- 10.3.2.1 The 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 total Contract must be completed before the Owner can consider a retainage reduction or release.
- 10.3.3 Price Reduction to Cover Loss. The Owner may reduce any Periodic Invoice, or application for Progress Payment, prior to payment to the extent necessary to protect the Owner from loss on account of actions of the Contractor including, but not limited to:
  - 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 the Owner upon payment.
  - 10.3.4.1 Transfer of title to Owner does not relieve the Contractor of the sole responsibility for the care and protection of materials and Work upon which payments have been made until final acceptance of the entire Work, or the restoration of any damaged Work, or waive the right of the Owner to require the fulfillment of all the terms of the Contract.
- 10.4 Progress payments to the Contractor do not release the Contractor or its surety from any obligations under this Contract.
  - 10.4.1 Upon the Owner's request, the Contractor shall furnish manifest proof of the status of Subcontractor's accounts in a form acceptable to the Owner.
  - 10.4.2 Pay estimate certificates must be signed by a corporate officer or a representative duly authorized by the 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.

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- 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 the Owner's representative approves the application for payment.
- 10.5 Off-Site Storage. With prior approval by the 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 the Owner.
- 10.5.1.1 Store materials in a Bonded Commercial Warehouse.
- 10.5.1.2 Provide separate 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 the Owner's representative.
- 10.5.1.3 Inspection by Owner's representative is allowed at any time. The Owner's Inspectors must be satisfied with the security, control, maintenance, and preservation measures.
- 10.5.1.4 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.
- 10.5.1.5 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.
- 10.5.1.6 With each monthly payment estimate, submit a report to the ODR, AE, and Inspector listing the quantities of materials already paid for and still stored in the off-site location.
- 10.5.1.7 Make warehouse records, receipts and invoices available to Owner's representatives, upon request, to verify the quantities and their disposition.
- 10.5.1.8 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 near the jobsite as directed by the 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.

## Article 11. Changes

- 11.1. Change Orders. A Change Order issued after execution of the Contract is a written order to the Contractor, signed by the ODR, the Contractor, and the Architect/Engineer, 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 the Contractor indicates his agreement therewith, including the adjustment in the Contract Sum and/or the Contract Time. The ODR may issue written authorization for the Contractor to proceed with work of a change order in advance of final execution by all parties.
- 11.1.1 The 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, and shall be performed under the applicable conditions of the Contract Documents. If such changes cause an increase or decrease in the 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.
- 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, 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, *quantum meruit*, 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, whether direct, consequential or otherwise in any wise incident to, arising out of, or resulting directly or indirectly from the work performed by Contractor under such Change Order.
- 11.1.3 Procedures for administration of Change Orders shall be established by the Owner and stated in Supplementary General Conditions, Special Conditions, or elsewhere in the Contract Documents.

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- 11.1.4 Except as provided above, no order, oral statement, or direction of the Owner or his duly appointed representative shall be treated as a change under this article or entitle the Contractor to an adjustment.
- 11.1.5 The Contractor agrees that the 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 the Contractor. Further, the Contractor agrees to include in all its subcontracts a provision to the effect that the subcontractor agrees that the 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 contractor relating to any claim arising from this 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 this 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 the Owner or the Contractor, the applicable unit prices shall be equitably adjusted as provided in the Special Conditions or as agreed to by the parties and incorporated into Change Order.
- 11.3. Claims for Additional Costs
- 11.3.1 If the Contractor wishes to make a claim for an increase in the Contract Sum not related to a requested change, they shall give the Owner and the Architect/Engineer 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 the Contractor shall act in accordance with Article 7.2.1. No such claim shall be valid unless so made. If the Owner and the 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 Change Order.
- 11.3.2 If the 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 the Owner to stop the Work pursuant to Article 14 where the Contractor was not at fault, 3) any written order for a minor change in the Work issued pursuant to Article 11.4, the Contractor shall make such claim as provided in Article 11.3.1.

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- 11.3.3 Should the Contractor or his Subcontractors fail to call attention of the AE to obvious discrepancies or omissions in the Bid/Proposal Documents during the pre-bid/pre-proposal period, but claim additional costs for corrective work after contract award, the Owner may assume intent to circumvent competitive bidding for necessary corrective work. In such case, the Owner may choose to let a separate contract for the corrective work, or issue a Unilateral Change Order to require performance by the Contractor. Claims for time extensions or for extra cost resulting from delayed notice of contract document discrepancies or omissions will not be considered by the Owner.
- 11.4. Minor Changes. The AE, with concurrence of the 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 the Contractor shall carry out promptly and record on as-built record documents.
- 11.5. Concealed Site Conditions. 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 bid/proposal 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, the ODR and the Architect/Engineer shall be notified in writing of such conditions before they are disturbed. Upon such notice, or upon its own observation of such conditions, the Architect/Engineer, with the approval of the 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 the ODR.
- 11.6. Extension of Time. All Changes to the Contract Time shall be made as a consequence of requests as required under Article 9.6, and as documented by Change Order as provided under Article 11.1.
- 11.7. Administration of Change Order Requests
- All changes in the Contract shall be administered in accordance with procedures approved by the Owner, and when required make use of such electronic information management system(s) as the owner may employ.
- 11.7.1 Routine changes in the Construction Contract shall be formally initiated by the Architect/Engineer by means of a Change Request form detailing requirements of the proposed change for pricing by the Contractor. This action may be preceded by communications between the Contractor, AE and ODR concerning the need and nature of the change, but such communications shall not constitute a basis for beginning the proposed Work by the Contractor. Except for emergency conditions described below, approval of the Contractor's

cost proposal by the Architect/Engineer and ODR will be required for authorization to proceed with the Work being changed. The Owner will not be responsible for the cost of work changed without prior approval and the 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 established Schedule of Values, to permit analysis by the AE and ODR using current estimating guides and/or practices. Photocopies of Subcontractor and vendor proposals shall be furnished unless specifically waived by the ODR. Contractor shall provide written response to change request within twenty-one (21) calendar 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 the 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, the 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 the Contractor alone (see Article 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.

11.8. Pricing Change Order Work

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

- 11.8.1 For work performed by its forces, the Contractor will be allowed their actual costs for materials, the total amount of wages paid for labor, the total cost of Federal Old Age Benefit (Social Security Tax) and of Worker's Compensation and Comprehensive General Liability Insurance, plus Bond cost if the change results in an increase in the Bond premium paid by the Contractor. To the total of the above costs, the Contractor will be allowed to add a percentage as noted below to cover overhead and profit combined. Overhead shall be considered to include insurance other than mentioned above, field and office supervisors and assistants, including safety and scheduling personnel, use of small tools, incidental job burdens and general Home Office expenses, and no separate allowance will be made therefore.

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Allowable percentages for overhead and profit on changes will not exceed 15 percent if the total of self-performed work is less than or equal to \$10,000, 10 percent if the total of self-performed work is between \$10,000 and \$20,000 and 7.5 percent if the total of self-performed work is over \$20,000, for any specific change priced.

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 the Contractor will be allowed to add a maximum mark-up of 10 percent if the total of all subcontracted work is less than or equal to \$10,000, 7.5 percent if the total of all subcontracted work is between \$10,000 and \$20,000 and 5 percent if the total of all subcontractor work is over \$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.

The Owner does not accept and will not pay for additional contract cost identified as indirect, consequential, or as damages caused by delay.

## Article 12. Project Completion and Acceptance

### 12.1. Closing Inspections

12.1.1 Substantial Completion Inspection. When the Contractor considers the entire Work or part thereof Substantially Complete, it shall notify the ODR in writing that the Work will be ready for Substantial Completion Inspection on a specific date. The Contractor shall include with this notice the Contractor's Punchlist to indicate that it has previously inspected all the Work associated with the request for inspection, has corrected items where possible, and includes all items scheduled for completion or correction prior to final inspection. The failure to include any items on this list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents. If any of the items on this list prevents the building from the use to which it is intended, the Contractor shall not request a Substantial Completion Inspection. The Owner and its representatives will review the list of items and schedule the requested inspection, or inform the Contractor in writing that such an inspection is premature because the Work is not sufficiently advanced or conditions are not as represented on the Contractor's list.

12.1.1.1. Prior to the Substantial Completion Inspection, the Contractor shall furnish a copy of its marked-up As-Built Drawings 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. 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, the AE, ODR, the Contractor and other Owner representatives as determined by the Owner, will jointly attend the Substantial Completion Inspection, which shall be conducted by the ODR or their delegate. If the ODR determines that the Work is Substantially Complete, the ODR will issue a Certificate of Substantial Completion to be signed by the AE, Owner and Contractor, establishing the date of Substantial Completion. AE will provide with this certificate a list of punchlist items (the Pre-Final Punchlist) for completion prior to final inspection. This list may include items in addition to those on the Contractor's punchlist, which the inspection team deems necessary to correct or complete prior to Final Inspection. If the Owner occupies the facility upon determination of Substantial Completion, the Contractor shall complete all corrective Work at the



convenience of the Owner, without disruption to Owner's use of the facility for its intended purposes.

- 12.1.2 Final Inspection. The 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, the Contractor shall complete and/or correct all Work within thirty (30) days of the Substantial Completion date. Upon completion of the Pre-Final Punchlist work, the Contractor shall give written notice to the ODR and AE that the Work will be ready for Final Inspection on a specific date. The 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, the ODR, AE and the Contractor will inspect the Work. The AE will submit to the 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 the AE and ODR in writing stating the disposition of each Final Punchlist item. The AE, 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 the ODR will issue a certificate establishing the date of Final Completion. Completion of all Work is a condition precedent to the 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 the Owner.
- 12.1.4 Purpose of Inspection. Inspection is for determining the completion of the Work, and does not relieve the 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 the 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 the Owner's rights under the Contract or relieve the Contractor of its responsibility for performance or warranties.
- 12.1.5 Additional Inspections
- 12.1.5.1 If the Owner's inspection team determines that the Work is not Substantially Complete at the Substantial Completion

Inspection, the ODR or AE will give the Contractor written notice listing cause(s) of the rejection. The ODR will set a time for completion of incomplete or defective work. Complete or correct all work so designated prior to requesting a second Substantial Completion Inspection.

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

12.1.5.3 The Contract Agreement contemplates three (3) comprehensive inspections: the Substantial Completion Inspection, the Final Completion Inspection, and the Inspection of Completed Final Punchlist Items. The cost to the Owner of additional inspections resulting from the Work not being ready for one or more of these inspections is the responsibility of the Contractor. The Owner may issue a Unilateral Change Order deducting these costs from Final Payment. Upon the Contractor's written request, the 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 the 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 Substantially 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. The Owner may occupy or use all or any portion of the Work following Substantial Completion, or at any earlier stage of completion. Should the Owner wish to use or occupy the Work, or part thereof, prior to Substantial Completion, the ODR will notify the Contractor in writing. Work performed on the premises by third parties on the Owner's behalf does not constitute occupation or use of the Work by the Owner for purposes of this Article. All Work performed by the Contractor after

occupancy, whether in part or in whole, shall be at the convenience of the Owner so as to not disrupt Owner's use of, or access to occupied areas of the project.

12.3 Acceptance & Payment

- 12.3.1 Request for Final Payment. Following the certified completion of all work, including all punch list items, cleanup, and the delivery of record documents, the Contractor shall submit a certified Application for Final Payment. Include all sums held as retainage and forward to the AE and the ODR for review and approval.
- 12.3.2 Final Payment Documentation. 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. Submit Consent of Surety to Final Payment 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, or otherwise satisfied within the period of time required by Tex. Gov't Code, Chapter 2251. 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. The Contractor may not subsequently submit a claim on behalf of a subcontractor or vendor unless the Contractor's affidavit notes that claim as an exception.
- 12.3.3 Architect/Engineer Approval. The AE 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, the AE 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. The Owner may deduct from the Final Payment all sums due from the Contractor. If the Certificate of Final Completion notes any Work remaining, incomplete, or defects not remedied, the Owner may deduct the cost of remedying such deficiencies from the Final Payment. On such deductions, the Owner will identify each deduction, the amount, and the explanation of the deduction on or by the 21<sup>st</sup> 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 Unilateral Change Order as may be applicable.
- 12.3.5 Final Payment Due. Final Payment is due and payable by the Owner, subject to all allowable offsets and deductions, on the 31<sup>st</sup> day following the Owner's approval of the Application for Payment. If the Contractor disputes any amount deducted by the Owner, the Contractor shall give notice of the dispute on or before the thirtieth

## Uniform General Conditions

(30<sup>th</sup>) 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 the 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); and/or
  - 12.3.6.2 Failure of the Work to comply with the requirements of the Contract Documents; and/or
  - 12.3.6.3 Terms of any warranties required by the Contract, or implied by law; and/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 the Contractor except those specifically identified in writing and submitted to the 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 the Contractor and closed until the expiration of all warranty periods.

## Article 13. Warranty & Guarantee

- 13.1. Contractor's General Warranty and Guarantee. Contractor warrants to the 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 best finish and workmanship. The Contractor further warrants that unless otherwise specified, all materials and equipment incorporated in the Work under the Contract are new. The 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, the 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 the Owner, Architect/Engineer or others, by making any progress payment or final payment, by the use or occupancy of the Work or any portion thereof by the Owner, at any time, or by any repair or correction of such defect made by the Owner.
- 13.2. Warranty Period. Except as may be otherwise specified or agreed, the 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 the Contractor.
- 13.3.2 Normal wear and tear under normal usage after acceptance of the Work by the Owner.
- 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 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:
- 13.4.1.1 Observations by Owner and/or AE.
- 13.4.1.2 Recommendation to pay any progress or final payment by AE.

## Uniform General Conditions

- 13.4.1.3 The issuance of a certificate of Substantial Completion or any payment by Owner to Contractor under the Contract Documents.
  - 13.4.1.4 Use or occupancy of the Work or any part thereof by Owner.
  - 13.4.1.5 Any acceptance by Owner or any failure to do so.
  - 13.4.1.6 Any review of a Shop Drawing or sample submittal; or
  - 13.4.1.7 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 the Contractor. The ODR will certify the date of service commencement in the Substantial Completion Certificate.
- 13.5.1 In addition to the Contractor's warranty and duty to repair, the Contractor expressly assumes all warranty obligations required under the Contract for specific building components, systems and equipment.
  - 13.5.2 The Contractor may satisfy any such obligation by obtaining and assigning to the Owner a complying warranty from a manufacturer, supplier, or Subcontractor. Where an assigned warranty is tendered and accepted by the Owner which does not fully comply with the requirements of the Contract, the Contractor remains liable to the 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 the Owner, or any agent of the Owner designated as responsible for management of the Warranty Period, of the discovery of a defect, the Contractor shall promptly remedy the defect(s), and provide written notice to the Owner and designated agent indicating action taken. In case of emergency where delay would cause serious risk of loss or damage to the Owner, or if the Contractor fails to remedy within 30 days, or within another period agreed to in writing, the Owner may correct the defect and be reimbursed the cost of remedying the defect from the Contractor or its Surety.
- 13.7 Certification of No Asbestos Containing Materials or Work. The Contractor shall ensure compliance with the Asbestos Hazard Emergency Response Act (AHERA– 40 CFR 763-99 (7)) from all subcontractors and materials suppliers, and shall provide a notarized certification to the 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 the Contractor's application for Final Payment.

## Article 14. Suspension and Termination

- 14.1. Suspension of Work for Cause. The Owner may, at any time without prior notice, suspend all or any part of the Work, if after reasonable observation and/or investigation, the 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.
- 14.1.1.1. The Owner will give the 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, the Contractor shall immediately stop the Work so identified. As soon as practicable following the issuance of such a notice, the Owner will initiate and complete a further investigation of the circumstances giving rise to the suspension, and issue a written determination of the findings.
- 14.1.1.2. If it is confirmed that the cause was within the control of the Contractor, the 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 the Contractor, and the suspension has prevented the 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.
- 14.1.1.3. 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) calendar days written notice to the Contractor, the 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 days for its own convenience. The Owner will give the 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 the Contractor from completing the Work within the Contract Time, it is an Excusable Delay. A notice of suspension for convenience may be modified by the Owner at any time on seven (7) calendar days written notice to the Contractor. If the Owner suspends the Work for its convenience for more than 60 consecutive calendar days, the Contractor may elect to terminate the contract pursuant to the provisions of the contract.
- 14.3. Termination by Owner for Cause
- 14.3.1 The Owner may, without prejudice to any right or remedy, terminate the employment of the Contractor and take possession of the site and of all materials, equipment, tools, construction equipment and

## Uniform General Conditions

machinery thereon owned by the 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; and/or
  - 14.3.1.2 Persistent disregard of laws, ordinances, rules, regulations or orders of any public authority having jurisdiction, including the ODR; and/or
  - 14.3.1.3 Persistent failure to prosecute the work in accordance with the Contract, and to insure its completion within the time, or any approved extension thereof, specified in this Contract; and/or
  - 14.3.1.4 Failure to remedy defective work condemned by the ODR; and/or
  - 14.3.1.5 Failure to pay subcontractors, laborers, and material suppliers pursuant to Tex. Gov't Code Chapter 2251; and/or
  - 14.3.1.6 Persistent endangerment to the safety of labor or of the Work; and/or
  - 14.3.1.7 Failure to supply or maintain statutory bonds or to maintain required insurance, pursuant to the contract; and/or
  - 14.3.1.8 Any material breach of the Contract; and/or
  - 14.3.1.9 The Contractor's insolvency, bankruptcy, or demonstrated financial inability to perform the work.
- 14.4 Failure by the Owner to exercise the right to terminate in any instance is not a waiver of the right to do so in any other instance.
- 14.4.1 Should the Owner decide to terminate the employment of the Contractor under the provisions of Article 14.1.1, it will provide to the Contractor and its Surety thirty (30) days prior written notice.
  - 14.4.2 Should the Contractor or its Surety, after having received notice of termination, demonstrate to the satisfaction of the Owner, remedy to the condition(s) upon which the notice of termination was based, the notice of termination shall be rescinded in writing by the Owner. If so rescinded, the Work may continue without an extension of time.
  - 14.4.3 If the Contractor or its Surety fails to demonstrate remedy to the satisfaction of the Owner within thirty days following receipt of notice, the Owner may arrange for completion of the Work and deduct the cost of completion from the unpaid Contract Sum.
    - 14.4.3.1 This amount includes the cost of additional Owner costs such as AE services, other consultants, and contract administration.
    - 14.4.3.2 The Owner will make no further payment to the Contractor or its Surety until all costs of completing the Work are paid. If the



unpaid balance of the Contract Sum exceeds the costs of administering and finishing the Work, the Contractor will receive the excess funds. If such costs exceed the unpaid balance, the Contractor or its Surety will pay the difference to the Owner.

- 14.4.3.3 This obligation for payment survives the termination of the Contract.
- 14.4.3.4 The owner reserves the right in termination for cause to take assignment of all contracts between the Contractor and its Subcontractors, vendors and suppliers. The ODR will promptly notify the Contractor of the contracts the Owner elects to assume. Upon receipt of such notice, the Contractor shall promptly take all steps necessary to effect such assignment.
- 14.5 Termination for Convenience of Owner. The 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 The Owner will immediately notify the Contractor and the AE in writing, specifying the reason for and the effective date of 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, the 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:
    - 14.5.4.1 Stop all work.
    - 14.5.4.2 Place no further subcontracts or orders for materials or services.
    - 14.5.4.3 Terminate all subcontracts.
    - 14.5.4.4 Cancel all materials and equipment orders as applicable.
    - 14.5.4.5 Take action that is necessary to protect and preserve all property related to this Contract which is in the possession of the Contractor.
  - 14.5.3 When the Contract is terminated for the Owner's convenience, the Contractor may recover from the Owner payment for all Work executed, including any additional work required pursuant to the notice of termination, and for any provable loss and reasonable expenses attributable to the Work resulting from such termination.
- 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 the Contractor or a Subcontractor or their agents or employees or any other persons performing any of the Work under a contract with the

## Uniform General Conditions

Contractor, then the Contractor may, upon thirty (30) additional days' written notice to the ODR, terminate the Contract and recover from the Owner payment for all Work executed and for any provable loss and reasonable expenses attributable to the Work resulting from such termination. If the cause of the work stoppage is removed prior to the end of the thirty (30) day notice period, the Contractor may not terminate the Contract.

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

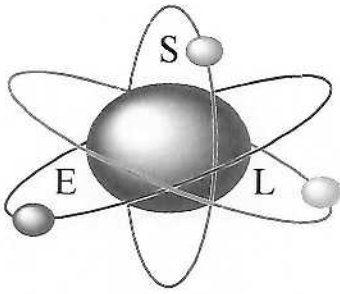
## **Article 15. Dispute Resolution**

- 15.1 Unresolved Contractor Disputes. The dispute resolution process provided for in Tex. Gov't Code, Chapter 2260, shall be used by the Owner and the Contractor to attempt to resolve any claim for breach of contract made by the Contractor, that is not resolved under procedures described throughout the Uniform General Conditions, Supplemental Conditions, or Special Conditions of the Contract.
- 15.2 Alternative Dispute Resolution Process. The Owner may establish a dispute resolution process to be utilized in advance of that outlined in Tex. Gov't Code, Chapter 2260.

## **Article 16. Miscellaneous**

- 16.1. Supplemental and Special Conditions. When the Work contemplated by the 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 Supplemental and Special Conditions as described below:
- 16.1.1 Supplemental Conditions may describe the standard procedures and requirements of contract administration followed by a contracting agency of the State. Supplemental 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. Supplemental 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 peculiar 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, the Owner may waive, suspend or modify any Article in these Uniform General Conditions which conflicts with any Federal statute, rule, regulation or procedure, where such waiver, suspension or modification is essential to receipt by the 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, the Owner may administer its design and construction management through an Internet-based management system. In such cases, the 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, the Owner will make the software accessible via the Internet to all project team members.
- 16.3.1.2 The Owner shall administer the software.
- 16.3.2 Training. When used, the Owner shall provide training to the project team members.

**End of Uniform General Conditions – revised 5/4/06**



**SCIENCE ENGINEERING, LTD.**  
**GEOTECHNICAL, ENVIRONMENTAL, MATERIALS TESTING**

**GEOTECHNICAL INVESTIGATION**

**FOR**

**NEW ADDITION TO THE RUBY FULLER BUILDING AT LAMAR STATE  
COLLEGE PORT ARTHUR**

**IN**

**PORT ARTHUR, TEXAS**

**REPORT NUMBER 20107**

**REPORTED TO:**

**SIGMA ENGINEERS, INC.  
4099 CALDER AVENUE  
BEAUMONT, TEXAS 77706**

**JANUARY 2020**

**PREPARED BY:  
SCIENCE ENGINEERING, LTD.**

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**GEOTECHNICAL INVESTIGATION**  
**Addition to the Ruby Fuller Building**  
**Orange, Texas**

**INTRODUCTION**

The study reported herein is an investigation of subsurface conditions for a new addition to the Ruby Fuller Building at Lamar State College Port Arthur in Port Arthur, Texas.

**AUTHORIZATION**

This investigation was authorized by Mr. Devin M. Jones, P.E. by e-mail dated January 16, 2020.

**SUBSURFACE EXPLORATION**

The subsurface exploration at the site was accomplished by means of two (2) undisturbed sample core borings drilled to depths of approximately twenty (20) feet below existing ground surface. Approximate locations of the boring are shown on the attached boring plan.

**SUBSURFACE INVESTIGATION**

The subsurface investigation consisted of drilling three-inch nominal diameter core borings. Undisturbed samples of the cohesive soils were obtained from the borings by means of thin-wall, seamless steel Shelby tube samplers, in accordance with the ASTM D-1587 method. . The shear strength of the cohesive soil samples was estimated by hand pentrometer in the field.

All undisturbed samples were extracted mechanically from the core barrels in the field, classified, wrapped in aluminum foil, and sealed in airtight plastic bags to prevent moisture loss and disturbance. The samples were transported to our laboratory for testing and further study.

**LABORATORY INVESTIGATIONS**

All samples from borings were examined and classified in the laboratory by a soil engineer, according to procedures outlined in ASTM D-2488. Laboratory tests were performed on selected soil samples in order to evaluate the engineering properties of the soil in accordance with the indicated standard procedures.

### LABORATORY TESTS

Atterberg Limits (L.L., P. L., P.I.)  
Soil Moisture Content  
Unconfined Compressive Strength  
Soils Classification

### STANDARD TESTS

ASTM D-4318  
ASTM D-2216  
ASTM D-2266  
ASTM D-2487

Undrained shear strength of selective cohesive soils was determined by unconfined compression tests. Water content and dry unit weight of the foundation soils were determined as routine parts of the unconfined compression tests. Atterberg limits tests were performed on the appropriate cohesive samples. The results of these tests are shown on attached boring logs.

### SUBSURFACE CONDITIONS

Specific types and depths of subsurface strata encountered on the site are shown on the attached boring logs. Review of the boring logs indicates that generalized stratigraphy is approximately as follows:

<u>Stratum No.</u>	<u>Average Depth, feet</u>	<u>Description of Strata</u>
I	0.00 - 2.00	Dark Gray SILTY CLAY (CL); Fill
II	2.00 - 14.00	Tan and Gray CLAY (CL) with ferrous and calcareous nodules
III	14.00 - 17.00	Tan and Gray SANDY CLAY (CL)
IV	17.00 - 20.00	Tan and Gray CLAY (CH)

The near surface soils are "CH" type soils when classified by the unified soils classification system. This type soil normally exhibits high swell potential during seasonal moisture variations.

Hydrostatic water was encountered at the time of drilling, as shown on the attached boring plan.

### CONSTRUCTION VARIATIONS

The information contained in this report summarizes conditions found on the date that the borings was drilled. The depth to the static water table may be expected to vary with the environmental variations, such as frequency and magnitude of precipitation and the time of year that construction begins.

## **DESIGN ANALYSIS AND RECOMMENDATIONS**

Information available to this office indicates that the proposed construction at the site will consist of a new addition to the Ruby Fuller Building.

### **FOUNDATION RECOMMENDATIONS (BELL BOTTOM PIERS)**

From analysis of the boring logs and laboratory test results, structural loads can be transmitted to the foundation soils by use of drilled and underreamed type footings. Footings should extend to a depth of eight (8) feet below existing ground surface to be located in Tan and Gray Clay. Utilizing a minimum factor of safety of three for dead load, or a minimum factor of two for total load, the allowable bearing capacity of the foundation soils for circular type footings is as follows: 2,700 PSF for dead load, plus long term live loads, and 4,000 PSF for total load. Whichever is critical should be used. The allowable loads given can be increased by thirty (30) percent for wind or temporary lateral loading.

There is a potential for upward movement of the plastic clays in contact with the sides of the piers; the pier shafts should be well reinforced throughout their length resist tensional force.

### **STRUCTURE FOUNDATION**

Each footing excavation should be inspected by the project's Engineer, Architect or Owner's representative prior to placing concrete to insure that (a) the footing has been constructed at the correct depth and the correct formation established by previously mentioned criteria, (b) the footing is concentric with the pier shaft or column, and (c) excessive cuttings, build-up or any soft-compressible material(s) have been removed from the bottom of the excavation.

Placement of concrete should be accomplished as soon as possible to prevent changes in the state of stress and the caving of the foundation soils. No footings should be poured without the prior approval of the projects' Engineer, Architect or Owner's representative.

### **FLOOR SLABS AND GRADE BEAMS**

Review of the Atterberg Limits determinations indicates that the surface soils are "CH" type soils, with high plasticity, which may exhibit expansion during seasonal wetting and drying cycles. We believe that conventional "slab-on-fill" construction may be used for the interior portion of the structures built at the



site. Select fill, a minimum of thirty-six (36) inch thickness should be used to bring the structure to grade.

Prior to placement of select fill, strip site sufficiently to remove all topsoil, existing vegetation, and roots larger than ½" in diameter to an approximate depth of thirty-six (36) inches. Then scarify the subgrade, add moisture, if necessary, and re-compact to 95% of the maximum dry density as determined by ASTM D-698 (Standard Proctor). The moisture content at the time of compaction of subgrade soils should be within +3% of the proctor optimum value.

Select fill should then be placed, under laboratory control, in no greater than eight-inch (8") loose layers, and compacted to a minimum of 95% of the maximum dry unit weight, as obtained in the laboratory by means ASTM D-698 procedure. Moisture content of ±2% optimum should be maintained during placement of the select fill material. A vapor barrier consisting of six (6) mil Polyethylene shall be placed between the select fill and concrete slab.

The material used as select fill should consist of a non-active sandy clay or clayey sand type substance, having a Liquid Limit of 36 or less and Plasticity Index (P.I.) varying from 10 to 20.

### **FOUNDATION SETTLEMENT**

A detailed settlement analysis was not within the scope of this study. It is anticipated that the footings designed, using the recommended allowable bearing pressures, will experience small settlements that will be well within the tolerable limit for the proposed structure.

### **SITE PREPARATION**

In order to remedy construction problems, which may develop if attempts are made to work the surface materials following prolonged periods of rainfall which are common to this area, it is recommended that prior to starting any work at the site that proper construction drainage is to be provided to maintain a relatively dry construction site. (Use a minimum slope of 5% within 10 feet of the foundation).

## LIMITATIONS

The conclusions and recommendations given in this report are based on the analysis of the data collected for this project. Additive conclusions or recommendations made from this data by others are their responsibility.

Our study is based on the data obtained from soil borings made at the locations shown on borings plan. The nature and extent of variations between borings may become evident during construction. We should be requested to observe exposed conditions. After making these observations, and noting the engineering significance of variations, we will advise you of any changes in recommendations believed appropriate.

We appreciate this opportunity to provide our services to this project. Please let us know if you require additional information. Thank you.

**Respectfully submitted for the firm,  
TBPE Registration No. 4060**

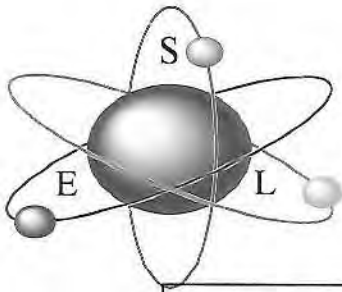


**Yousef Rahmani, P.E.  
President**

Encl.:        Boring Plan  
              Boring Logs 1 and 2  
              Geotechnical Chart/Symbols

Copies:     2 - Client  
              1 - SEL File 20107

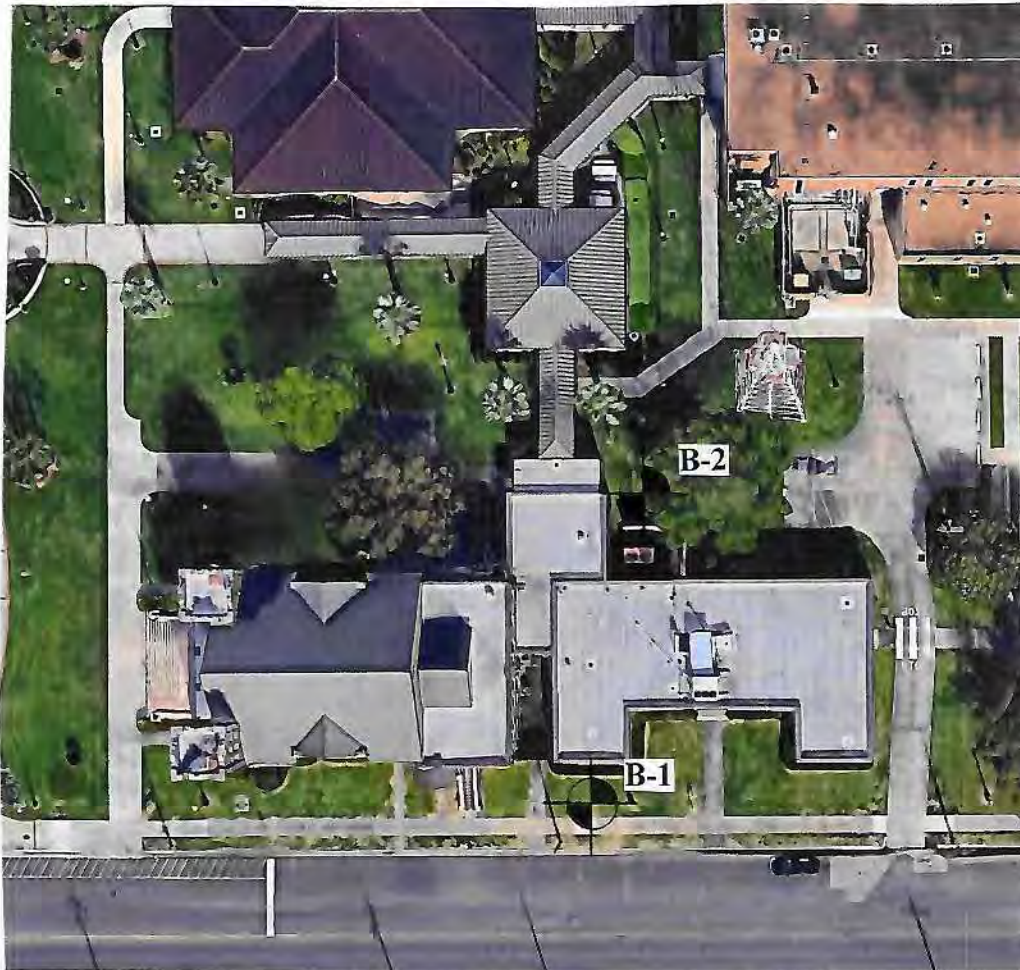
YR/nb



# SCIENCE ENGINEERING, LTD.

GEOTECHNICAL, ENVIRONMENTAL, MATERIALS TESTING

Report Number 20107



NEW ADDITION TO RUBY FULLER BUILDING  
PORT ARTHUR, TEXAS

BORING PLAN

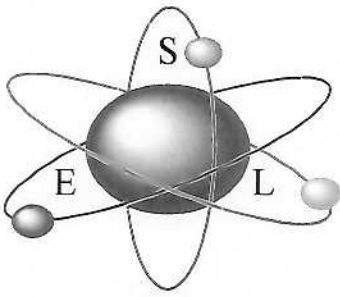
JANUARY 2020

NOT TO SCALE

P.O. Box 2048 / Nederland, Texas 77627 / Tel.: (409) 982-0686 or (409) 727-2218

Fax: (409) 982-0619 / e-mail: [yousef@science-engineer.com](mailto:yousef@science-engineer.com)





# SCIENCE ENGINEERING, LTD.

## GEOTECHNICAL, ENVIRONMENTAL, MATERIALS TESTING

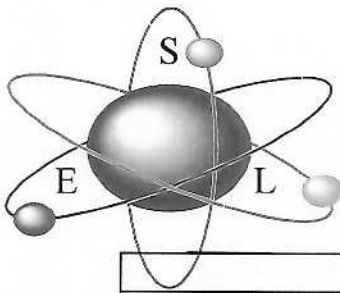
### LOG OF BORING

Project: <u>New Addition to the Ruby Fuller Building</u>	Project No: <u>20107</u>
<u>Port Arthur, Texas</u>	Date of Report: <u>01/23/2020</u>
Boring Number: <u>B-1</u>	Date of Boring: <u>01/21/2020</u>
Location: <u>See Boring Plan</u>	Authorization: <u>Mr. Devin M. Jones, P.E.</u>
Dry Auger: <u>0</u> to <u>20</u> Feet	

DEPTH, FEET	SYMBOL	SAMPLE	BLOWS PER FOOT	STRATUM DESCRIPTION	WATER CONTENT (%)	DRY DENSITY (PCF)	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX (PI)	PERCENT PASSING NO. 200 SIEVE	SHEAR STRENGTH	
											POCKET PENETROMETER (TSF)	UNCONFINED COMPRESSIVE STRENGTH (TSF)
				Dark Gray SILTY CLAY			38	18	20		0.12	
				Dark Gray CLAY with ferrous nodules							0.50	
5				– tan and gray	29	92	72	24	48		0.50	0.40
				– ferrous and calcareous nodules							0.85	
10					19	102	69	22	47		1.00	0.60
					19	109	60	21	39		1.25	0.97
15				Tan and Gray SANDY CLAY	23	100	36	17	19		0.25	0.30
				Tan and Gray CLAY	22	98	53	20	33		0.50	0.50
20				Bottom at 20 feet								
				1. Water was encountered at 13' - 0" during drilling.								
				2. Water level was at 11' - 0" after 15 minutes.								

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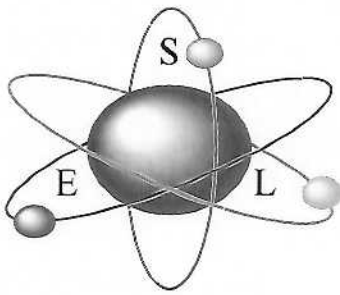
Fax: (409) 982-0619 / e-mail: [yousef@science-engineer.com](mailto:yousef@science-engineer.com)



# SCIENCE ENGINEERING, LTD.

## GEOTECHNICAL, ENVIRONMENTAL, MATERIALS TESTING

LOG OF BORING												
Project: <u>New Addition to the Ruby Fuller Building</u> <u>Port Arthur, Texas</u>				Project No: <u>20107</u>								
Boring Number: <u>B-2</u>				Date of Report: <u>01/23/2020</u>								
Location: <u>See Boring Plan</u>				Date of Boring: <u>01/21/2020</u>								
Dry Auger: <u>0</u> to <u>20</u> Feet				Authorization: <u>Mr. Devin M. Jones, P.E.</u>								
DEPTH, FEET	SYMBOL	SAMPLE	BLOWS PER FOOT	STRATUM DESCRIPTION	WATER CONTENT (%)	DRY DENSITY (PCF)	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX (PI)	PERCENT PASSING NO. 200 SIEVE	SHEAR STRENGTH	
											POCKET PENETROMETER (TSF)	UNCONFINED COMPRESSIVE STRENGTH (TSF)
				Dark Gray SILTY CLAY							0.50	
				CL								
				Dark Gray CLAY with ferrous nodules	22	97	59	21	38		0.50	0.23
5				- ferrous and calcareous nodules							0.50	
					25	97	80	26	54		0.75	0.60
					20	101	73	23	50		0.85	0.60
10					19	106	50	19	31		1.00	0.60
					31	90	79	25	54		0.85	0.60
15				CH								
				Tan and Gray SANDY CLAY								
				CL	27	106	41	20	21		0.75	0.51
				Tan and Gray CLAY								
				CH	22	100	54	20	34		0.75	0.70
20				Bottom at 20 feet								
				1. Water was encountered at 13' - 0" during drilling.								

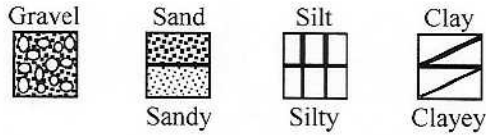


# SCIENCE ENGINEERING, LTD.

## GEOTECHNICAL, ENVIRONMENTAL, MATERIALS TESTING

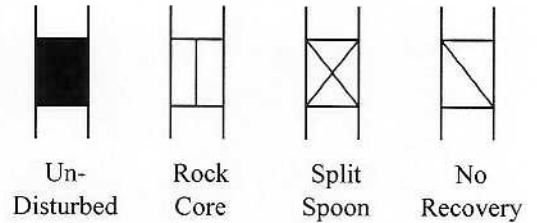
### KEY TO SOIL CLASSIFICATION AND SYMBOLS

#### SOIL TYPE



Predominant type shown heavy

#### SAMPLE TYPE

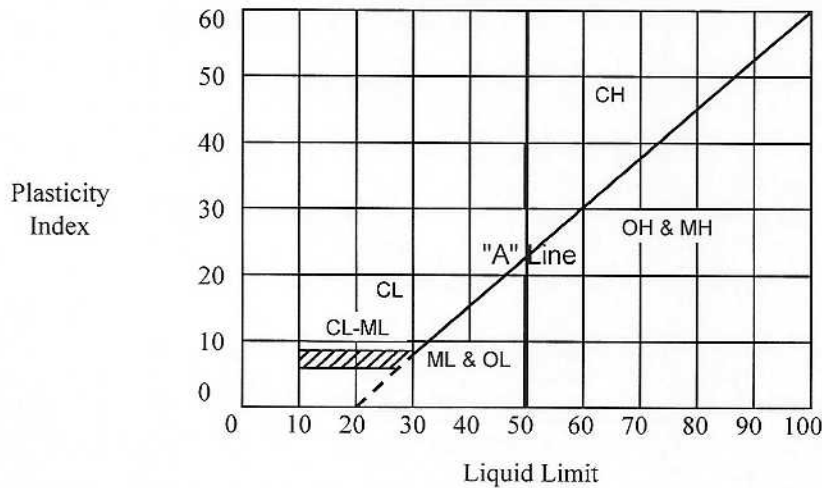


#### SOIL GRAIN SIZE

U.S. Standard Sieve

	6"	3"	3/4"	4	10	40	200		
Boulders	Cobbles	Gravel		Sand			Silt	Clay	
		Coarse	Fine	Coarse	Medium	Fine			
	152	76.2	19.1	4.76	2.00	0.420	0.074	0.002	(mm)

#### PLASTICITY CHART



#### CONSISTENCY OF COHESIVE SOILS

Penetration Resistance, blows per foot	Consistency	Cohesion TSF	Plasticity Index	Degree of Plasticity
0 - 2	Very Soft	0 - 0.125	0 - 5	None
2 - 4	Soft	0.125 - 0.25	5 - 10	Low
4 - 8	Firm	0.25 - 0.5	10 - 20	Moderate
8 - 15	Stiff	0.5 - 1.0	20 - 40	Plastic
15 - 30	Very Stiff	1.0 - 2.0	> 40	Highly Plastic
> 30	Hard	> 2.0		

#### RELATIVE DENSITY OF COHESIONLESS SOILS

Penetration Resistance, blows per foot	Relative Density
0 - 4	Very Loose
4 - 10	Loose
10 - 30	Medium Dense
30 - 50	Dense
> 50	Very Dense

## **SECTION 01 95 00 – DRAWINGS AND SUBMITTALS**

### **PART 1 - GENERAL**

#### **1.01 RELATED DOCUMENTS**

Drawings, Technical Specifications, TSUS construction specifications Division 1, TSUS uniform general conditions for construction contract, safety requirements of OSHA and prevailing building codes & city, state and county.

#### **1.02 SCHEDULE OF DRAWINGS & SUBMITTALS**

COV-1 COVER SHEET

### **ARCHITECTURAL**

C1.0 DEMOLITION SITE PLAN  
C1.1 SITE PLAN  
C1.2 TYPICAL DETAILS  
C1.3 SITE DETAILS  
C2 GRADING PLAN  
C3.1 PAVING PLAN  
C3.2 PAVING PLAN  
A0.1 FIRST FLOOR DEMOLITION PLAN  
A0.2 SECOND FLOOR DEMOLITION PLAN  
A1.1 FIRST FLOOR PLAN  
A1.2 SECOND FLOOR PLAN  
A1.3 FIRST FLOOR REFLECTED CEILING PLAN  
A1.4 SECOND FLOOR REFLECTED CEILING PLAN  
A2.0 ROOM SCHEDULE  
A2.1 DOOR SCHEDULE  
A2.2 DOOR AND WINDOW DETAILS  
A2.3 FIRST FLOOR PATTERN PLAN  
A2.4 SECOND FLOOR PATTERN PLAN  
A2.5 TYPICAL WINDOW FLASHING AND LINTEL DETAILS  
A2.6 INTERIOR FINISH ELEVATIONS  
A3.1 EXISTING EXTERIOR ELEVATIONS  
A3.2 NEW BUILDING EXTERIOR ELEVATIONS  
A3.3 CROSS SECTION VIEW  
A3.4 CROSS SECTION VIEW  
A3.5 CROSS SECTION VIEW  
A3.6 CROSS SECTION VIEW  
A4.1 WALL SECTION  
A4.2 WALL SECTION  
A4.3 WALL SECTION  
A4.4 DETAILS  
A4.5 WALL SECTION  
A4.6 WALL SECTION  
A5.1 ENLARGED PLANS  
A5.2 INTERIOR ELEVATIONS  
A5.3 DETAILS

A6.1	INTERIOR ELEVATIONS AT MEETING HALL
A6.2	MILLWORK DETAILS
A6.3	LADDER DETAILS
A7.0	DEMOLITION ROOF PLAN
A7.1	ROOF PLAN
A7.2	TYPICAL ROOF DETAILS
A8.1	PLAN DETAILS
A8.2	PLAN DETAILS

## **STRUCTURAL**

S1.1	GENERAL NOTES
S1.2	GENERAL NOTES
S2.1	FIRST FLOOR FRAMING PLAN
S2.2	SECTIONS AND DETAILS
S2.3	SECTIONS AND DETAILS
S2.4	SECOND FLOOR FRAMING PLAN
S2.5	HVAC PLATFORM PLAN
S3	ROOF FRAMING PLAN
S4	FOUNDATION PLAN
S5	SECTIONS
S6	SECTIONS AND ELEVATIONS

## **MECHANICAL, ELECTRICAL & PLUMBING**

M-1	HVAC FIRST FLOOR PLAN
M-1.1	HVAC SECOND FLOOR PLAN
M-2	DETAILS
M-3	SCHEDULES
M-4	MECHANICAL BUILDING SECTIONS
MEP-1	HVAC ROOF PLAN
E-1	POWER FIRST FLOOR PLAN
E-1.1	POWER SECOND FLOOR PLAN
E-2	LIGHTING FIRST FLOOR PLAN
E-2.1	LIGHTING SECOND FLOOR PLAN
E-3	SCHEDULES
P-1	PLUMBING FIRST FLOOR PLAN
P-1.1	PLUMBING SECOND FLOOR PLAN
P-2	DETAILS AND SCHEDULES



### 1.03 PROJECT SPECIFIC REQUIRED SUBMITTALS

Four (4) copies of the shop drawings will be required. The Engineer will return two (2) copies with approval and/or comments. A color sample shall be submitted in four (4) original units of which the Engineer will return one copy with selection. The following items are to be submitted for approval before the particular items are delivered to the site:

- A. Shop Drawings on:
  - 1. Reinforcing Steel
  - 2. Masonry Precast items
  - 3. Structural and Miscellaneous Steel
  - 4. Decking & joist
  - 5. Roofing & sheet metal
  - 6. Doors & Frames
  - 7. Cabinet Work
  - 8. Glass & Glazing
  - 9. Special glazing
  - 10. Toilet partitions
  - 11. Signage
  - 12. Pre-Manufactured parking canopy
  - 13. Duct Work & Duct Assembly
  - 14. Fire Sprinkler System
  - 15. Fire Alarm System
  - 16. EIF's
  - 17. Stair Handrails
  - 18. Stair Glass Panels
  - 19. Stair Components
  - 20. Duct work
  
- B. Submittals for approval and color selection:
  - 1. Concrete Mix
  - 2. Select Fill
  - 3. Installation procedure for structural & Misc. steel
  - 4. Brick & Block
  - 5. Acoustical Ceiling
  - 6. Doors & Frames
  - 7. Joint sealers
  - 8. Insulation
  - 9. Painting and wall coverings.
  - 10. Floor Covering
  - 11. Ceramic Tile
  - 12. Electrical Gear and Lighting & Devices
  - 13. HVAC Equipment and Controls
  - 14. Roofing
  - 15. Door Hardware
  - 16. Lighting Fixtures
  - 17. Plumbing Fixtures
  - 18. HVAC Equipment Controls

**1.04 ACTION ON SUBMITTALS**

- A. Where action is required, Engineer will review submittal, mark with "Action" and where possible, return as soon as possible.
- B. Where submittals are held for coordination, Contractor will be advised without delay.
- C. Return shop drawings and samples: Each submittal will be returned to the contractor stamped or marked by the Engineer as follows:  
**REVIEWED - NOTE ANY COMMENTS:** The contractor is advised that fabrication, manufacture, and/or construction may proceed provided the work is in compliance with Engineer's notations and the contract documents.  
**REVIEWED - CORRECT AND RESUBMIT:** The Contractor is advised that no work shall be fabricated, manufactured, and/or construction that the contractor shall make a resubmittal to the Engineer.

Copy of the Engineer's review stamp is shown below

**SIGMA ENGINEERS, INC.**  
**BEAUMONT, TEXAS**

OUR REVIEW OF THE SUBMITTAL IS ONLY FOR GENERAL CONFORMANCE WITH THE DESIGN CONCEPT AND GENERAL COMPLIANCE WITH THE INFORMATION GIVEN IN THE CONTRACT DOCUMENTS. OUR CHECKING DOES NOT INCLUDE REVIEW OF QUANTITIES, DIMENSIONS, WEIGHTS OR GAUGES, FABRICATION PROCESSES OR CONSTRUCTION METHOD. CONTRACTOR IS SOLELY RESPONSIBLE FOR CONFIRMING, VERIFYING AND CORRELATING DIMENSIONS AT THE JOB SITE; AND COORDINATION BETWEEN ALL TRADES AND SAFETY OF THE WORK. OUR CHECKING OF THESE DRAWINGS OR DATA SHALL NOT RELIEVE THE CONTRACTOR OF THE RESPONSIBILITY FOR DEVIATION FROM THE REQUIREMENTS OF THE CONTRACT DOCUMENTS NOR FOR ERRORS OR OMISSION IN THE SHOP DRAWINGS AND SUBMITTALS.

NO EXCEPTIONS TAKEN       EXCEPTIONS TAKEN  
 SUBMIT SPECIFIED ITEM       REVISE / RESUBMIT

FOR THE FIRM \_\_\_\_\_ DATE \_\_\_\_\_

- D. Do not order material, fabrication or equipment until submittal is returned stamped "Reviewed - Note any comments".
- E. Do not resubmit shop drawings unless Engineer so directs on his review stamp. If shop drawings are resubmitted without Engineer's instructions to do so, they will be returned to contractor without being rechecked and re-stamped by Engineer.
- F. Corrections: The contractor shall direct specific attention in writing or on resubmitted shop drawings to revisions other than the corrections requested by the Engineer on previous submissions.
- G. Possession: Unless specifically stated otherwise, any sample may be retained until completion of the work. Such samples will be used to compare with materials and work actually installed on the project.

**END OF SECTION 01 95 00**

## **SECTION 02 41 19 – SELECTIVE DEMOLITION**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

Drawings, Technical Specifications, TSUS construction specifications Division 1, TSUS uniform general conditions for construction contract, safety requirements of OSHA and prevailing building codes & city, state and county.

#### **1.2 DEFINITIONS**

- A. Remove: Detach items from existing construction and legally dispose of them off-site, unless indicated to be removed and salvaged or removed and reinstalled.
- B. Remove and Salvage: Detach items from existing construction, in a manner to prevent damage, and deliver to Owner ready for reuse.
- C. Remove and Reinstall: Detach items from existing construction, in a manner to prevent damage, prepare for reuse, and reinstall where indicated.
- D. Existing to Remain: Leave existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.
- E. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.

#### **1.3 MATERIALS OWNERSHIP**

- A. Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, demolished materials become Contractor's property; remove from Project site.
- B. Historic items, relics, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, antiques, and other items of interest or value to Owner that may be encountered during selective demolition remain Owner's property. Carefully remove and salvage each item or object in a manner to prevent damage and deliver promptly to Owner.
  - 1. Coordinate with Owner's historical adviser, who will establish special procedures for removal and salvage.

#### **1.4 PRE-DEMOLITION MEETING**

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

## 1.5 SUBMITTALS, GENERAL

- A. In accordance with the requirements of Division 01 section "Common Product Requirements," submit a complete listing of all manufacturers, products, model numbers, and designs proposed for use in the Work of this Section.
- B. Maintain all submittals at the Project Site for use during construction and for distribution to the Owner, through the Architect, upon completion of the Work.
- C. Submit only the items listed below to the Architect for review in accordance with Conditions of the Contract and Division 01 sections.

## 1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
- B. Engineering Survey: Submit engineering survey of condition of building.
- C. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property. Indicate proposed locations and construction of barriers.
- D. Schedule of Selective Demolition Activities: Indicate the following:
  - 1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's on-site operations are uninterrupted.
  - 2. Interruption of utility services. Indicate how long utility services will be interrupted.
  - 3. Coordination for shutoff, capping, and continuation of utility services.
  - 4. Use of elevator and stairs.
  - 5. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.
- E. Inventory: After selective demolition is complete, submit a list of items that have been removed and salvaged.
- F. Predemolition Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as damage caused by selective demolition operations. Submit before Work begins.
- G. Warranties: Documentation indicating that existing warranties are still in effect after completion of selective demolition.

## 1.7 CLOSEOUT SUBMITTALS

- A. Inventory: Submit a list of items that have been removed and salvaged.
- B. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.
- C. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

## 1.8 QUALITY ASSURANCE

- A. Demolition Firm Qualifications: Employ an experienced firm that has specialized in demolition work similar in material and extent to that indicated for this Project.
- B. Professional Engineer Qualifications: Comply with Division 01 Section by TSUS, "Quality Requirements."
- C. Refrigerant Recovery Technician Qualifications: Certified by an EPA-approved certification program.
- D. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- E. Standards: Comply with ANSI A10.6 and NFPA 241.

## 1.9 PROJECT CONDITIONS

- A. Owner will occupy portions of building immediately adjacent to remodeling procedures area. Conduct remodeling procedures so Owner's operations will not be disrupted. Provide not less than 72 hours' notice to Owner of activities that will affect Owner's operations.
- B. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities.
  - 1. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from authorities having jurisdiction.
- C. Owner assumes no responsibility for condition of areas to be selectively demolished.
  - 1. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
  - 2. Before selective demolition, Owner will remove the following items:
    - a. TBD
- D. Notify Engineer of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- E. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
  - 1. Hazardous materials will be removed by Owner before start of the Work.
  - 2. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.
- F. Hazardous Materials: Hazardous materials are present in building to be selectively demolished. A report on the presence of hazardous materials is on file for review and use. Examine report to become aware of locations where hazardous materials are present.
  - 1. Hazardous material remediation is specified elsewhere in the Contract Documents.
  - 2. Do not disturb hazardous materials or items suspected of containing hazardous materials except under procedures specified elsewhere in the Contract Documents.
  - 3. Owner will provide material safety data sheets for suspected hazardous materials that are known to be present in buildings and structures to be selectively demolished because of building operations or processes performed there.

- G. Historic Areas: Ensure the size of demolition spoils, hauling equipment, and other materials are of sizes that clear surfaces within historic spaces, areas, rooms, and openings, including temporary protection, by 12 inches or more.
- H. Storage or sale of removed items or materials on-site will not be permitted.
- I. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
  - 1. Maintain fire-protection facilities in service during selective demolition operations.

#### 1.10 COORDINATION

- A. Arrange selective demolition schedule so as not to interfere with Owner's operations.

#### 1.11 WARRANTY

- A. Existing Warranties: Remove, replace, relocate, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials and using approved contractors so as not to void existing warranties. Notify warrantor before proceeding. Existing warranties include the following:
  - 1. Roof.
- B. Notify warrantor on completion of selective demolition, and obtain documentation verifying that existing system has been inspected and warranty remains in effect. Submit documentation at Project closeout.

### **PART 2 - PRODUCTS**

- A. PERFORMANCE REQUIREMENTS
- B. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- C. Standards: Comply with ANSI/ASSE A10.6 and NFPA 241.

#### 2.2 REPAIR MATERIALS

- A. Use repair materials identical to existing materials.
  - 1. If identical materials are unavailable or cannot be used for exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.
  - 2. Use materials whose installed performance equals or surpasses that of existing materials.
- B. Comply with material and installation requirements specified in individual Specification Sections.

### **PART 3 - EXECUTION**

#### 3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped before starting demolition operations.

- B. Review Project Record Documents of existing construction or other existing condition and hazardous material information provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.
- C. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
- D. Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.
- E. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Engineer.
- F. Engage a professional engineer to perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective building demolition operations.
  - 1. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.
- G. Steel Tendons: Locate tensioned steel tendons and include recommendations for de-tensioning.
- H. Verify that hazardous materials have been remediated before proceeding with building demolition operations.
- I. Survey of Existing Conditions: Record existing conditions by use of measured drawings and preconstruction photographs.
  - 1. Comply with requirements specified in Division 01 Section "Photographic Documentation."
  - 2. Inventory and record the condition of items to be removed and salvaged. Provide photographs or video of conditions that might be misconstrued as damage caused by salvage operations.
  - 3. Before selective demolition or removal of existing building elements that will be reproduced or duplicated in final Work, make permanent record of measurements, materials, and construction details required to make exact reproduction.

### 3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.
- B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utility services and mechanical/electrical systems serving areas to be selectively demolished.
  - 1. Owner will arrange to shut off indicated services/systems when requested by Contractor.
  - 2. Arrange to shut off utilities with utility companies.
  - 3. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
  - 4. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated on Drawings to be removed.
    - a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.

- b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material and leave in place.
  - c. Eliminate all plumbing piping “dead legs”
  - d. Equipment to Be Removed: Disconnect and cap services and remove equipment.
  - e. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
  - f. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
  - g. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
  - h. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material and leave in place.
- C. Utility Requirements: Refer to Facilities Services Subgroup Divisions for shutting off, disconnecting, removing, and sealing or capping utilities. Do not start selective demolition work until utility disconnecting and sealing have been completed and verified in writing.

### 3.3 PREPARATION

- A. Dangerous Materials: Drain, purge, or otherwise remove, collect, and dispose of chemicals, gases, explosives, acids, flammables, or other dangerous materials before proceeding with selective demolition operations.
- B. Pest Control: Employ a certified, licensed exterminator to treat building and to control rodents and vermin before and during selective demolition operations.
- C. Refrigerant: Before starting demolition, remove refrigerant from mechanical equipment according to 40 CFR 82 and regulations of authorities having jurisdiction.
- D. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
  - 1. Do not close or obstruct streets, walks, walkways, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.
  - 2. Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction.
  - 3. Protect existing site improvements, appurtenances, and landscaping to remain.
  - 4. Erect a plainly visible fence around drip line of individual trees or around perimeter drip line of groups of trees to remain.
- E. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
  - 1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
  - 2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
  - 3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.



4. Cover and protect furniture, furnishings, and equipment that have not been removed.
  5. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Division 01 Section "Temporary Facilities and Controls."
- F. Temporary Enclosures: Provide temporary enclosures for protection of existing building and 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 not complete, provide insulated temporary enclosures. Coordinate enclosure with ventilating and material drying or curing requirements to avoid dangerous conditions and effects.
- G. Temporary Shoring: Provide and maintain interior and exterior shoring, bracing, or structural support to preserve stability and prevent movement, settlement, or collapse of construction to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
1. Strengthen or add new supports when required during progress of selective demolition.
  2. Remove temporary barricades and protections where hazards no longer exist.

### 3.4 SELECTIVE DEMOLITION

- A. Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
  2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
  3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
  4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
  5. Maintain fire watch during and for at least 2 hours after flame-cutting operations.
  6. Maintain adequate ventilation when using cutting torches.
  7. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
  8. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
  9. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
  10. Dispose of demolished items and materials promptly. Comply with requirements in Division 01 Section "Construction Waste Management and Disposal."
- B. Existing Facilities: Comply with building manager's requirements for using and protecting elevators, stairs, walkways, loading docks, building entries, and other building facilities during selective demolition operations.

- C. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
- D. Work in Historic Areas: Selective demolition may be performed only in areas of Project that are not designated as historic. In historic spaces, areas, and rooms, or on historic surfaces, the terms "demolish" or "remove" mean historic "removal" or "dismantling" as specified in Division 02 section "Historic Removal and Dismantling."
- E. Removed and Salvaged Items: Comply with the following:
  1. Clean salvaged items.
  2. Pack or crate items after cleaning. Identify contents of containers.
  3. Store items in a secure area until delivery to Owner.
  4. Transport items to Owner's storage area on-site.
  5. Protect items from damage during transport and storage.
- F. Removed and Reinstalled Items:
  1. Clean and repair items to functional condition adequate for intended reuse.
  2. Pack or crate items after cleaning and repairing. Identify contents of containers.
  3. Protect items from damage during transport and storage.
  4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.
- G. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

### 3.5 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

- A. Concrete: Demolish in small sections. Using power-driven saw, cut concrete to a depth of at least one inch at junctures with construction to remain. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete. Neatly trim openings to dimensions indicated.
- B. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals using power-driven saw, and then remove concrete between saw cuts.
- C. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, and then remove masonry between saw cuts.
- D. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, and then break up and remove.
- E. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI's "Recommended Work Practices for the Removal of Resilient Floor Coverings. Do not use methods requiring solvent-based adhesive strippers.
- F. Air-Conditioning Equipment: Remove equipment without releasing refrigerants.
- G. Roofing: Remove no more existing roofing than what can be covered in one day by new roofing and so that building interior remains watertight and weathertight.
  1. Remove existing roof membrane, flashings, copings, and roof accessories.
  2. Remove existing roofing system down to substrate.

### 3.6 PATCHING AND REPAIRS

- A. Promptly repair damage to adjacent construction caused by selective demolition operations.
- B. Patching: Comply with Division 01 Section "Cutting and Patching."

### 3.7 DISPOSAL OF DEMOLISHED MATERIALS

- A. Remove demolition waste materials from Project site and dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction.
  - 1. Do not allow demolished materials to accumulate on-site.
  - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
  - 3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
  - 4. Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."
- B. Burning: Do not burn demolished materials.

### 3.8 CLEANING

- A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

**END OF SECTION 02 41 19**

## **SECTION 02 50 00 - SITE REMEDIATION**

### **PART 1 - GENERAL**

#### **1.01 RELATED DOCUMENTS**

Drawings, Technical Specifications, TSUS construction specifications Division 1, TSUS uniform general conditions for construction contract, safety requirements of OSHA and prevailing building codes & city, state and county.

#### **1.02 DESCRIPTION OF WORK**

Site remediation includes, but is not limited to:

- A. Protection of trees to remain.
- B. Removal of trees and other vegetation.
- C. Stripping topsoil.
- D. Clearing and grubbing.

#### **1.03 JOB CONDITIONS**

- A. Protect trees against unnecessary cutting, breaking or skinning of roots, skinning or bruising of bark.
- B. Provide 4'0" high lumber barricade 2'0" from face of all present trees shown to remain.
- C. Do not smother trees by stockpiling construction or excavated materials within drip lines.
- D. Eliminate unnecessary foot or vehicular traffic within drip line of trees.
- E. Do not park vehicles within drip line.
- F. Provide temporary guards to protect trees to be left standing.
- G. Coat cut faces of roots 1-1/2" or larger with emulsified asphalt or other acceptable coating.
- H. Temporarily cover exposed roots with wet burlap and cover with earth as soon as possible.

### **PART 2- EXECUTION**

#### **2.01 SITE CLEARING**

- A. General
  - 1. Remove vegetation or obstructions interfering with installation of new construction.
  - 2. Carefully cut roots and branches of trees indicated to be left standing.
- B. Fill Material:
  - 1. Fill depressions caused by clearing work with soil having plasticity index of 12 maximum.
  - 2. Place fill material in horizontal layers not to exceed 8" loose depth.
  - 3. Compact fill to density equal to original ground.
  - 4. See mechanical, electrical and plumbing drawings and specifications for removal of items under those sections.

#### **2.02 DISPOSAL OF MATERIALS**

- A. Burning is not permitted on Owner's property.
- B. Remove waste material from site.

**END OF SECTION 02 50 00**

## **SECTION 02 50 50 - SHORING AND BRACING**

### **PART 1 - GENERAL**

#### **1.01 RELATED DOCUMENTS**

Drawings, Technical Specifications, TSUS construction specifications Division 1, TSUS uniform general conditions for construction contract, safety requirements of OSHA and prevailing building codes & city, state and county.

#### **1.02 DESCRIPTION OF WORK**

- A. Extent of shoring and bracing is indicated on drawings and includes, but is not limited to, the following:
  - 1. Shoring and bracing necessary to protect existing buildings, streets, walks, utilities and other improvements and excavation against loss of ground or caving embankments.
  - 2. Maintenance of shoring and bracing.
  - 3. Removal of shoring and bracing.
- B. Building excavation is specified in another Division 2 section.

#### **1.03 QUALITY ASSURANCE**

- A. Assign supervision of shoring and bracing to a qualified foundation consultant.
- B. Comply with local codes and ordinances of governing authorities having jurisdiction.
- C. Provide design drawings for shoring and bracing prepared and sealed by a Registered Professional Engineer.

#### **1.04 JOB CONDITIONS**

- A. Before starting work, check and verify governing dimensions and elevations.
- B. Take photographs, as directed, recording any prior settlement, or cracking of structures, pavements and other improvements.
- C. Prepare a list of such damages verified by dated photographs and signed by persons conducting investigation.
- D. Survey adjacent structures establishing exact elevation at fixed points to act as benchmarks.
- E. Locate datum level used to establish benchmark at sufficient distance so as not to be affected by movement resulting from excavation operations.
- F. Resurvey benchmarks weekly and maintain accurate log of elevations for comparison with original elevations.
- G. Notify Engineer if changes in elevation occur, or if cracks, sags or other damage is evident.

#### **1.05 UTILITIES**

Protect existing sewer, water, gas, electricity, and other utility services.

## **PART 2 - PRODUCTS**

### **2.01 MATERIALS**

- A. Provide suitable shoring and bracing materials which will support loads imposed.
- B. Materials need not be new but should be in serviceable condition.

## **PART 3 - EXECUTION**

### **3.01 SHORING**

- A. Protect the site from caving and unacceptable soil movement.
- B. Locate system of shoring to clear permanent construction and to permit necessary operations to be performed.
- C. Provide shoring system adequately anchored and braced to resist earth movement and hydrostatic pressures.
- D. Shoring system retaining earth on which the support or stability of existing structures is dependent must be removed only after back filling operation is performed.

### **3.02 BRACING**

- A. Locate bracing to allow construction of permanent work.
- B. Do not relocate bracing until new bracing is in place.
- C. Install internal bracing to prevent spreading or distortion of braced frames.

### **3.03 REMOVAL**

- A. Remove shoring, sheeting and bracing in stages to avoid disturbance of underlying soils and damage to structures, pavements, and utilities.
- B. Repair or replace adjacent work damaged or displaced through the installation or removal of shoring and bracing.

**END OF SECTION 02 50 50**

## **SECTION 03 10 00 - CONCRETE FORMWORK AND ACCESSORIES**

### **PART 1 - GENERAL**

#### **1.01 RELATED DOCUMENTS**

Drawings, Technical Specifications, TSUS construction specifications Division 1, TSUS uniform general conditions for construction contract, safety requirements of OSHA and prevailing building codes & city, state and county.

#### **1.02 DESCRIPTION OF WORK**

- A. Erect formwork to sizes and shapes to produce concrete work shown on plans.
- B. Cooperate with other crafts having items requiring embedment in concrete.

### **PART 2 - PRODUCTS**

#### **2.01 FORMS**

- A. Wood: Use selected material to obtain required finishes.
- B. Metal: Free of warps, defect, rust, scale and other imperfections that may mar the finish of concrete.
- C. Earth forms upon approval by Engineer only.

#### **2.02 ACCESSORIES**

- A. Carton Forms
  - 1. Heavy duty corrugated fiberboard impregnated with asphalt.
  - 2. Provide with end closures.
  - 3. Store, assemble, place and protect as directed by manufacturer.
  - 4. See Drawings for size and location.
- B. Form Coating: A.C. Horn's "Formfilm" or equal.
- C. Form Ties:
  - 1. Steel with break-back points of 1" or more.
  - 2. Strength to withstand concrete form pressures.
  - 3. Removable type for exposed surfaces.
- D. Chamfers: Wood, metal, PVC or rubber fabricated to produce uniform smooth lines and tight joints.
- E. Control Joints:
  - 1. Anchorite - Jahn Joint
  - 2. Medco - Screed Joint
  - 3. Greenstreak - Screed Joint
- F. Expansion Joints - Paving and Walks - 1/2" Burke Pre-molded Asphalt fiber with Greenstreak 941-1/2" expansion board cap. Insert 3/8" round reinforcing bar into cap void (temporary) to hold alignment until concrete takes initial set.

## **PART 3 - EXECUTION**

### **3.01 FORM DESIGN AND CONSTRUCTION**

- A. Construct to slopes, lines and dimensions shown.
- B. Erect plumb, straight and sufficiently tight to prevent leakage.
- C. Forms, ties, shoring and bracing designed and construction to safely withstand the weight and pressure of the fresh concrete, construction loads, wind loads, etc., without deflection or movement.
- D. Design and construction of formwork is the sole responsibility of Contractor.
- E. Construct forms for beams, girders, lintels so that sides are removable without disturbing bottom of form or its supports.
- F. Apply form coating prior to placement of reinforcing.
- G. Provide access openings to clean and inspect forms and reinforcement.
- H. Form accurately openings, depressions, chases, etc., as required by the drawings or other trades.
- I. Clean form surfaces thoroughly just before placing concrete.

### **3.02 INSTALLATION OF EMBEDDED ITEMS**

- A. Place and secure all anchors, inserts, hangers, sleeves, bolts, etc.
- B. Use wood templates for placing structural steel anchor bolts.
- C. Set small bolts and anchorage items in fresh concrete where possible.
- D. Cooperate with other trades having items requiring embedment in concrete.
- E. Place conduits as near the center of slabs as possible.
- F. Do not encase aluminum conduit in concrete.
- G. Place items so that they do not interfere with structure.

### **3.03 CONSTRUCTION JOINT (BEAMS)**

- A. Locate at center of spans or as shown on drawings.
- B. Extend reinforcing through construction joint.
- C. Place 4, 6" x 3'0" additional bars diagonally across joint.
- D. Provide 2, 2 x 4 formed vertical keys in beam.
- E. Form joints with bulkheads fitted to reinforcement to prevent leakage.

### **3.04 EXPANSION JOINTS**

- A. Provide where walks and other slabs abut structural members.
- B. Provide in walks, drives and parking areas.
- C. Provide #4 x 2'-0" slip dowel reinforcing as follows:
  - 1. Three (3) in curbs.
  - 2. Spaced at 18" on center in walk.
  - 3. Spaced at 12" on center in drives and parking areas.
- D. After concrete has taken full set, expansion cap to be removed and void filled with sealant.
- E. Expansion and Contraction Joints
  - 1. Expansion and control joints shall be located where shown on drawings.
  - 2. Joint Fillers:
    - a. Use Key Load transfer boards as manufactured by Marine Lumber Co., of Houston, Texas with 1" removable top strip and 3/4" diameter x 20" long smooth steel dowels at 22" on center. (Verify dowel length on drawings).



- b. Remove top strip and seal joint with gray "Sonneborn" SL1 self-leveling horizontal joint sealant.
- c. Installation to be in accordance with manufacturers printed instructions.

**3.05 CONSTRUCTION JOINTS (SLABS)**

- A. Provide control joints for each 2500 square feet of slab area maximum; 50 feet maximum between joints or as shown on plans.
- B. Anchor with #4 x 24" bars or manufacturers approved stakes at 2'-6" on center maximum.
- C. Provide #4 x 2'-0" slip dowels
- D. See drawings for other specific locations.
- E. Not required for exterior drives and paved areas.

**3.06 CONTROL JOINTS**

- A. Provide at 5'-0" O.C. maximum in walks.
- B. Provide as shown on plans in drives.

**3.07 SCREEDS FOR SLABS ON GRADE**

- A. Use of pin screed is prohibited.
- B. Provide continuous pipe screed mounted on steel chairs or wood stakes, if wood stakes are used remove from concrete after concrete has been leveled.

**3.08 REMOVAL OF FORMS**

- A. Do not remove forms from columns, walls and beams for at least 48 hours after placement of concrete.
- B. Do not remove soffit forms of beams and slabs for at least 7 days after placement of concrete, then re-shore.
- C. Time and safe practice of removing forms, shoring and re-shoring is the responsibility of the Contractor.
- D. Remove forms in a manner so as not to damage concrete surfaces or corners.
- E. Remove forms from concrete below grade.

**END OF SECTION 03 10 00**

## **SECTION 03 20 00 - CONCRETE REINFORCING**

### **PART 1 - GENERAL**

#### **1.01 RELATED DOCUMENTS**

Drawings, Technical Specifications, TSUS construction specifications Division 1, TSUS uniform general conditions for construction contract, safety requirements of OSHA and prevailing building codes & city, state and county.

#### **1.02 DETAILING AND FABRICATION**

Conform to the following:

- A. American Concrete Institute Bulletins ACI 315 and 318.
- B. American Concrete Institute Detailing Manual.
- C. Details and notes on drawings.
- D. Project Manual and Shop Drawings.

#### **1.03 SHOP DRAWINGS**

- A. Submit five (5) copies showing lengths, bending, placing, and all accessories.
- B. Obtain the Engineers' review before proceeding with work.

### **PART 2 - PRODUCTS**

#### **2.01 STEEL BARS**

- A. New deformed billet steel, ASTM designation A-305.
- B. Clean, free of rust, scale, or oil.
- C. 1/4" diameter smooth: ASTM designation A-306.
- D. No. 3, ASTM designation A615 grade 70.
- E. No. 4 and larger, ASTM designation A615 grade 60.
- F. Expansion joint dowels: 3/4" diameter plain steel bars with sawn end and endocarp.
- G. At the Contractor's option, bars for slabs on grade, walks, drives and curb: Grade 40.

#### **2.02 WELDED WIRE FABRIC**

- A. ASTM designation A185.
- B. Size and spacing as shown on drawings.
- C. Wire mesh for sidewalks to be 6 x 6 W6 x W6.

#### **2.03 STEEL ACCESSORIES**

- A. Standard bar chairs and spacers for all slabs and beams above grade, galvanized where soffit is exposed in the completed building.
- B. Precast concrete supports for bottom bars in concrete on grade, including drives and parking, approximately 3" x 3" x height required with casts in tie wire.
- C. Supports for top reinforcing steel in slabs on grade:
  - 1. 3" x 6" x 20-gauge galvanized bar chairs.
  - 2. Depth of chair to provide 1" concrete coverage.
- D. Tie Wire: 16-gauge annealed iron wire.

- E. Other accessories in accordance with the American Concrete Institute detailing manual.
- F. Bricks or broken concrete are to be not permitted to support reinforcing in any concrete work.

### **PART 3 - EXECUTION**

#### **3.01 PLACEMENT OF REINFORCING STEEL**

- A. Place to obtain at least minimum coverage for concrete protection.
- B. Arrange, space, and secure tie bars and bar supports to hold reinforcement in position during placement of concrete.
- C. Clean reinforcement of concrete splash from previous castings.
- D. Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars".

#### **3.02 PLACEMENT OF WELDED WIRE FABRIC**

- A. Place continuously in areas shown on drawings.
- B. Extent to within 4" of concrete edges.
- C. Lap not less than spacing of wires parallel to lap.
- D. Position for proper concrete coverage.
- E. Offset end laps in adjacent widths.
- F. Lace all splices with wire.
- G. Install in toppings as required on drawings including fill for metal stair pans.

#### **3.03 MASONRY LINTELS**

Provide reinforcing steel for lintels in concrete masonry walls as scheduled on drawings.

**END OF SECTION 03 20 00**

## **SECTION 03 30 00 - CAST-IN-PLACE CONCRETE**

### **PART 1 - GENERAL**

#### **1.01 RELATED DOCUMENTS**

Drawings, Technical Specifications, TSUS construction specifications Division 1, TSUS uniform general conditions for construction contract, safety requirements of OSHA and prevailing building codes & city, state and county.

#### **1.02 DESCRIPTION OF WORK**

- A. Extent of concrete work shown on drawings.
- B. General lightweight structural concrete will be used for upper floor and roof slabs.

#### **1.03 QUALITY CONTROL**

- A. Comply with provisions of American Concrete Institute 301 "Specifications for Structural Concrete for Buildings".
- B. Employ, at Contractor's expense, a testing laboratory acceptable to Engineer to perform material evaluation tests and to design concrete mixes.
- C. Retesting of rejected materials and installed work to be at Contractor's expense.

#### **1.04 SUBMITTALS**

- A. Submit manufacturer's product data with application and installation instruction for materials, including admixtures, patching compounds, curing compounds and others as requested by Engineer.
- B. Submit laboratory test reports for concrete materials and mix design test as specified.

### **PART 2 - PRODUCTS**

#### **2.01 CONCRETE MATERIALS**

- A. Portland Cement:
  - 1. ASTM Designation C150, Type 1.
  - 2. Use one brand of cement throughout project.
- B. Aggregates:
  - 1. ASTM Designation C33 (normal weight).
  - 2. Provide aggregates from a single source for exposed concrete.
  - 3. Fine aggregates: Clean, hard, natural sand.
  - 4. Course aggregates: Hard, durable, uncoated and maximum size in accordance with the following:
    - a) 100% passing 1-1/2" screen, 60% passing 1" screen for columns, walls, beams and slabs.
    - b) Graded 3/8" down for concrete topping.
  - 5. ASTM Designation C330 (lightweight).
- C. Water: Potable

- D. Admixtures:
  - 1. Pozzolith (Retarder-Accelerator) Densifier as manufactured by Masterbuilders.
  - 2. Air Entraining Agent: Neutralized Vinsol Resin Solution conforming to ASTM Designation C260.
- E. Curing Agent: Hydrocide as manufactured by Sonneborn Building Products.
- F. Membrane: 6 mil. polyethylene and tape.

## 2.02 MIXING AND PROPORTIONING

- A. Quality:
  - 1. Footings and beams:
    - a) 3000 pos. compressive strength concrete.
    - b) 480 pounds of cement per cubic yard minimum.
    - c) 0.58 water/cement ratio minimum.
  - 2. All other concrete:
    - a) 2500 pos. compressive strength concrete.
    - b) 425 pounds of cement per cubic yard minimum.
    - c) 0.65 water/cement ratio minimum.
- B. Admixtures:
  - 1. (Retarder-Accelerator) Densifier for all concrete as required by weather.
  - 2. Air-entrainer admixture at rate that concrete at point of placement has air content not less than 2% or more than 4% air.
  - 3. Slump limits:
    - a) Ramps and sloping surfaces: not more than 3".
    - b) Foundation systems: not less than 1" and more than 3".
    - c) All other concrete: not less than 2" and more than 4".

## 2.03 CONCRETE MIXING

- A. Ready Mixed Concrete:
  - 1. Conform to ASTM Designation C-94.
  - 2. Add no water while in transit.
  - 3. When air temperature is between 85° F (30° C) and 90 ° F (32° C) reduce mixing and delivery time from 1-1/2 hours to 75 minutes.
  - 4. When air temperature is above 90 ° F (32° C) reducing mixing and delivery time to 60 minutes.

## PART 3 - EXECUTION

### 3.01 CONCRETE PLACEMENT

- A. General:
  - 1. Notify Engineer and testing laboratory at least 24 hours prior to date of concrete placement.
  - 2. Do not place concrete during rain or when temperature is 45° F or less.
  - 3. Make suitable arrangements for temporary heat if freezing conditions occur during curing period.
  - 4. Protect adjacent areas and surfaces from concrete splatter.
- B. Handling Concrete:
  - 1. Use methods that cause no separation or loss of ingredients.
  - 2. If wheeled carriers are used, provide adequate runways which rest on the structure or fill and in no case rest on reinforcing or steel centering.

- C. Placing Concrete:
1. Use methods that cause no separation of concrete.
  2. Place in uniform layers, approximately level and do not exceed 18" vertically.
  3. Use mechanical vibrators with sufficient duration and intensity to consolidate and densify formed surfaces.
  4. Produce uniform, even dense surfaces free of voids, honeycombs, air pockets, unscheduled joints and suitable for type finish indicated.
  5. Place concrete for drilled footings immediately after excavation on undisturbed soil.
  6. Place footings and piers monolithically.
  7. Place concrete slab in continuous operation within limits of construction or control joints.
  8. Bring slabs to proper levels with use of steel trussed straightedge.
  9. Use full float and darbies to smooth surface, free of humps and hollows.
  10. Do not use 2x wood straightedges to screed off slabs.
  11. Do not pin type screeds (see Section 03 10 00).

### 3.02 FINISHES OF FORMED SURFACES

- A. Rough Form Finish: For formed surfaces not exposed to view:
1. Surface having texture imparted by form facing material.
  2. Repair and patch tie holes and defective area.
  3. Fins and other projections exceeding 1/4" in height rubbed down or chipped off.
- B. Smooth Form Finish: For formed surfaces exposed to view or that are covered with a coating such as waterproofing, damp proofing, paint, etc.:
1. Surface obtained with selected form facing material arranged orderly and symmetrically with a minimum of seams.
  2. Repair and patch defective areas with fins or other projections completely removed and smoothed.
- C. Smooth Rubbed Finish:
1. Rub exposed surfaces with carborundum stone.
  2. Rub within 24 hours of form removal.
  3. Moisten and rub surfaces to remove defects to produce a uniform color and texture.
  4. Do not apply cement grout other than that created by the rubbing process.
- D. Grout Cleaned Finish: Apply this finish to surfaces which have received smooth form finish.
1. Combine one-part cement (a blend of standard portland and white portland cement so that final color of dry grout will match adjacent surfaces) and 1-1/2 parts fine sand by volume, mix with water to consistency of thick paint.
  2. Thoroughly wet surfaces and apply grout to coat surfaces and fill small holes.
  3. Remove excess grout by scraping and rubbing with clean burlap.
  4. Keep damp by fog spray for 36 hours after rubbing.

### 3.03 MONOLITHIC SLAB FINISHES

- A. Scratch Finish: For slab surfaces that are to receive topping, mud set tile, cement terrazzo, etc.
1. Plane surface to a tolerance not exceeding 1/4" in 2'.

2. Slope surfaces to drains where required.
3. After leveling, roughen surface before final set with rake.
- B. Trowel Finish: For slab surface exposed to view or receiving coverings or paint:
  1. Machine trowel to extent practical.
  2. Hand trowel to produce hard, dense, smooth surface free of trowel marks.
  3. Surface plane tolerance not exceeding 1/8" in 10' when tested with 10' straight edge.
  4. Grind smooth defects which would telegraph through applied floor covering system.
- C. Non-Slip Broom Finish: For walks, ramps and exterior areas noted:
  1. Immediately after trowel finishes, slightly roughen surface with fiber bristle broom.
  2. Broom perpendicular to main traffic route.
- D. Non-slip Aggregate Finish: For steps, landings, ramps and areas noted:
  1. After float finish and before starting trowel finish, spread 25 pounds of dampened non-slip aggregate per 100 square feet.
  2. Tamp aggregate flush with surface using steel trowel.
  3. Apply steel trowel finish.
  4. After curing, lightly work surface with a steel wire brush; or an abrasive stone, and water to expose non-slip aggregate.
- E. Chemical-Hardener Finish: For all interior concrete floors except as noted otherwise:
  1. Apply chemical hardener after complete curing and drying of the concrete floor.
  2. Dilute hardener with water and apply to floor in 3 coats allowing 24 hours drying between coats:
    - a) First coat: 1/3 strength.
    - b) Second coat: 1/2 strength.
    - c) Third coat: 2/3 strength.
  3. Apply coats evenly.

### **3.04 CONCRETE CURING AND PROTECTION**

- A. General:
  1. Start initial curing as soon as free water has disappeared from concrete surface.
  2. Keep moist continuously for not less than 72 hours.
  3. Continue curing for at least 7 days in accordance with ACI 301 procedures.
- B. Curing Methods:
  1. Moisture Cover Curing:
    - a) Cover concrete with moisture retaining cover.
    - b) Place in widest practicable width.
    - c) Lap side and end joints at least 3" and seal with waterproof tape or adhesive.
    - d) Repair any holes or tears during curing period.
  2. Membrane Curing:
    - a) Apply membrane-forming curing compound as soon as finishing operations are complete.
    - b) Apply in accordance with manufacturer's directions.
    - c) Use of chemical agent by approval of Engineer. (Do not use at thin set ceramic tile areas.)

### **3.05 CONCRETE SURFACE REPAIRS**

- A. Repair and patch defective areas immediately after removing forms.
- B. Dampen and brush coat defective areas with neat cement grout.
- C. Blend white and standard portland cement so that when dry patch will match color of surrounding concrete.
- D. Use epoxy-based mortar for structural repairs where directed by Engineer.

### **3.06 QUALITY CONTROL TESTING**

- A. Slump: ASTM C-143, one test for each set of compressive strength test specimens.
- B. Compression Test:
  - 1. Three (3) cylinders for each twenty (20) cubic yards of concrete.
  - 2. Test one (1) cylinder at seven (7) days, one (1) cylinder at twenty-eight (28) days and retain one (1) cylinder for later testing if required.
- C. Send copies of test results to the Engineer.
- D. Test reports to include the following:
  - 1. Project identification name.
  - 2. Date of concrete placement.
  - 3. Name of testing service.
  - 5. Concrete type and class.
  - 6. Location of concrete batch in structure.
  - 7. Design compressive strength of concrete.
  - 8. Concrete mix proportions and materials.
  - 9. Compressive breaking strength and type of break for both seven (7) days and twenty-eight (28) days.
- E. Additional tests of in-place concrete as deemed necessary by Engineer.

**END OF SECTION 03 30 00**



## **SECTION 04 81 00 - UNIT MASONRY**

### **PART 1 - GENERAL**

#### **1.01 RELATED DOCUMENTS**

Drawings, Technical Specifications, TSUS construction specifications Division 1, TSUS uniform general conditions for construction contract, safety requirements of OSHA and prevailing building codes & city, state and county.

#### **1.02 DESCRIPTION OF WORK**

Extent of each type of masonry work is indicated on drawings and schedule.

#### **1.03 QUALITY ASSURANCE**

- A. Samples: Provide the following:
  - 1. All masonry units: Five (5) samples each type showing the variations in color and texture.
  - 2. Reinforcement, ties, anchors, etc.: Two (2) samples each.
- B. Panel:
  - 1. Erect 3' high x 4' wide panel of each type masonry unit showing texture, mortar, joint tooling, etc.
  - 2. Erect where directed and preserve until final masonry work is reviewed.

#### **1.04 JOB CONDITIONS**

- A. At end of each day or shut down period, cover tops of walls, exposed to weather with non-staining waterproof covering.
- B. Extend cover a minimum of 24 inches down both sides of wall and hold securely in place.
- C. Do not place any masonry work during freezing weather unless approved methods to prevent freezing of materials is used.
- D. Do not exceed limit of compressive strength of semi-plastic mortar with wall height progress.

#### **1.05 STORAGE OF MATERIALS**

- A. Load, transport, unload and handle masonry units by methods to prevent damage.
- B. Store masonry units on raised platforms clear of ground
- C. Store cement and other materials subject to damage from the elements under cover in a dry place.
- D. Discard any damaged material.

### **PART 2 - PRODUCTS**

#### **2.01 MASONRY UNITS**

- A. General: Obtain masonry units from one manufacturer of uniform texture and color for each kind required, for each continuous area and visually related areas.
- B. Face Brick:
  - 1. Shall be per drawings.

- C. Concrete Masonry Units:
  - 1. Lightweight type complying with ASTM Designation C-90, Grade U-1.
  - 2. Manufactured from lightweight concrete aggregate conforming with ASTM Designation C-331.
  - 3. Nominal face size 8" x 16" and thickness as shown on drawings.
  - 4. Autoclave cured with high pressure steam for a minimum of 8 hours.
- D. Mortar Materials:
  - 1. Portland cement: Type "M" ASTM Designation C-150 Type 1.
  - 2. Lime: Magnolia Type "S" Lime or lump lime as made by U.S. Gypsum Co., conforming to ASTM Designation C-207.
  - 3. Stainless Cement: ASTM Designation C-150, Type 1.
  - 4. Sand: ASTM Designation C-144.
  - 5. Water: Potable.
- E. Accessories:
  - 1. Masonry wall reinforcing:
    - a) Welded wire units fabricated in lengths of not less than 10' with matching tees and corners.
    - b) Cold drawn steel wire conforming to ASTM Designation A-82.
    - c) Deformed side bars and plain cross rods.
    - d) Width 1-1/2" to 2" less than thickness of masonry unit.
    - e) Ladder type: Pair 9-gauge side bars and 9-gauge cross rods at 16" on center.
    - f) Truss type: Pair 9-gauge side bars and 9-gauge continuous diagonal cross rods at 16" on center.
    - g) Provide units with adjustable 2-piece rectangular ties where horizontal joints of facing wythe do not align with back-up joints.
    - h) For interior walls fabricate from mill galvanized wire.
    - i) For exterior wall hot-dip galvanized after fabrication with 1.5 oz. zinc coating, ASTM A 153, Class B2.
  - 2. Wall Ties:
    - a) Fabricate from 3/16" cold-drawn steel wire ASTM A82 and length required for proper embedment in wythes of masonry.
    - b) For solid masonry units provide ties with ends bent to 90-degree angles to form hook 2" long.
    - c) Where horizontal joints in wythes do not align, use two (2) piece ties.
  - 3. Flexible Anchors: Where masonry is anchored to structural steel, provide two (2) piece anchor which allow horizontal and vertical movement of masonry but will provide lateral restraint.
  - 4. Flashing:
    - a) Provide concealed flashings shown to be built into masonry.
    - b) Virgin polyvinyl chloride formed into uniform flexible sheets not less than 20 mils thick and black in color.
  - 5. Expansion Joint Filler: Pre-molded, compressible elastic fillers of foam rubber, neoprene, or extruded plastic.

- F. Mortar and Grout Mixes:
  - 1. Do not use calcium chloride in mortar or grout.
  - 2. Mortar for Unit Masonry comply with ASTM C270, Proportion Specifications, except limit materials to those specified herein and limit cement/lime ratio as follows:
    - a) Type N: Over 1/2 to 1 parts lime per 1-part Portland cement.
    - b) Masonry Mix: One (1) part approved masonry mix with type "S" lime to three (3) parts sand.
    - c) Color to be selected by the engineer.

## **PART 3 - EXECUTION**

### **3.01 INSTALLATION GENERAL**

- A. Build masonry construction to full thickness shown, except build single wythe walls to actual thickness of masonry units shown.
- B. Build chases and recesses as required for work of other trades.
- C. Provide not less than 8" of masonry between chase or recesses.
- D. Cut masonry units with motor-driven saw to produce clean, sharp, unchipped edges.
- E. Wet clay brick having ASTM C67 absorption rates greater than 0.025 oz. per square inch per minute.
- F. Do not wet concrete masonry units.
- G. Layout walls for accurate spacing of surface bond patterns, with uniform joint widths and to locate openings movement type joints, returns and offsets.
- H. Avoid use of less than half size units.
- I. Lay-up walls plumb and true and with courses level accurately spaced and coordinated with other work.
- J. Stopping and resuming work:
  - 1. Rack back 1/2 masonry unit length in each course, do not tooth.
  - 2. Clean, roughen and lightly wet exposed surfaces (except concrete masonry) so as to obtain the best possible bond with new work.
  - 3. Remove loose units and mortar.
- K. Build in items specified under this and other sections, and see that they are provided with anchors as specified and securely anchor into masonry work.
- L. Fill space between hollow metal frames and masonry units.
- M. Match new work to existing.
- N. Build interior partitions to underside of structure above unless otherwise noted.

### **3.02 MORTAR BEDDING AND JOINTING**

Use Type N Mortar for exterior above grade load bearing and non-load bearing walls, parapet walls, interior load bearing walls and non-load bearing partitions.

### **3.03 BATCH CONTROL**

- A. Measure and batch materials be either volume or weight.
- B. Mix mortar with minimum amount of water consistent with workability to provide maximum tensile bond strength within the capacity of the mortar.
- C. Mix mortar ingredients for a minimum of 5 minutes in a mechanical batch mixer.
- D. Do not retemper mortar that has begun to set.

### **3.04 INSTALLATION MASONRY UNITS**

- A. Lay brick with completely filled head and bed joint.
- B. Concrete masonry units:
  - 1. Lay with full mortar coverage on horizontal and vertical face shells.
  - 2. Bed webs in mortar in starting course on footings and foundation walls and in all courses of piers, columns and pilasters.
- C. Joints
  - 1. Maintain joint widths shown except for minor variations required to maintain bond alignment.
  - 2. Face brick:
    - a) Cut flush and tool concave when mortar is thumb print hard.
    - b) Use round stainless-steel jointer slightly larger than joint to compress and seal joint.
  - 3. Concrete masonry units:
    - a) Cut joints flush where masonry is concealed or is covered by some other material.
    - b) Where units are exposed or painted cut joints flush and tool when thumb print hard to form a "V" joint.
- D. Remove units disturbed after laying, clean and relay in fresh mortar.

### **3.05 CAVITY WALLS**

- A. Keep cavity clean of mortar droppings and other material during construction.
- B. Strike joints facing cavity flush.
- C. Tie exterior and back-up wythes with metal ties spaced 24 inches on center vertically and 16 inches on center horizontally.
- D. Provide weep holes in exterior wythe located immediately above ledges and flashing spaced at 2'-6" on center.

### **3.06 BRICK VENEER CONSTRUCTION**

- A. Provide corrugated ties at each stud and 24" o.c. vertically.
- B. Fasten ties directly to studs if sheathing is Styrofoam
- C. Tape around anchor where it penetrates Styrofoam.

### **3.07 HORIZONTAL JOINT REINFORCING**

- A. Provide continuous horizontal joint reinforcing as shown and/or specified.
- B. Fully embed side rods in mortar with a minimum cover of 5/8 inch on exterior side and 1/2 inch at other locations.
- C. Lap reinforcement a minimum of 6" at ends.
- D. Do not bridge control or expansion joints.
- E. Provide continuity at corners and intersections by use of prefabricated "L" and "T" section.
- F. Cut and bend units as directed by manufacturer for continuity of returns, offsets, column fire proofing, pipe enclosures and other special conditions.
- G. For single wythe walls space reinforcing at 16 inches on center vertically.

### **3.08 ANCHORING MASONRY WORK**

Anchor masonry to structural members where masonry abuts such members to comply with the following:

- A. Provide open space not less than 3/4" in width between masonry and structural member.
- B. Fill space with fiberglass expansion joint material.
- C. Anchor masonry to structural members with metal ties embedded in masonry joints and attached to structure.
- D. Space anchors at 24" on center vertically.

### **3.09 LINTELS**

- A. Install lintels wherever openings of 1'-0" or more in width are shown.
- B. Provide "U" shaped concrete masonry lintel units with reinforcing bars and filled with concrete grout.
- C. Provide minimum bearing of 8" at each jamb.
- D. Temporarily shore concrete masonry lintels for at least 7 days.

### **3.10 CONTROL AND EXPANSION JOINTS**

- A. Provide vertical control and expansion joints where shown on drawings.
- B. If locations of control joints are not shown, space at 30'-0" on center maximum.
- C. See Division 7 sections for "Joint Sealers".

### **3.11 FLASHING OF MASONRY WORK**

- A. Install concealed flashing in masonry work at all shelf angles, lintels, ledges and other obstructions to the downward flow of water in the wall so as to divert such water to the exterior.
- B. Prepare masonry surfaces smooth and free from projections which could puncture flashing.
- C. Place through-wall flashing on bed of mortar.
- D. Seal joints and penetrations of flashing with mastic.
- E. Extend flashing the full length of lintels and shelf angles and a minimum of 8" into masonry each end.
- F. Extend flashing from a line 1/2" from exterior face of outer wythe of masonry, through outer wythe, turned up minimum 4" and through the inner wythe to within 1/2" of inner face of the wall in exposed work.
- G. Where interior surface of inner wythe is concealed, carry flashing through the inner wythe and turn up 2" minimum.
- H. Provide weep holes in head joints in course above flashing and at 30" on center or as shown.
- I. Install reglets and nailers for flashing and other related work as shown or required.

### **3.12 REPAIR, POINTING AND CLEANING**

- A. Remove and replace units that are loose, chipped, broken, stained or damaged, or do not match adjoining units as intended.
- B. During the tooling of joints, enlarge any voids or holes, and completely fill with mortar.
- C. Point-up all joints at corners, openings and adjacent work to provide a neat, uniform appearance, properly prepared for application of caulking or sealants.
- D. Clean brick masonry surfaces with stiff brush and water or by high pressure water.
- E. Use commercial cleaning agents in accordance with manufacturer's instructions.
- F. Clean concrete masonry by dry brushing at the end of each day's work and after final pointing to remove mortar spots and droppings.
- G. Water-repellent for exterior masonry specified in Division 7 Sections.

**END OF SECTION 04 81 00**

## **SECTION 05 12 00 - STRUCTURAL STEEL**

### **PART 1 - GENERAL**

#### **1.01 RELATED DOCUMENTS**

Drawings, Technical Specifications, TSUS construction specifications Division 1, TSUS uniform general conditions for construction contract, safety requirements of OSHA and prevailing building codes & city, state and county.

#### **1.02 DESCRIPTION OF WORK**

- A. Extent of Structural Steel work is shown on drawings, including schedules, notes and details to show size and location of members, typical connections and type of steel required.
- B. Structural Steel is that work defined is AISC "Code of Standard Practice" and as otherwise shown.
- C. Miscellaneous Metal Fabrications are specified in other sections of Division 5.

#### **1.03 QUALITY ASSURANCE**

Comply with provisions of following, except as otherwise noted:

- A. AISC "Code of Standard Practice for Steel Buildings and Bridges".
- B. AISC "Specifications for the Design, Fabrication, and Erection of Structural Steel for Building" including "Commentary" and Supplements issued.
- C. AISC "Specifications for Structural Joints using ASTM A325 or A490 Bolts".
- D. AWS D1.1 "Structural Welding Code".
- E. ASTM A6 "General Requirements for Delivery of Rolled Steel Plates, Shapes, Sheet Piling and Bars for Structural Use".

#### **1.04 SUBMITTALS**

- A. Submit shop drawings prepared under supervision of a registered professional engineer, including complete details and schedules for fabrication and assembly of structural steel.
- B. Include details of cuts, connections, camber, holes and other pertinent data.
- C. Indicate welds by standard AWS symbols, and show size, length and type of each weld.
- D. Provide setting drawings, templates and directions for installation of anchor bolts and other anchorage's installed by others.

#### **1.05 DELIVERY**

- A. Deliver materials to site at such intervals to insure uninterrupted programs for work.
- B. Deliver anchor bolts and anchorage's devices, which are to be embedded in cast-in-place concrete or masonry, in ample time not to delay work.

## PART 2 - PRODUCTS

### 2.01 MATERIALS

- A. For fabrication of work which is exposed to view, use material that is smooth and free of blemishes, including pitting, seam marks, roller marks, rolled trade names and roughness.
- B. Structural steel shapes, plates and bars: Conform to ASTM A36.
- C. Cold formed steel tubing: Conform to ASTM A500 Grade B
- D. Hot formed steel tubing: Conform to ASTM A 501.
- E. Steel pipe: Conform to ASTM A53, Type E or S, Grade B, black finish except where noted to be galvanized.
- F. Anchor bolts: Conform to ASTM A307, non-headed type unless otherwise indicated.
- G. Threaded fasteners: Provide hexagonal heads and nuts for all connections to conform to ASTM A307 Grade A, regular low-carbon steel, bolts and nuts.
- H. Welding electrodes: Comply with AWS Code, for high strength low-alloy steel, provide electrodes, welding rods and filler metals equal in strength and compatible in appearance with parent metal jointed.
- I. Steel primer paint: Zinc Chromate, oil-alkyd; TT-P-57, Type 1. Coordinate with fireproofing for compatibility.
- J. Metallic Shrinkage-Resistant Grout: Provide grout as manufactured by one of the following:
  - 1. Firmix; Euclid Chemical Co.
  - 2. Embeco 153; Master Builders
  - 3. Ferrolith G; Sonneborn/Contech.
  - 4. Irontox; Toch Brothers
  - 5. Kemox C; Sika Chemical
  - 6. Vibra-Foil; W.R. Grace

### 2.02 FABRICATION

- A. Fabricate and assemble structural assemblies in shop to greatest extent possible.
- B. Fabricate items in accordance with AISC Specifications and as indicated on final shop drawings.
- C. Provide camber in structural members where indicated.
- D. Properly mark and match-mark materials for field assembly.
- E. Fabricate for delivery sequence which will expedite erection and minimize field handling.
- F. Where finishing is required, complete assembly, including welding, before start of finishing operations.
- G. Provide finish surfaces of members exposed to view free of marking, burrs and other defects.
- H. Weld or bolt shop connections as indicated.
- I. Bolt field connection except as noted otherwise.
- J. Provide high-strength threaded fasteners for principal bolted connections.
- K. Provide unfinished threaded fasteners for only bolted connection of secondary framing members to primary members, such as purlins and girts, and for temporary bracing.



- L. Install high-strength threaded fasteners in accordance with AISC "Specifications for Structural Joints using ASTM A325 or A490 Bolts".
- M. Comply with AWS Code for procedures, appearance and quality of welds, and methods used in correcting welding work.
- N. Provide holes required for securing other work to structural steel framing, and for passage of other work through steel framing members, as shown on final shop drawings.
- O. Cut, drill or punch holes perpendicular to metal surfaces.
- P. Do not flame cut holes or enlarge by burning.
- Q. Drill holes in bearing plates.

### **2.03 SHOP PAINTING**

- A. Shop paint structural steel except surfaces to be welded.
- B. Apply 2 coats to surfaces which are inaccessible after assembly.
- C. Clean steel in accordance with Steel Structures Painting Council.
- D. Apply at a rate to provide a uniform dry film thickness of 1.5 mils.

## **PART 3 - EXECUTION**

### **3.01 INSPECTION**

- A. Examine areas and conditions under which structural steel work is to be installed.
- B. Notify Contractor in writing of conditions detrimental to proper and timely completion of work.
- C. Do not proceed until unsatisfactory conditions are corrected in a manner acceptable to Erector.

### **3.02 ERECTION**

- A. Provide temporary shoring and bracing to bear imposed loads.
- B. Provide temporary guy lines to align structure as erection proceeds.
- C. Remove temporary shoring, bracing and guys when final connections are made, and roof slab or floor slab loads are imposed.
- D. Clean concrete and masonry bearing surfaces and roughen to improve bond to surfaces.
- E. Clean bottom surfaces of base and bearing plates.
- F. Set base and bearing plates on wedges or other adjusting devices.
- G. Tighten anchor bolts after supported members are plumbed.
- H. Do not remove wedges or shims, but if protruding, cut off flush with edge of base or bearing plate prior to packing with grout.
- I. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.
- J. Set structural frames accurately to lines and elevations indicated.
- K. Align and adjust members forming a part of a complete structure before permanently fastening.
- L. Clean surfaces which will be in permanent contact.
- M. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
- N. Level and plumb individual members within specified AISC tolerances.
- A. O. Splice members only where indicated on shop drawings.

- P. On exposed welded construction, remove erection bolts, fill holes with plug welds and grind smooth.
- Q. Comply with AISC Specifications for bearing, adequacy of temporary connections, alignment and removal of paint on surfaces adjacent to field welds.
- R. Do not enlarge holes in members by burning or use of drift pins, except in secondary bracing members.
- S. Ream holes that must be enlarged to admit bolt.
- T. Do not use gas cutting torch in field for correcting fabricating errors in structural framing.
- U. Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint and apply paint to exposed areas with same material as used for shop coat.

**END OF SECTION 05 12 00**

## **SECTION 05 21 00 - STEEL JOISTS**

### **PART 1 - GENERAL**

#### **1.01 RELATED DOCUMENTS**

Drawings, Technical Specifications, TSUS construction specifications Division 1, TSUS uniform general conditions for construction contract, safety requirements of OSHA and prevailing building codes & city, state and county.

#### **1.02 DESCRIPTION OF WORK**

Extent of steel joists is shown on drawings, including basic layout and type of joists required.

#### **1.03 QUALITY ASSURANCE**

- A. Comply with current standards for materials or operations as follows but not limited to:
  - 1. Published Specifications of Manufacturer.
  - 2. The American Society of Testing and Materials (ASTM).
  - 3. The Steel Joists Institute (SJI).
  - 4. The American Institute of Steel Construction (AISC).
  - 5. American Iron and Steel Institute (AISI).
- B. If requested, furnish an affidavit from the manufacturer or fabricator stating that materials or a manufactured or fabricated product complies with the specifications. Even with such certification contractor must comply with any added requirements specified.
- C. Qualify welding processes and operators in accordance with the AWS "Standard Qualification Procedure".
- D. Expense of removing and replacing any portion of steel joists for testing purposes will be born by Owner if welds are found to be satisfactory, but if found to be defective, expense to be born by Contractor.
- E. Each joists designation design shall be approved by the Steel Joist Institute.
- F. Special joists shall be designed and sealed by Professional structural engineer.

#### **1.04 SUBMITTALS**

- A. Product Data:
  - 1. Submit manufacturer's specifications for joists and accessories.
  - 2. Submit manufacturer's certification that joists comply with SJI "Specifications".
- B. Shop Drawings:
  - 1. Submit drawings showing layout of joists, special connections, mounting and accessories.
  - 2. Show mark, number, type, location and spacing of joists and bridging.

#### **1.05 DELIVERY, STORAGE AND HANDLING**

- A. Deliver, store and handle joists as recommended in SJI "Specifications".
- B. Handle and store in a manner to avoid deforming members and to avoid excessive stresses.

## PART 2 - PRODUCTS

### 2.01 MATERIALS

- A. Steel: Comply with SJI "Specifications", for Type and LH joists.
- B. Paint: Comply with SJI "Specifications" except asphalt type paint not permitted.

### 2.02 FABRICATION

- A. General:
  - 1. Splices in tension members less than 60 feet in length will not be permitted.
  - 2. All butt welds will be fabricated using splice plates.
  - 3. Splices in tension members in excess of 60 feet in length will be allowed from the bearing to the quarter point only.
  - 4. Do not splice adjacent members within the same panel points.
  - 5. Provide camber as follows:
    - a) 20' length, 1/4" camber
    - b) 30' length, 3/8" camber
    - c) 40' length, 5/8" camber
    - d) 50' length, 1" camber
    - e) 60' length, 1-1/2" camber
- B. Provide extended ends on joists where shown, complying with requirements of applicable SJI "Specifications" and load tables.
- C. Ceiling extensions:
  - 1. Provide in areas having items attached directly to bottom chord of joists.
  - 2. Provide extension of sufficient strength to support items shown attached.
  - 3. Extend extensions to within 1/2" of finished wall surface or as indicated.
- D. Bridging:
  - 1. Provide horizontal or diagonal type bridging for open web joists, complying with SJI "Specifications".
  - 2. Provide bridging anchors for ends of bridging lines terminating at walls or beams.
  - 3. Provide end anchorage's to secure joists to adjacent construction.
- E. Shop Paint:
  - 1. Remove scale, rust and other material from joists and accessories prior to application of paint.
  - 2. Apply one coat to provide a dry paint film thickness of not less than 0.50 mil.

## PART 3 - EXECUTION

### 3.01 INSPECTION

- A. Erector must examine areas and conditions under which joists are to be installed and notify contractor in writing of conditions detrimental to proper and timely completion of work.
- B. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to Erector.

### **3.02 ERECTION**

- A. Place and secure steel joists in accordance with SJI "Specifications", final shop drawings and as herein specified.
- B. Do not start placement of joists until supporting work is plumb, level, and secured.
- C. Place, adjust and align in accurate locations and spacing before permanently fastening.
- D. Provide temporary bridging, connections, and anchors to insure lateral stability during construction.
- E. Where joists are 40 feet and longer, install center row of bridging before slackening of hoist lines.
- F. Install bridging simultaneously with joist erection, before construction loads are applied.
- G. Anchor ends of bridging lines where terminating at walls or beams.
- H. Field weld joists to supporting members in accordance with SJI "Specifications".
- I. Coordinate welding sequence and procedure with placing of joists.
- J. After joist installation, touch up with paint all weld areas, abraded or rusty surfaces.

**END OF SECTION 05 21 00**

## **SECTION 05 30 00 - METAL DECKING**

### **PART 1 - GENERAL**

#### **1.01 RELATED DOCUMENTS**

Drawings, Technical Specifications, TSUS construction specifications Division 1, TSUS uniform general conditions for construction contract, safety requirements of OSHA and prevailing building codes & city, state and county.

#### **1.02 DESCRIPTION OF WORK**

The extent of metal decking is shown on the drawings, including basic layout and type of deck units required.

#### **1.03 QUALITY ASSURANCE**

- A. Comply with the following codes and standards:
  - 1. AISI "Specification for the Design of Cold-Formed Steel Structural Members".
  - 2. AWS "Structural Welding Code".
  - 3. SDI "Design Manual for Floor Decks and Roof Decks".
- B. Quality welding processes and welding operators in accordance with AWS "Standard Qualification Procedure".
  - 1. Welded decking in place is subject to inspection and testing.
  - 2. Expense of removing and replacing portions of decking for testing will be borne by Owner if welds are found to be satisfactory.
  - 3. Work found to be defective will be removed and replaced at Contractor's expense.

#### **1.04 SUBMITTALS**

- A. Submit manufacturer's certification as may be required to show compliance with these specifications.
- B. Submit shop drawings showing:
  - 1. Layouts and types of deck panels.
  - 2. Anchorage details and conditions requiring closure panels.
  - 3. Supplementary framing, sump pans, cant strips, cut openings, special jointing or other accessories.

### **PART 2 - PRODUCTS**

#### **2.01 MATERIALS**

- A. Steel for Painted Metal Decks: ASTM A611, Grade C.
- B. Steel for Galvanized Metal Decks: ASTM A446, Grade A.
- C. Miscellaneous Steel Shapes: ASTM A36.
- D. Galvanizing: ASTM A525, G60.
- E. Galvanizing Repair Paint: High zinc-dust content paint for repair of damaged galvanized surfaces complying with Military Specifications MIL-P-21035 (ships).
- F. Paint: Manufacturer's baked-on, rust inhibitive paint for application to metal surfaces which have been chemically cleaned and phosphate chemical treated.
- G. Flexible Closure Strips: Manufacturer's standard vulcanized, closed cell, synthetic rubber.

## **2.02 FABRICATION**

- A. General:
  - 1. Form deck units in length to span three (3) or more supports.
  - 2. Form units with flush, telescoped or nested two (2) inch laps at ends and interlocking or nested side laps.
- B. Roof Deck:
  - 1. 1 1/2" deep formed with 22-gauge steel.
  - 2. Minimum Section Modulus of 0.137 inch cubed per foot.
  - 3. Type B Lok as manufactured by Merco Mfg., Inc.
- C. Cover Plates:
  - 1. Fabricate cover plates for end-abutting deck units of same gauge material as decking.
  - 2. Form to match contour of deck and approximately 6" wide.
- D. Metal Closure Strips:
  - 1. Fabricate of 18-gauge steel.
  - 2. Form to provide tight fitting closures at end of flutes and sides of decking.
- E. Cant Strips:
  - 1. Fabricate of 22-gauge steel.
  - 2. Bend to form a 45° not less than 5" wide with top and bottom flanges not less than 2" wide.

## **PART 3 - EXECUTION**

### **3.01 INSPECTION**

- A. Examine areas and conditions under which metal deck is to be installed and notify contractor of conditions detrimental to proper and timely completion of work.
- B. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to installer.

### **3.02 INSTALLATION**

- A. General:
  - 1. Install deck units and accessories in accordance with manufacturer's recommendations.
  - 2. Place deck units on supporting framework and adjust to final position with ends accurately aligned before fastening permanently.
  - 3. Do not stretch or contract side lap interlocks.
  - 4. Place deck units flat and square, secured to adjacent framing without warp or excessive deflection.
  - 5. Coordinate with steel erector the location of deck bundles to prevent overloading structural members.
  - 6. Do not use floor deck units for storage or working platforms until permanently secured.

- B. Fastening Deck Units:
  - 1. Fasten floor deck units to supporting members by not less than 3/4" diameter fusion weld or elongated welds of equal strength, spaced 12" o.c. with a minimum of 2 welds per unit at each support.
  - 2. Tack weld or use matching screws at 4'-0" o.c. for fastening end closures.
  - 3. Fasten roof deck units to supporting members by not less than 1/2" diameter fusion welds or elongated welds of equal strength, spaced 12" o.c. at supports and at closer spacing where required for lateral force resistance.
  - 4. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work.
  - 5. Use welding washers where recommended by deck manufacturer.
  - 6. Lock side laps of adjacent deck units between supports at intervals not exceeding 36" o.c.
- C. Cutting and Fitting: Cut and neatly fit deck units and accessories around other work projecting through or adjacent to the decking.
- D. Reinforcement at Openings: Provide reinforcement and closure pieces as required for strength, continuity of decking and support of other work.
- E. Hanger Slots or Clips:
  - 1. Provide UL approved punched hanger slots between flutes of lower element where floor deck units are to receive hangers for support of ceilings, air ducts, diffusers or light fixtures.
  - 2. Hanger clips designed to clip over male side lap joints of floor deck units may be used instead of hanger slots.
  - 3. Locate slots or clips at not more than 14" o.c. in both directions, not over 9" from walls at ends and not more than 12" from walls at sides.
- F. Joint Covers: Provide joint covers at abutting end and changes of direction of floor deck units.
- G. Touchup Painting: After decking installation, wire brush, clean and paint scarred areas, welds and rust spots on top and bottom of decking units and supporting steel members.

**END OF SECTION 05 30 00**



## **SECTION 05 40 00 - COLD-FORMED METAL FRAMING**

### **PART 1 - GENERAL**

#### **1.01 RELATED DOCUMENTS**

Drawings, Technical Specifications, TSUS construction specifications Division 1, TSUS uniform general conditions for construction contract, safety requirements of OSHA and prevailing building codes & city, state and county.

#### **1.02 SUMMARY**

- A. Types of cold formed metal framing units include the following:
  - 1. Load bearing punched channel studs
  - 2. C-shaped load bearing steel studs
  - 3. C-shaped steel joists

#### **1.03 SUBMITTALS**

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Project Manual sections.
- B. Product data and installation instructions for each item of cold formed metal framing and accessories.
- C. Shop drawings for special components and installations not fully dimensioned or detailed in manufacturer's product data.

#### **1.04 QUALITY ASSURANCE**

- A. Component Design: Calculate structural properties of studs and joists in accordance with American Iron and Steel Institute (AISI) "Specification for Design of Cold-Formed Steel Structural Members."
- B. Welding: Use qualified welders and comply with American Welding Society (AWS) S1.3, "Structural Welding Code - Sheet Steel."
- C. Fire Rated Assemblies: Where framing units are components of assemblies indicated for a fire-resistance rating, including those required for compliance with governing regulations, provide units that have been approved by governing authorities that have jurisdiction.
- D. Pre-Installation Conference: Prior to start of installation of metal framing systems, meet at project site with installers of other work including door frames and mechanical and electrical work. Review areas of potential interference and conflicts, and coordinate layout and support provisions for interfacing work.

### **PART 2 - PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. Manufacturers: Subject to compliance with requirements provide products of one of the following:
  - 1. Unimast Incorporated, Franklin Park, Illinois

- 2.01 **2.02** All studs and accessories shall be the type, size, gauge and spacing specified.

- 2.03** All structural members shall be designed in accordance with American Iron and Steel Institute (AISI) "Specification for the Design of Cold-Formed Steel Structural Members", 1986 edition.
- 2.04** All framing members shall be formed from corrosion-resistant steel, corresponding to the requirements of ASTM A446, with a minimum yield strength of 40 ksi for PCS style studs and 33 ksi for CWS style studs, SWT and UDLT tracts.

### **PART 3 - INSTALLATION**

- 3.01** All framing components shall be cut squarely for attachment to perpendicular members, or, as required, for an angular fit against abutting members.
- 3.02** Axially loaded studs shall be installed in a manner which will assure that their ends are positioned against the inside of tract prior to fastening.
- 3.03** Fastening of components shall be with self-drilling screws or welding. Screws shall be of sufficient size to insure the strength of the connection. Wire tying of components shall not be permitted. All welds shall be touched up with a zinc rich paint.
- 3.04** Track shall be securely anchored to the supporting structure.
- 3.05** Complete, uniform and level bearing support shall be provided for the bottom tract.
- 3.06** Abutting lengths of track shall each be securely anchored to a common structural element, butt-welded or spliced.
- 3.07** Studs shall be plumbed, aligned and securely attached to flanges of both upper and lower tract.
- 3.08** Framing of wall openings shall include headers and supporting studs.
- 3.09** Temporary bracing, where required, shall be provided until erection is completed.
- 3.10** Resistance to bending and rotation about the minor axis shall be provided by horizontal strap or cold-rolled channel bracing (gypsum board and gypsum sheathing per AISI Specification, Sec. D4).
- 3.11** Diagonally braced stud walls shall be provided at locations designated as "shear walls" for frame stability and lateral load resistance. Additional studs, when necessary, shall be positioned to resist the vertical components.
- 3.12** Splices in axially loaded studs shall not be permitted.

**END OF SECTION 05 40 00**

## **SECTION 05 50 00 - METAL FABRICATIONS**

### **PART 1 - GENERAL**

#### **1.01 RELATED DOCUMENTS**

Drawings, Technical Specifications, TSUS construction specifications Division 1, TSUS uniform general conditions for construction contract, safety requirements of OSHA and prevailing building codes & city, state and county.

#### **1.02 DESCRIPTION OF WORK**

- A. Metal fabrications include items made from iron and steel shapes, plates, bars, strips, tubes, pipes and castings which are not part of structural steel or other metal systems specified elsewhere.
- B. Types of work in this section include, but not limited to:
  - 1. Pipe Handrails
  - 2. Loose steel lintels
  - 3. Trench frames and grates
  - 4. Bench supports
  - 5. Steel stairs
  - 6. Steel angle framing

#### **1.03 QUALITY ASSURANCE**

- A. Take field measurements prior to preparation of shop drawings and fabrication, where possible.
- B. Do not delay job progress: Allow for trimming and fitting when taking field measurements before fabrication might delay work.
- C. Pre-assemble items in shop to greatest extent possible to minimize field splicing and assembly.
- D. Disassemble units only as necessary for shipping and handling limitations.
- E. Clearly mark units for reassembly and coordinated installation.

#### **1.04 SUBMITTALS**

- A. Submit shop drawings for fabrication and erection of miscellaneous metal fabrication.
- B. Include plans, elevations and details of sections and connections.
- C. Show anchorage and accessory items.
- D. Provide templates for anchor and bolt installation by others.

### **PART 2 - PRODUCTS**

#### **2.01 MATERIALS**

- A. Metals:
  - 1. Steel Plates, Shapes and Bars: ASTM A36.
  - 2. Structural Steel Sheet:
    - a) Hot rolled: ASTM A570
    - b) Cold rolled: ASTM A611, Class 1
  - 3. Steel Pipe: ASTM A53, type and grade as required for design loading, schedule 40.

4. Brackets, Flanges and Anchors: Cast or formed of the same type metal and finish as being supported.

## 2.02 MISCELLANEOUS METAL FABRICATIONS

- A. Steel Pipe Railings and Handrails
  1. Fabricate handrails to design, dimensions and details indicated.
  2. Provide handrails formed of 1-1/2" pipe or as indicated.
  3. Form bends by use of prefabricated fittings and radius bends or by bending pipe.
  4. Close ends of pipe by using prefabricated fittings.
  5. Interconnect railing and handrail members by butt welding or welding with internal connectors.
  6. Provide wall brackets, flanges, miscellaneous fittings and anchors for attachment of railings and handrails to other work.
  7. Grind all welds smooth and galvanize after fabrication.
- B. Loose Steel Lintels:
  1. Provide loose steel lintels for openings and recesses in masonry walls as shown.
  2. Provide in lengths to produce not less than 8" bearing of each side of opening.
  3. Galvanize loose steel lintels to be installed in exterior walls.
- C. Trench Frames and Grates:
  1. Furnish Cast Iron frame and Grate No. TGMB-8 as manufactured by McKinley Iron Works.
- D. Bench Supports
  1. Provide bench supports as detailed on drawings.
  2. Butt weld joints and grind smooth.
  3. Galvanize after fabrication.
  4. Provide necessary anchoring devices.
- E. Steel Stair
  1. Provide steel stair as shown on drawings constructed with:
    - a) Stringers: 10" channels
    - b) Steel pans: 16 ga.
    - c) Steel riser closure: 16 ga. (where shown)
    - d) Tread supports: 1/4" x 1/4" x 1/8" angles
    - e) Strap anchors: 1/4" x 2" x length required
    - f) Columns: 4" square tube with 3/8" base plate
- F. Steel Angle Framing:
  1. Fabricate as detailed on plans.
  2. Punch angle at 24" o.c. to receive 3/8" bolts to fasten wood blocking.
  3. Coat with zinc chromate paint after fabrication.

## PART 3 - EXECUTION

### 3.01 PREPARATION

- A. Coordinate and furnish anchorage's, setting drawings, diagrams, templates, and instructions for installation of anchorage's, inserts, sleeves and anchor bolts.
- B. Inform other crafts of locations, size and type of blocking required prior to application of finishes.

### 3.02 INSTALLATION

- A. General
  - 1. Provide required fasteners for securing miscellaneous metal fabrications to in-place construction.
  - 2. Perform necessary cutting, drilling and fitting required for installation of items.
  - 3. Set work accurately in location, alignment and elevation plumb, level, true and free from rack, measured from established lines and levels.
  - 4. Fit exposed connections together to form tight hairline joints.
  - 5. Weld connections which are not to be left as exposed joints, but cannot be shop welded because of size limitations.
- B. Attach steel angle framing to bar joists by bolting or welding.

**END OF SECTION 05 50 00**

## **SECTION 05 73 00 - MISCELLANEOUS SHEET METAL**

### **PART 1 - GENERAL**

#### **1.01 RELATED DOCUMENTS**

Drawings, Technical Specifications, TSUS construction specifications Division 1, TSUS uniform general conditions for construction contract, safety requirements of OSHA and prevailing building codes & city, state and county.

#### **1.02 DESCRIPTION OF WORK**

Definition: Miscellaneous sheet metal includes items custom fabricated from metal sheets which are not specified in other sections of this Project Manual. Types of sheet metal items in this section include:

- A. Miscellaneous cabinets
- B. Closures and trim
- C. Window sills
- D. Pockets for window treatment
- E. Filler panels
- F. Lighting troughs
- G. Heating-coiling unit enclosures

#### **1.03 QUALITY ASSURANCE**

Shop Assembly: Pre-assemble items in the shop to the 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.

#### **1.04 SUBMITTALS**

- A. Product Data  
Submit manufacturer's product data, installation instructions and general recommendations for each specified miscellaneous sheet metal product, including paint products and other finishing materials.
- B. Shop Drawings  
Submit shop drawings for fabrication of sheet metal work. Include plans, elevations and detail sections. Indicate jointing, fasteners, anchorage, and accessory items, and specify finishes.
- C. Samples  
Submit 8" square samples of each metal finish required. Prepare samples on metal of same alloy and gage to be used for the work.
  - 1. For color anodized aluminum whose normal color and texture variations are to be expected, include 2 or more units in each set of samples indicating the limits of such variation.

#### **1.05 PROJECT CONDITIONS**

Coordinate work of this section with adjoining work for proper sequencing of each installation.

### **PART 2 - PRODUCTS**

## 2.01 MANUFACTURERS

- A. Subject to compliance with requirements, provide products of one of the following:
  - 1. American Steel Products Corp.
  - 2. Berjen Metal Industries, Inc.
  - 3. Brandt Airflex Corp.
  - 4. Custom Enclosures, Inc.
  - 5. Pioneer Ind. Div., Core Ind. Inc.

## 2.02 MATERIALS

- A. General: Provide materials selected for their surface flatness, smoothness and freedom from surface blemishes where exposed to view in the finished unit. Do not use materials having exposed-to-view surfaces exhibiting pitting, seam marks, roller marks "oil canning", stains, discoloration or other imperfections.
- B. Galvanized Sheet Steel: ASTM A526 (commercial quality) or A527 (lock forming quality), Coating Designation G90, mill phosphatized.
- C. Sheet Steel: Provide commercial quality cold-rolled carbon steel sheet as follows, unless otherwise indicated:
  - 1. Zinc-Coated Sheet Steel: ASTM A591, with Class C zinc coating; chemically treated in mill with phosphate solution and light chromate rinse.
  - 2. Sheet Steel: ASTM A366, Class I, matte finish.
  - 3. Either of above materials, at fabricator's option.
- D. Stainless Steel Sheet: ASTM A167, Type 302/304, with No. 4 finish, unless otherwise indicated.
- E. Aluminum Sheet: Alloy and temper recommended by manufacturer for use intended and as suitable for application of finish indicated, but with not less than the strength and durability properties specified in ASTM B209 for 5005-H15.
- F. Metal-Faced Laminated Panels: Shop fabricated, laminated panels of exposed metal facing, core, and metal backing, as indicated.
  - 1. Metal Facing: Sheet metal, type and gage as indicated.
  - 2. Core: Rigid, dimensionally stable, moisture-resistant, material as indicated.
  - 3. Metal Backing: 26-gage galvanized steel sheet, unless otherwise indicated.
  - 4. Edge Construction: Self-edged with metal facing, unless otherwise indicated.
- G. Fasteners: Use fasteners made of the same basic metal as the fastened metal, unless otherwise indicated. Do not use metals which are corrosive or incompatible with materials joined.
  - 1. Provide exposed fasteners (if any) which match finish of fastened metal, unless otherwise indicated.
  - 2. Do not use exposed fasteners except where unavoidable. Match finish of metal surrounding fastener, unless otherwise indicated.
  - 1. 3. Provide Phillips flathead machine screws for exposed fasteners, unless otherwise indicated.

- H. Anchors and Inserts: Use nonferrous metal or hot-dip galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or lead expansion bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete or masonry work.
- I. Shop Primer for Sheet Steel: Manufacturer's or Fabricator's standard, fast-curing, lead-free, "universal" primer, selected for resistance to normal atmospheric corrosion, for compatibility with finish paint system indicated and of capability to provide a sound foundation for fields-applied topcoats despite prolonged exposure; complying with performance requirements of FS TT-P-645.
- J. Shop-Applied Baked Enamel Finish System for Sheet Steel alkyd gloss enamel complying with FS TT-E-498, Type B; applied over shop primer complying with either FS TT-P-636 or TT-P-645.
- K. Shop Primer for Zinc Coated Sheet Steel: Zinc dust, zinc oxide primer paint complying with FS TT-P-641, Type II.
- L. Shop Primer for Aluminum Sheet: Zinc-chromate base complying with FS TT-P-645 or TT-P-1757.
- M. Factory-Applied Baked Enamel Finish: Alkyd gloss enamel (FS TT-E-489, Class B).
- N. Bituminous Paint: SSPC-Paint 12 (Cold applied asphalt mastic).
- O. Joint Sealers: See Division 7 section.

## 2.03 FABRICATION, GENERAL

- A. Fabricate items to comply with requirements indicated, including those for quality, thickness and finish of material as well as those indicating dimensions and details. Use heavier metal gages, stiffeners or metal backing as required to produce surface flatness, free of "oil-canning", and to impart sufficient strength for use indicated. If not otherwise indicated, provide the following minimum thickness of metal and comply with SMACNA recommendations for fabrication and installation details.
  - 1. Sheet Steel: 16-gage
  - 2. Galvanized Sheet Steel: 16-gage
  - 3. Stainless Steel: 16-gage
  - 4. Aluminum: 0.125"
- B. Form sheet metal items in maximum lengths and keep joints to a minimum. Do not expose cut edges of sheet metal except as indicated. Fold back exposed ends of unsupported sheet metal to form a 1/2" wide hem on the concealed side, or ease exposed edges with backing to a radius of approximately 1/32". Form items with flat, flush surfaces, true to line and level, and without cracking and grain separation at bends.
- C. Continuously weld all joints and seams except where other methods of joining are indicated; grind welds smooth and flush on exposed surfaces. Comply with AWS and other metal authorities.
  - 1. Use filler metals and welding procedures which will blend with and match the color of sheet metal being joined and will avoid discoloration at welds.



- D. Provide straps, plates and brackets as required for support and anchorage of fabricated items to adjoining work.
- E. Reinforce sheet metal items as required for attachment and support of hinges, catches and other hardware for operating components.

#### **2.04 MISCELLANEOUS CABINETS**

- A. General: Fabricate to sizes and details indicated using gages and metals indicated, or, if not indicated, not less than the following gages in sheet steel, or their equivalent.
  - 1. Door or Drawer Panels: 16-gage
  - 2. Exposed Tops: 14-gage
  - 3. Exposed Fronts, Sides and Trim: 16-gage
  - 4. Concealed Panels and Trim: 20-gage
  - 5. Frames: 14-gage
- B. Form doors of one-piece hollow metal with no seams exposed on exterior face or edges. Fill inner space with inorganic insulation.
- C. For flush installation with adjacent construction, provide edge trim where indicated; otherwise, form a trimless flush mounting.
- D. Provide panels glazed with the following material at locations indicated; set glass in felt glazing strips with removable interior stops, unless otherwise indicated.
  - 1. Clear float glass complying with FS DD-G-451, Type I, Class 1, Quality q3, thickness as indicated.
  - 2. Clear tempered float glass complying with FS-DD-G-1403, Kind FT, Condition A, Type I, Class 1, thickness as indicated.
- E. Provide all hardware as indicated or required, finished to match adjacent door hardware including the following:
  - 1. Door hinges, pulls and keepers
  - 2. Latching and locking devices

#### **2.05 CLOSURES AND TRIM**

- A. Form closures and trim members to profiles indicated, using 18 gage sheet steel unless otherwise indicated. Furnish all components required for support and installation of closures and trim. Fabricate closures and trim to tightly close with adjoining work, and with weather-tight joints at exterior installation.
- B. Locate fasteners to be concealed where possible; otherwise to be as inconspicuous as possible. Size to securely support the work and space to prevent buckling or waviness of the finished surface.
- C. Drill and tap holes required for securing closures to other surfaces.
  - D. Provide gaskets of closed-cell sponge neoprene or mastic sealing tape where indicated or required for concealed, continuous seal at abutting surfaces.
- E. Provide concealed support at joints to hold meeting faces in flush alignment. Miter or cope trim members at corners to form tight joint.

#### **2.06 WINDOW SILLS**

- A. Form sills to profiles indicated, using 14 gage sheet steel, unless otherwise indicated. Provide end closures and coordinate dimensions and attachment methods with window and other related work. Caulk all lap joints.

## **2.07 POCKETS FOR WINDOW TREATMENT**

- A. Form pockets to profiles indicated using 18 gage sheet steel, unless otherwise indicated. Provide end closures and coordinate dimensions and attachment methods with window treatment equipment, window frames, ceiling suspension system, and other related work to produce a coordinated and integrated assembly. Reinforce pocket for attachment of window treatment equipment and hardware or use heavier gage metal.
- B. For continuous pockets provide built-in filler panels between adjoining window treatment units to coincide with window mullions and of size indicated or required to fit to filler panels at ends of partitions.

## **2.08 FILLER PANELS**

- A. Fabricate filler panels for closing ends of partition systems, and at other locations as indicated. Construct to sizes and shapes required, with reveals, trim, and concealed anchorage's to adjacent surfaces. Use 16 gage sheet steel unless otherwise indicated.
- B. Provide gaskets of closed-cell sponge neoprene between filler panel ends with abut glass. Use 1" square material, unless otherwise indicated. Set approximately 1/4" into channeled edge of filler panel and secure with waterproof adhesive.
- C. Provide gaskets at all edges of panels which abut adjacent surfaces to form a continuous seal. Use compressible gaskets of mastic sealing tape, applied to center of panel edges to be concealed from view, unless otherwise indicated.
- D. Provide insulation, as indicated, for sound-deadening in filler panels. Use flexible or semi-rigid mineral fiber insulation blankets, secured to inside panel faces with waterproof adhesive.

## **2.09 LIGHTING TROUGH**

- A. Fabricate lighting troughs to profile and details indicated using 18 gage steel unless otherwise indicated; coordinate size of troughs, cutouts for electrical connections, and method of attachment with adjoining work and with electrical requirements. Lighting fixtures and electrical work is specified in Division 16.

## **2.10 HEATING-COOLING UNIT ENCLOSURES**

- A. Fabricate units to profiles, sizes, and details indicated using sheet metal of the type, finish, and gages indicated, or, if not indicated, fabricate enclosures from sheet steel in the following minimum gages:
  - 1. Framing: 12-gage
  - 2. Sills and Stools: 14-gage
  - 3. Front Panels and Bases: 16-gage
  - 4. Concealed Panels and Trim: 20-gage
- B. Design Loading Criteria: Provide enclosures capable of supporting a minimum loading of 200 lb. per sq. ft. or 150 lb. per linear foot (whichever is greater) without permanent deflection. Include stiffeners or laminated backing using noncombustible materials as required for strength and rigidity. Include brackets, plates and straps in assemblies for support of other work.

- C. Provide louvers and grilles of size, type and materials indicated. For removable grilles use modular units with recessed openings and enclosures. Fabricate removable grilles and openings to close tolerances to produce well-fitted assemblies free of warp or rattle with grilles supported continuously along parallel edges and tops flush with top of enclosure. Form support for grille to serve also as collar for connection to discharge opening in heating-cooling units where indicated or required for operation.
- D. Provide removable tops and fronts where indicated or required for access to heating-cooling units and to piping, ductwork, controls, and electrical service. Fabricate removable panels and openings in enclosure to a fitting tolerance of not less than 1/32" and not more than 1/10" at each edge, with face of panels flush with adjoining fixed surfaces of enclosure. Design and fabricate panels and openings so that panels may be easily removed without interfering with adjoining work or furniture. Provide concealed slips and hardware to hold panels in place without warp or rattle.
- E. Provide hinged access panels if enclosures for access to heating-cooling unit controls, either as separate elements or integrated with grille openings, as indicated or required.
- F. Coordinate construction, configuration and dimensions of enclosures with those of heating-cooling units. Provide blind knockouts for piping, ductwork, control lines, and electrical conduit and wiring, and where indicated or required, provide support for those elements and heating-cooling units.
- G. Locate fixed surfaces of enclosure to coincide precisely with window mullions and partition system terminations. Provide closures at ends of units, at recessed openings in base of units, and other locations where required to conceal from view unfinished wall or floor surfaces, piping, conduit, ductwork or heating-cooling units.
  - 1. Provide built-in partitions (bulkheads) within enclosures between heating-cooling units, located to coincide with mullions and partition system terminations. Fabricate panels in manner similar to exposed filler panels to prevent transmission of sound.
- H. Provide sound deadening for concealed faces of metal panels over 6" wide consisting of a heavy bituminous coating applied at the minimum rate of 20 sq. ft. per gal. Apply sound-deadening coating after completion of shop finishing.

## **2.11 SHOP FINISHING**

- A. Comply with NAAMM "Metal Finishes Manual" for finish designations and application recommendations, except as otherwise indicated.
- B. Comply with SSPC-PA1 "Paint Application Specification No. 1" for shop painting.
- C. Complete mechanical finishes of flat sheet metal surfaces before fabrication, wherever possible. After fabrication, finish all joints, bends, abrasions and other surface blemishes to match sheet finish. Protect mechanical finishes on exposed surfaces from damage by application of adhesive paper or other temporary protective covering, prior to shipment.
- D. Colors: Provide colors indicated, or if not indicated, as selected by Engineer from manufacturer's standard colors.
- E. Sheet Steel:

1. Surface Preparation: Solvent-clean surfaces in compliance with SSPC-SP-1 to remove dirt, oil, grease and other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel in compliance with SSPC-SP 5 (White Metal Blast Cleaning) or SSPC-SP8 (Pickling).
  2. Chemical Pretreatment: Apply hot phosphate surface treatment to uncoated steel sheet to comply with SSPC-PT 4.
  3. Factory-Primed Sheet Steel: Apply shop primer for sheet steel immediately following surface preparation and pretreatment.
  4. Factory-Primed Zinc-Coated Sheet Steel: Apply shop primer for zinc-coated steel sheet immediately following surface preparation.
- F. Factory-Applied Baked Enamel Finish: Apply baked enamel finish system for sheet steel immediately following surface preparation and chemical pretreatment. Comply with paint manufacturer's recommendations for application and baking to achieve a minimum dry film thickness of 2.0 mils.
- G. Aluminum:
1. Color Anodized Finish: AA-M32C12A42 (directional textured medium satin mechanical finish, medium matte etched finish with 0.7 mil minimum thick integrally colored anodic coating).
  2. Conversion-Coated and Factory-Primed Finish: AA-C12C42R1x (cleaned with inhibited chemical, conversion coated with an acid-chromate-fluoride-phosphate treatment, and painted with an organic coating specified below). Apply where painting after installation is indicated (not work of this section).
    - a) Organic Coating: Air-dried zinc-chromate primer with a minimum dry film thickness of 1.0 mils.
  3. Baked Enamel Finish: AA-C12C42R1x (cleaned with inhibited chemicals, conversion coated with an acid chromate-fluoride-phosphate treatment and painted with organic coating specified below). Apply coating in strict compliance with paint manufacturer's specifications.
    - a) Organic Coating: Manufacturer's standard thermosetting acrylic enamel primer/topcoat system, 1.5 minimum dry film thickness.

## **PART 3 - EXECUTION**

### **3.01 PREPARATION**

- A. Field Measurements: Perform sheet metal work in cooperation with other trades. Where possible, verify size, location and placement of miscellaneous sheet metal work prior to fabrication and shop assembly.
- B. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages, such as concrete inserts, anchor bolts, and miscellaneous items having integral anchors, which are to be embedded in concrete or masonry construction. Coordinate deliver of such items to the project site.

### **3.02 INSTALLATION**

- A. Locate and place sheet metal items plumb, level and in alignment with adjacent work.
- B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect sheet metal surfaces and to make a weather-tight connection.
- C. Form tight joints with exposed connections accurately fitted together. Provide reveals and openings for sealants and joint fillers, as indicated.
- D. Protect zinc-coated, galvanized and nonferrous metal surfaces from corrosion or galvanic action by application of a heavy coating of bituminous paint on surfaces which will be in contact with concrete, masonry or dissimilar metals.
- E. Repair finishes damaged by cutting, welding, soldering and grinding operations required for shop fitting and jointing. Restore finishes and prime coats of paint so that there is no evidence of corrective work. Return items which cannot be refinished in the field to the shop, make required alterations, and refinish the entire unit or provide new units, at fabricator's option.
- F. Provide concealed gaskets, flashing, sealants, fillers and insulation, and install as the work progresses to make installations weather-tight or sealed.

**END OF SECTION 05 73 00**

## **SECTION 06 10 00 - ROUGH CARPENTRY**

### **PART 1 - GENERAL**

#### **1.01 RELATED DOCUMENTS**

Drawings, Technical Specifications, TSUS construction specifications Division 1, TSUS uniform general conditions for construction contract, safety requirements of OSHA and prevailing building codes & city, state and county.

#### **1.02 DESCRIPTION OF WORK**

- A. Rough carpentry includes carpentry work not specified as part of other sections and which is generally not exposed to view.
- B. Type of work in this section include:
  - 1. Wood framing.
  - 2. Wood grounds, nailers, blocking and sleepers.
  - 3. Wood furring.
  - 4. Sheathing.
  - 5. Sub-flooring.
  - 6. Underlayment.
- C. Finish carpentry is specified in another section of Division 6.

#### **1.03 SUBMITTALS**

If requested, furnish an affidavit from manufacturer or fabricator stating that materials, manufactured or fabricated product complies with the governing specifications.

#### **1.04 COMPLIANCE WITH STANDARDS**

- A. Comply with requirements of the current specifications or standards for materials or operations as follows:
  - 1. Specifications of Manufacturer.
  - 2. National Lumber Manufacturer's Association (NLMA).
  - 3. Southern Pine Inspection Bureau (SPIB).
  - 4. Douglas Fir Plywood Association (DFPA).
  - 5. West Coast Lumberman's Association (WCLA).
  - 6. Western Pine Association (WPA).
  - 7. Southern Cypress Manufacturer's Association (SCMA).
  - 8. California Redwood Association (CRA).
  - 9. Commercial Standard (CS).
  - 10. Underwriters Laboratory, Inc. (ULI).
  - 11. National Wood Preserver's Association (NWP).
- B. Project specification takes precedence if in conflict with referenced specifications.

#### **1.05 PRODUCT HANDLING**

- A. Keep materials dry at all times.
- B. Stack lumber and plywood, and provide air circulation within stacks.

#### **1.06 JOB CONDITIONS**

- A. Fit carpentry work to other work, scribe and cope as required for accurate fit.
- B. Correlate location of furring nailers, blocking, grounds, etc., to allow proper attachment of other work.

## PART 2 - PRODUCTS

### 2.01 MATERIALS

- A. Lumber
1. Factory mark each piece of lumber with type, grade, mill and grading agency.
  2. Provide dressed lumber S4S unless noted otherwise.
  3. Provide lumber with 19% maximum moisture content.
  4. For light framing provide standard grade any specie.
  5. For structural framing (6" and wider and from 2" to 4" thick) provide any specie and grade which meets or exceeds the following:
    - a) Minimum fiber stress in bending: 1500 psi
    - b) Minimum modules of elasticity: 1,500,000.
  6. For exposed framing (2" through 4" thick) provide one of the following grade and specie:
    - a) Douglas Fir, Appearance Framing (WCLB or WWPA).
    - b) Southern Pine, Appearance Grade, Kiln Dried (SPIB).
    - c) Redwood, Clear All Heart (RIS).
    - d) Approved equal.
  7. Timber (5" and thicker)
    - a) No. 1 Grade Douglas Fir (WCLB or WWPA).
    - b) No. 2 SR Grade Southern Pine (SPIB).
  8. Boards (less than 2" thick)
    - a) Exposed for natural finish
      - 1) Redwood, select Heart Grade (RIS).
      - 2) Moisture content: 15% maximum MC-15 or K-D
    - b) Exposed for painted finish
      - 1) Southern Pine No. 1 (SPIB)
      - 2) Douglas Fir Construction (WCLB or WWPA)
      - 3) Moisture content: 15% maximum MC-15 or K-D
    - c) Concealed
      - 1) Southern Pine No. 2 (SPIB)
      - 2) Moisture Content: 19% maximum (s-Dry)
    - d) Sizes: To 1 x 8 unless noted otherwise.
      - 1) Sheathing: Shiplap
      - 2) Sub-flooring: Tongue and grooved.
- B. Treated Lumber:
1. All lumber in contact with concrete, masonry, plaster, terrazzo or roofing:
    - a) Southern Pine No. 2 grade (SPIB)
    - b) Douglas Fir Standard grade (WCLB or WWPA)
  2. Preservative:
    - a) Woodlife treated by Dri-Vac Process.
    - b) Net retention of two (2) pounds per cu. ft.
    - c) Bearing stamp of lumber treating company.

- C. Plywood:
  - 1. Sheathing or backing:
    - a) Thickness as shown on drawings.
    - b) BD Ext. APA.
  - 2. Sub-flooring:
    - a) Thickness as shown on drawings.
    - b) BC Int APA.
- D. Miscellaneous Sheathing
  - 1. Glass Fiber Board:
    - a) High density glass fiber with an integral vapor permeable, water resistant, air infiltration barrier facing.
    - b) K-value of 0.2 at mean temperature of 40 deg. F (4.4 deg. C)
    - c) Unless otherwise noted 4' x 8' sheets.
    - d) Manufacturer: Owens-Corning Fiberglass Corp.
  - 2. Extruded Polystyrene Plastic Board:
    - a) Rigid closed-cell expanded polystyrene panels with integral high density skin.
    - b) Comply with FS HH-I-524, Type II, Class B.
    - c) Minimum 18 psi compressive strength.
    - d) Aged K-value of 0.185 at 40 deg. F (4.4 deg C) mean temperature.
    - e) 0.5% maximum water absorption.
    - f) Manufacturers:
      - 1) Foamular by VC Industries.
      - 2) Styrofoam T6 by Dow Chemical U.S.A.
  - 3. Isocyanurate Plastic Board:
    - a) Rigid closed-cell isocyanurate panels consisting of glass fiber reinforced polyisocyanurate foam plastic core between aluminum foil facings.
    - b) Aged K-value of 0.14.
    - c) Minimum 20 psi compressive strength.
    - d) 1.5% maximum water absorption.
    - e) Manufacturers:
      - 1) High-R Sheathing by Owens-Corning Fiberglass Corp.
      - 2) Thermax Sheathing by Celotex Corp.
      - 3) Thermatite by Johns-Mansville.
  - 4. Gypsum Sheathing:
    - a) Gypsum board complying with ASTM C-79.
    - b) Water-repellent treated core with water absorption of less than 10% by weight after 2 hour immersion (ASTM C 473).
  - 5. Fiberboard Sheathing: Complying with ASTM C 208 manufacturer's special high density high strength board.
- E. Building Paper:
  - 1. Sisalkraft as manufactured by Sisalkraft Co.
  - 2. Brown-Skin as manufactured by Angier Corp.
  - 3. Asphalt saturated felt, non-perforated, ASTM 226.
- F. Rough Hardware:



1. Bolts:
  - a) Size and space as shown on drawings.
  - b) Where sizes not shown use 1/2".
  - c) Galvanized and furnished with nuts and washers.
2. Nails:
  - a) Size and quantities as required by good practices.
  - b) Galvanized.
3. Power Driven Pins: Size and spacing and charges as recommended by manufacturers.
  - a) Hilti.
  - b) Ramset.
4. Toggle and Expansion Bolts:
  - a) Where indicated or required on drawings.
  - b) 3/16" for securing members 1" or less in thickness.
  - c) 3/8" for securing members over 1" in thickness.
  - d) Galvanized.

## **PART 3 - EXECUTION**

### **3.01 INSTALLATION**

#### **A. General**

1. Discard units of material with defects which might impair quality of work.
2. Set carpentry work accurately to required levels and lines, with members plumb and true and accurately cut and fitted.
3. Securely attach carpentry work to substrate by anchoring as shown and as required by recognized standards.
4. In exposed carpentry use finish nails and counter sink.
5. Use common wire nails for rough carpentry work.
6. Select fasteners of size that will not penetrate members where opposite side will be exposed to view or will receive finishes.
7. Make tight connections between finish members.
8. Pre-drill holes as required to prevent splitting of finish members.

#### **B. Wood Grounds, Nailers, Blocking and Sleepers:**

1. Coordinate with other work involved.
2. Provide where shown or required for attachment of other work.
3. Form to shapes shown or required for true line and level of attached work.
4. Counter sink bolts and nuts flush with surface where required.
5. Build into masonry during masonry installation.
6. Where possible anchor to formwork before concrete placement.
7. Provide permanent grounds of dressed preservative treated, key beveled lumber not less than 1-1/2" wide and of thickness to bring face of finish work to desired line.

#### **C. Wood Furring:**

1. Install plumb and level with closure strips of edge of opening.
2. Use 1 x 3 at 24" o.c. horizontally and vertically for plywood paneling.
3. Use 1 x 3 at 16" o.c. vertically for gypsum board.

4. Use 1 x 2 at 16" o.c. vertically for plaster lath.
- D. Wood Framing:
1. Comply with recommendations of "Manual for House Framing".
  2. Unless otherwise shown use 2 x 4 studs at 16" o.c. with 4" face perpendicular to face of wall.
  3. Provide single toe plate and double top plate 2" thick by width of studs, except single top plate may be used for non-load bearing walls.
  4. Nail or anchor to supporting construction.
  5. Construct corners and intersections with not less than 3 studs.
  6. Provide double studs at jambs of all openings.
  7. Headers (non-load bearing partitions):
    - a) 2-2 x 4 for openings 3' and less.
    - b) 2-2 x 6 for openings 3' and more.
  8. Headers (load bearing partitions):
    - a) As shown on drawings.
    - b) If not shown as recommended by NFPA "Manual for House Framing".
  9. Provide diagonal corner bracing at 45 deg. angle full height of wall in load bearing exterior walls.
  10. Omit corner bracing with the following sheathing:
    - a) Plywood 4' wide vertical panels.
    - b) Gypsum sheathing 4' wide vertical panels.
    - c) Fiberboard sheathing, intermediate type, 4' vertical panels.
    - d) Diagonal board sheathing.
- E. Joist Framing:
1. Provide framing of sizes and spacing shown.
  2. Install crown up and support ends without less than 1-1/2" bearing on wood or metal and 3" on masonry.
  3. Attach to wood bearing by toe nailing or metal connectors.
  4. Fire cut members built into masonry.
  5. Frame openings with headers and trimmers supported by metal joist hangers.
  6. Do not notch joists in middle third of span.
  7. Limit notches to 1/6 of depth of joist.
  8. Do not bore holes larger than 1/3 depth of joist or locate closer than 2" from top or bottom.
  9. Lap joists over bearings a minimum of 4".
- F. Bridging:
1. Provide for joist spanning 10' or more.
  2. Provide 1 x 4 cross bridging or 2" depth of joist solid bridging at 8' o.c.
- G. Rafters:
1. Notch to fit top plate.

2. Where rafters abut ridge, place directly opposite each other and nail to ridge member.
  3. Bevel ends of jack rafters for full bearing against hip and valley rafters.
  4. Provide hip and valley rafters 2" wide by 2" deeper than regular rafters.
  5. Provide 1 x 6 collar beam at every third pair of rafters.
- H. Timber Framing
1. Provide wood beams and girders of size and spacing shown.
  2. Install beams with crown side up and provide not less than 4" bearing on supports.
  3. Provide continuous members unless shown otherwise; tie together over supports if not continuous.
  4. Where beams are framed into pockets of exterior concrete or masonry, provide 1/2" of space between sides and ends of beam and walls.
  5. Where built-up beams of nominal 2" dimension lumber on edge are shown, fasten together with 2 rows of 20 nails spaced not less than 32" o.c. top and bottom.
- I. Board Sheathing and Sub-flooring:
1. Install boards with end joints staggered over supports and with each piece spanning at least 3 supports.
  2. Nail with 8 common nails, 2 per support for boards 6" or less and 3 per boards over 6" wide.
  3. Apply at 45 deg. angle with supports.
  4. Cover sheathing with building paper, lapped minimum 4" and nailed with roofing nails.
- J. Glass Fiber Board Sheathing:
1. Comply with manufacturer's directions for application.
  2. Apply with long edges parallel to studs and with edges centered over studs and contacting.
- K. Plastic Board Sheathing:
1. Comply with manufacturer's directions for application.
  2. Provide vapor relief strips or equivalent for permitting escape of any moisture that otherwise would be trapped in stud cavity.
- L. Gypsum Wall Sheathing:
1. Apply 2' x 8' sheathing with long edges at right angles to studs with grooved edge down.
  2. Apply 2' x 8' and long sheathing with long edges parallel to studs.
  3. Center joints over supports with 2' x 8' sheets end joints staggered.
  4. Fasten with 1-1/2" long x 11 gauge galvanized roof nails with 3/8" heads or 15 gauge divergent point galvanized staples 1/2" x 1-1/2" long.
  5. Provide not less than 4 fasteners per 2 ft. Width of sheathing in each stud in framing that is diagonally braced and, provide 7 fasteners per 2 ft. Width of sheathing in walls not diagonally braced.
  6. Keep perimeter fasteners 3/8" from edge of sheathing.

- M. Fiber Board Sheathing:
1. Drive fasteners flush with surface of sheathing and locate perimeter fasteners 3/8" from edge of sheathing.
  2. For 1/2" sheathing use 11 gauge galvanized roofing nails with 3/8" heads and 1-1/2" long, or 16 gage galvanized staples with 7/16" crown and 1-1/8" long.
  3. For 25/32" sheathing use 11 gage galvanized roofing nails with 3/8" heads and 1-3/4" long or 16 gage galvanized staples with 7/16" crown and 1-1/2" long.
  4. Install 2' x 8' sheathing with long edges at right angles to studs with grooved edge down.
  5. Install 4' x 8' sheathing with long edges parallel to and centered over studs.
  6. Allow 1/8" open space between edges and ends of adjacent units, and stagger end joints.
  7. Space fasteners not more than 3" o.c. around perimeter and 6" o.c. at intermediate supports.

**END OF SECTION 06 10 00**

## **SECTION 06 20 00 - FINISH CARPENTRY**

### **PART 1 - GENERAL**

#### **1.01 RELATED DOCUMENTS**

Drawings, Technical Specifications, TSUS construction specifications Division 1, TSUS uniform general conditions for construction contract, safety requirements of OSHA and prevailing building codes & city, state and county.

#### **1.02 DESCRIPTION OF WORK**

- A. Definition: Finish carpentry includes carpentry work which is exposed to view, is nonstructural, and which is not specified as part of other sections.
- B. Types of finish carpentry work in this section include:
  - 1. Exterior running and standing trim
  - 2. Interior running and standing trim
  - 3. Siding, board type
  - 4. Plywood soffits and panels
  - 5. Pre-finished plywood paneling
  - 6. Pre-finished hardwood paneling, board type
  - 7. Softwood paneling system, board type
- C. Plywood siding is specified in a Division 7 section.
- D. Rough carpentry is specified in another Division 6 section.
- E. Builders hardware and wood doors are specified in Division 8 sections.
- F. Architectural woodwork is specified in another Division 6 section.

#### **1.03 QUALITY ASSURANCE**

- A. Factory-mark each piece of lumber and plywood with type, grade, mill and grading agency identification; except omit marking from surfaces to receive transparent finish, and submit mill certificate that material has been inspected and graded in accordance with requirements if it cannot be marked on a concealed surface.
- B. Fire Retardant Marking: Mark each unit of fire-retardant treated lumber and plywood with classification marking of Underwriters Laboratory, Inc., or other testing and inspecting agency acceptable to authorities having jurisdiction. Place marking on surfaces which will not be exposed after installation.

#### **1.04 SUBMITTALS**

- A. Product Data: Submit manufacturer's specifications and installation instructions for each item of factory fabricated siding and paneling.
- B. Samples: Submit the following samples for each species and cut or pattern of finish carpentry.
  - 1. Exterior standing and running trim: 2'-0" long x full board or molding width, finished on one side and one edge.
  - 2. Interior standing and running trim: 2'-0" x full board or molding width, unfinished.
  - 3. Siding: 2'-0" long, finished on one side and one edge.

4. Exterior plywood, for transparent finish: 2'-0" long x panel width, finish applied to upper half of each piece.
  5. Board-type paneling: 2'-0" long x full board width
  6. Plywood paneling: 2'-0" long x panel width.
- C. Wood Treatment Data: Submit chemical treatment manufacturer's instructions for handling, storage, installation and finishing treated materials.
1. Dip Treatment: For each type specified, include certification by treating plant stating chemical solutions used, submersion period and conformance with specified standards.
  2. Fire Retardant Treatment: Include certification by treating plant indicating type of chemical used and fire performance characteristics achieved.

#### **1.05 PRODUCT DELIVERY, STORAGE AND HANDLING**

- A. Protect finish carpentry materials during transit, delivery, storage and handling to prevent damage, soiling and deterioration.
- B. Do not deliver finish carpentry materials, until painting, wet work, grinding and similar operations which could damage, soil or deteriorate woodwork have been completed in installation areas. If, due to unforeseen circumstances, finish carpentry materials must be stored in other than installation areas, store only in areas meeting requirements specified for installation areas.

#### **1.06 JOB CONDITIONS**

- A. Conditioning: Installer shall advise Contractor of temperature and humidity requirements for finish carpentry installation areas. Do not install finish carpentry until required temperature and relative humidity conditions have been stabilized and will be maintained in installation areas.
- B. Maintain temperature and humidity in installation area as required to maintain moisture content of installed finish carpentry within a 1.0 percent tolerance of optimum moisture content, from date of installation through remainder of construction period. The fabricator of woodwork shall determine optimum moisture content and required temperature and humidity conditions.

#### **2.01 WOOD PRODUCT QUALITY STANDARDS**

- A. Softwood Lumber Standards: Comply with PS 20 and with applicable grading rules of the respective grading and inspecting agency for the species and product indicated.
- B. Plywood Standard: Comply with PS 1/ANSI A199.1.
- C. Hardwood Lumber Standard: Comply with National Hardwood Lumber Association (NHLA) rules.
- D. Hardwood Plywood Standard: Comply with PS 51.
- E. Woodworking Standard: Where indicated for a specific product comply with specified provision of the following:
  1. Architectural Woodwork Institute (AWI) "Quality Standard"
- F. Glued-up Lumber Standard: Comply with PS 56.

## PART 2 - PRODUCTS

### 2.02 MATERIALS - GENERAL

- A. Nominal sizes are indicated, except as shown by detailed dimensions. Provide dressed or worked and dressed lumber, as applicable, manufactured to the actual sizes as required by PS 20 or to actual sizes and patterns as shown, unless otherwise indicated.
- B. Moisture Content of Softwood Lumber: Provide seasoned (KD) lumber having a moisture content from time of manufacture until time of installation not greater than values required by the applicable grading rules of the respective grading and inspecting agency for the species and product indicated.
- C. Moisture Content of Hardwood Lumber: Provide kiln dried (KD) lumber having a moisture content from time of manufacture until time of installation within the ranges required in the referenced woodworking standard.
- D. Lumber for Transparent Finish (Stained or Clear): Use pieces made of solid lumber stock.
- E. Lumber for Painted Finish: At Contractor's option, use pieces which are either glued-up lumber or made of solid lumber stock.
- F. For exterior finish carpentry work use glued-up lumber complying with PS 56 for "wet use" and certified so by respective grading and inspecting agency for species and product indicated.
- G. Hardwood Plywood Stock Panels: Provide manufacturer's stock hardwood plywood panels complying with applicable requirements of PS 51 for species and grade of face veneers and backing, adhesive, construction, thickness, panel size and finish.
  - Face Veneer Species: Rotary Cut Natural Birch
  - Face Veneer Species: Plain sliced Red Oak
  - Face Veneer Species: Plain sliced American Walnut
  - Grade: Premium
  - Grade: Good
- H. Backing Veneer Species: Any hardwood compatible with face species.
  - Grade: Same as face grade
  - Grade: Sound
  - Construction: Lumber core
  - Construction: Veneer core
  - Construction: Medium density fiberboard core (MDF)
  - Construction: Plywood core; Grade 1-M-1, 1-M-2, 1-M-3 to comply with ANSI A208.1.
  - No. of Plies: 3
  - No. of Plies: 5
  - No. of Plies: 7
  - Thickness: 1/4"
  - Thickness: 1/2"
  - Thickness: 3/4"
  - Panel Size: 48" x 96"
  - Panel Size: 48" x 120"
  - Plywood Type (Water Resistance Capability): Type I

(Exterior).

Plywood Type (Water Resistance Capability): Type II

(Interior)

Face Pattern: Plain (no grooves) with veneer edge matched within each panel face to comply with type of match required by referenced product standard.

Face Pattern: V-grooved, standard random pattern with edge grooved and grooves at center of panel and at third points of panel.

Face Veneer Matching (panel-to-panel): No match

Face Veneer Matching (panel-to-panel): Sequence matched from one or similar flitches at required by quantity of panels.

Finish: Polish sanded

Finish: Pre-finished with manufacturer's standard clear factory finish.

- I. Pre-finished Hardwood Paneling, Board Type: Subject to compliance with requirements, provide tongued-and-grooved, end matched, pre-finished solid hardwood paneling of random widths and lengths, milled to standard pattern indicated from kiln-dried lumber as manufactured by Potlatch Corporation under product name "Townsend Wall Planks"; in line, species and other qualities listed below:

Standard Line: V-grooved pattern, 1/2" thick, unstained (clear) finish.

Species: Ash

Species: Cherry

Species: Pecan

Species: Red Oak

Species: American Walnut

Grade: Select

Grade: Colonial

Gregorian Line: Channel-groove pattern; thickness as indicated with species; stained finish, colonial grade.

Species: Ash, 3/4" thick

Species: White and Red Oak mixed, 3/4" thick

Species: Roughsawn American Walnut, 1/2" thick

Carriage House Line: V-groove pattern, 3/4" thick, stained finish.

Species: Ash

Species: White and Red Oak mixed

Finish: Two topcoats of baked-on alkyd-urea varnish.

Provide surface texture and color as indicated or, if not indicated, as selected from manufacturer's standard finishes for line selected; with flame-spread rating of 200 or less as per ASTM E 84.

## 2.03 MISCELLANEOUS MATERIALS

- A. Fasteners and Anchorage's: Provide nails, screws and other anchoring devices of the type, size, material, and finish required for application indicated to provide secure attachment, concealed where possible, and complying with applicable Federal Specifications.
1. Where finish carpentry is exposed on exterior or in areas of high relative humidity, provide fasteners and anchorages with a hot-dipped zinc coating (ASTM A 153).



- B. Screens for Soffit Vents: Provide wire cloth, 18 x 14 mesh of 0.013 diameter aluminum wire, complying with FS RR-W-365, Type VII; except black anodized "gun metal" coating on wire.  
Screen for Soffit Vents: 18 x 16 or 18 x 14 mesh of plastic coated fiber threads, complying with FS L-S-125, with black or dark gray finish.

## 2.04 WOOD TREATMENT

- A. Preservative Treatment (Trt-Ws): Following basic fabrication provide 3-minute dip treatment of finish carpentry items indicated to receive preservative treatment in 5 percent solution of pentachlorophenol, with vehicle which will not interfere with finish application and will produce minimum effect upon appearance. Apply brush coat on surfaces cut after treatment.
- B. Fire-Retardant Treated Wood (FRTW): Where wood is indicated as "FRTW", provide material complying with applicable standards for pressure impregnation with fire retardant chemicals and with following requirements.
  - 1. AWWPA Standard for Lumber: AWWPA / 2 except as otherwise indicated.
  - 2. AWWPA Standard for Plywood: AWWPA C27 except as otherwise indicated.
  - 3. Surface Burning Characteristics: Provide materials with surface burning characteristics not exceeding those indicated below when tested in accordance with ASTM E 84 for not less than standard time period (10 minutes).
    - a) Flame Spread: 25.
  - 4. For FRTW wood exposed to exterior, use treatment chemicals and process which show no increase in surface burning characteristics when tested in accordance with ASTM D 2898, Method A (Standard Rain Test).
    - a) Product: Subject to compliance with requirements provide "NCX" by Koppers Co., Inc. or "Exterior Firex" by Hoover Universal, Inc.
  - 5. For FRTW wood used in interior applications not exposed to relative humidities in excess of 92% use treatment chemicals with reduced hygroscopicity which are non-corrosive to metal fasteners, are non-blooming and permit use of transparent oil based finishes.
    - a) Products: Subject to compliance with requirements, provide one of the following:
      - 1) "Dricon"; Koppers Company, Inc.
      - 2) "Flameproof LHC" Osmose Wood Preserving Co. of America, Inc.
      - 3) "Protex"; Hoover Universal Wood Preserving Division.
  - 6. Kiln-dry wood after treatment to a maximum moisture content of 15% for plywood, 19% for lumber.
  - 7. Inspect each piece of lumber and plywood or each unit of finish carpentry after drying; do not use twisted, warped, bowed or otherwise damaged or defective wood.

## PART 3 - EXECUTION

### 3.01 PREPARATION

- A. Condition wood materials to average prevailing humidity conditions in installation areas prior to installing.

- B. Back prime lumber for painted finish exposed on the exterior or, where indicated, to moisture and high relative humidity on the interior. Comply with requirements of section on painting within Division 9 for primers and their application.
- C. Pre-installation Meeting: Meet at project site prior to delivery of finish carpentry materials and review coordination and environmental controls required for proper installation and ambient conditioning in areas to receive work. Include in meeting the Contractor, Engineer and Owner Representatives (if any), Installers of finish carpentry, wet work including plastering, other finishes, painting, mechanical work and electrical work, and firms and persons responsible for continued operation (whether temporary or permanent) of HVAC system as required to maintain temperature and humidity conditions. Proceed with finish carpentry on interior only when everyone concerned agrees that required ambient conditions can be properly maintained.

### **3.02 INSTALLATION**

- A. Discard units of material which are unsound, warped, bowed, twisted, improperly treated, not adequately seasoned or too small to fabricate work with minimum of joints or optimum jointing arrangements, or which are of defective manufacturer with respect to surfaces, sizes or patterns.
- B. Install the work plumb, level, true and straight with no distortions. Shim as required using concealed shims. Shim as required using concealed shims. Install to a tolerance of 1/8" in 8'0" for plumb and level countertops; and with 1/16" maximum offset in flush adjoining 1/8" maximum offsets in revealed adjoining surfaces.
- C. Scribe and cut work to fit adjoining work, and refinish cut surfaces or repair damaged finish at cuts.
- D. Standing and Running Trim: Install with minimum number of joints possible, using full-length pieces (from maximum lengths of lumber available) to the greatest extent possible. Stagger joints in adjacent and related members. Cope at returns, miter at corners, to produce tight fitting joints with full surface contact throughout length of joint. Use scarf joints for end-to-end joints.
  - 1. Make exterior joints water-resistant by careful fitting.
  - 2. Apply flat grain lumber with bark side exposed to weather.
- E. Fire-Retardant Treated Wood (FRTW): Handle, store and install in accordance with manufacturer's directions and as required to meet required classification or rating. Provide special fasteners, molding, adhesives and other accessories as tested and listed for type of fire-retardant materials indicated.
- F. Anchor finish carpentry work to anchorage devices or blocking built-in or directly attached to substrates. Secure to grounds, stripping and blocking with countersunk, concealed fasteners and blind nailing as required for a complete installation. Except where pre-finished matching fasteners heads are required, use fine finishing nails for exposed nailing, countersunk and filled flush with finished surface, and matching final finish where transparent is indicated.
  - 1. Attach siding to framing to comply with siding manufacturer's instructions including requirements for type, size, materials, location and spacing of fasteners.
- G. Hardwood Plywood Paneling: Where grain character or color variations are noticeable, select and arrange panels on each wall for best match of adjacent panels. Install with uniform tight joints between panels.

1. Attach panels to supports with panel adhesive and temporary bracing or fasteners, plus nailing where covered by moldings (if any), in accordance with manufacturer's instructions for concealed-fastener installation.
  2. Arrange panels with V-groove and joints over supports, and nail with type and spacing of fasteners recommended by panel manufacture, with pre-finished heads on fasteners selected to match V-groove color.
  3. Apply panel adhesive on supports, immediately prior to panel placement and nailing.
- H. Pre-finished Hardwood Paneling, Board Type: Install in accordance with manufacturer's instructions for concealed nailing. Arrange in random-width pattern suggested by manufacturer, unless boards are of uniform width. Stagger end joints in random pattern for best visual effect (uniformly distributed on each wall). Install with uniform joints, with only tongued-and-grooved or end-matched joints within each field of paneling.
1. Where grain character and color of boards vary noticeably, select and arrange boards for best visual effect as directed by the Engineer.
- I. Softwood Paneling System, Board Type: Install in accordance with manufacturer's instructions by method indicated below, or if not indicated, as recommended by manufacturer for substrate provided.
1. Fasten paneling to wood substrates using manufacturer's concealed clip system.
  2. Fasten paneling to gypsum wallboard substrates using adhesives.

### **3.03 ADJUSTMENT, CLEANING, FINISHING AND PROTECTION**

- A. Repair damaged and defective finish carpentry work wherever possible to eliminate defects functionally and visually where not possible to repair properly, replace woodwork. Adjust joinery for uniform appearance.
- B. Clean finish carpentry work on exposed and semi-exposed surfaces. Tough-up shop applied finishes to restore damaged or soiled areas.
- C. Refer to Division 9 sections for final finishing of installed finish carpentry work.
- D. Protection: Installer of finish carpentry work shall advise Contractor of final protection and maintained conditions necessary to ensure that work will be without damage or deterioration at time of acceptance.

**END OF SECTION 06 20 00**

## **SECTION 06 40 23 - ARCHITECTURAL WOODWORK**

### **PART 1 - GENERAL**

#### **1.01 RELATED DOCUMENTS**

Drawings, Technical Specifications, TSUS construction specifications Division 1, TSUS uniform general conditions for construction contract, safety requirements of OSHA and prevailing building codes & city, state and county.

#### **1.02 DESCRIPTION OF WORK**

Extent of architectural woodwork is shown on drawings and include the following:

- A. Casework for transparent finish.
- B. Plastic laminate counter tops.
- C. Wood shelving.
- D. Wood paneling.

#### **1.03 QUALITY ASSURANCE**

- A. Comply with specified provisions of Architectural Woodwork Institute "Quality Standards".
- B. Mark each unit of architectural woodwork with mills or fabricators identification and grade mark, located on surfaces which will not be exposed to view.

#### **1.04 SUBMITTALS**

- A. Submit shop drawings showing location of each item, dimensioned plans and elevation, large scale details, attachment devices and other components.
- B. Submit shop drawings for the following:
  - 1. Casework.
  - 2. Shelving.

#### **1.05 DELIVERY, STORAGE AND HANDLING**

- A. Protect woodwork during transit, deliver, storage and handling to prevent damage, soiling or deterioration.
- B. Do not deliver woodwork until wet work, grinding and similar operations which could damage or soil woodwork have been completed in installation area.
- C. If woodwork must be stored in other than installation area, store only in areas meeting requirements specified for the installation area.

#### **1.06 JOB CONDITIONS**

- A. Advise Contractor of temperature and humidity requirements.
- B. Do not install woodwork until required temperature and humidity have been stabilized in installation area and will remain until completion of job.

### **PART 2 - PRODUCTS**

#### **2.01 BASIC MATERIALS AND FABRICATION METHODS**

- A. Except as otherwise noted, comply with following requirements for architectural woodwork.

- B. Provide kiln-dried lumber with an average moisture content of 9% to 13% for exterior work and 6% to 11% for interior work.
- C. Maintain temperature and humidity during fabrication, storage and finishing operations so that moisture content values for woodwork at time of installation do not exceed the following:
  - 1. Interior Wood: 8% - 13% for damp region as defined by AWI.
  - 2. Exterior Wood: 9% - 14% for damp region as defined by AWI.
- D. Interior Wood for Transparent Finish:
  - 1. Solid Wood: Unselected Birch complying with requirements for specified woodwork grade.
  - 2. Plywood: Unselected Birch plywood with exterior glue complying with requirements for specified woodwork grade.
- E. Plastic Laminate: Premium grade to comply with NEMA LD-3; type, thickness, color, pattern and finish as indicated for each application.
- F. Comply with indicated standards for the following types of architectural woodwork:
  - 1. Wood Casework: WIC Section 14.
  - 2. Plastic Laminate Counter tops: WIC Section 16.
  - 3. Shelving: WIC Section 11.
  - 4. Miscellaneous Work: WIC Section 11.
- G. For design and construction features comply with details shown for profile and construction of woodwork or comply with applicable quality standards.
- H. Fabricate woodwork with precut openings to receive hardware, appliances, plumbing fixtures, electrical work and similar items.
- I. Locate openings accurately and use templates or rough-in diagrams for proper size and shape.
- J. Smooth edges of cutoffs and where located in counter tops and similar exposures, seal edges of cut outs with a water-resistant coating.
- K. Before proceeding with fabrication of woodwork that will be fitted to other construction, obtain and verify dimension as required for accurate fit.
- L. Fabricate exposed edges of plywood of woodwork with hardwood bands matching face veneer of plywood.

## 2.02 CASEWORK

- A. Mill assemble where space permits.
- B. Use blind fastening where possible.
- C. Glue all joints under pressure with water proof glue.
- D. Provide extended members where scribing will be required.
- E. Install hardware specified in this section at mill.
- F. Do not stain exposed surfaces with glue.
- G. Drawers:
  - 1. Dado fronts to receive sides and bottom.
  - 2. Dado sides to receive back and bottom.
  - 3. 3/4" solid back.
  - 4. 1/4" marlite bottoms (white).
- H. Provide 1/2" plywood cabinet backs.
- I. Hardware
  - 1. Adjustable shelf standards equal to K & V No. 85.
  - 2. Adjustable shelf supports equal to K & V No. 185.

3. Drawer slides equal to K & V No. 1300.
4. Cabinet pulls and hinges furnished under Hardware Allowance.

### **2.03 PLASTIC LAMINATE**

- A. 1/16" Premium grade Formica or equal in wood grains, patterns and solid colors as selected by Engineer.
- B. See drawings for tops that have covered splashes.
- C. Apply with adhesive as recommended by manufacturer.

### **2.04 SHELVING**

- A. 3/4" thick unselected birch or BC fir plywood.
- B. Bond exposed edges with 1/4" x 3/4" hardwood.
- C. See plan for widths.
- D. Mount on 1 x 2 continuous cleats.

### **2.05 PLYWOOD PANELING**

- A. Paneling will be selected by the Engineer.

## **PART 3 - EXECUTION**

### **3.01 INSTALLATION**

- A. Install work plumb, level, true and straight with no distortions.
- B. Shim as required using concealed shims.
- C. Install to a tolerance of 1/8" in 8'0" for plumb and level, with 1/16" maximum offset in flush adjoining surface; and 1/8" offsets in revealed adjoining surfaces.
- D. Scribe and cut to fit adjoining work, and refinish cut surfaces or repair damaged finish at cuts.
- E. Casework:
  1. Install without distortion so that doors and drawers will fit openings properly and be accurately aligned.
  2. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation.
  3. Complete the installation of hardware and accessory items as indicated.
- F. Counter tops: Anchor securely to base units and other support systems as indicated.
- G. Shelving: Complete the assembly of units and install in the areas indicated, including hardware and accessories as indicated.
- H. See shop drawings for application of plywood paneling.

### **3.02 CLEANING, FINISHING AND PROTECTION**

- A. Completely clean casework of all debris, stains, dirt, labels, etc., before final acceptance of work.
- B. Refer to Division 9 Sections for finishing of installed casework.
- C. Advise contractor of final protection and maintained conditions necessary to ensure that work will be without damage or deterioration at time of acceptance.

## **END OF SECTION 06 40 23**

## **SECTION 07 19 00 - WATER REPELLENTS**

### **PART 1 - GENERAL**

#### **1.01 RELATED DOCUMENTS**

Drawings, Technical Specifications, TSUS construction specifications Division 1, TSUS uniform general conditions for construction contract, safety requirements of OSHA and prevailing building codes & city, state and county.

#### **1.02 DESCRIPTION OF WORK**

- A. Extent of surfaces to receive water repellent is shown on drawings and by provisions of this section.
- B. Following surfaces require water repellent:
  - 1. Exterior masonry.
  - 2. Exterior cement plaster or stucco.

#### **1.03 JOB CONDITIONS**

- A. Do not proceed with application of water repellent, except with written recommendation of manufacturer, when ambient temperature is less than 50° F. (10 ° C)
- B. Do not apply to surfaces that have cured less than a period of two months.
- C. Do not proceed with application when rain or temperature below 40° F (4° C) are predicted for a period of 24 hours, or earlier than 3 days after surfaces became wet.
- D. Do not apply to frozen surfaces.

### **PART 2 - PRODUCTS**

#### **2.01 MATERIALS**

- A. Duracone as manufactured by Grace Construction Materials.
- B. Prime-A-Pel 200 as manufactured by Chemprobe Co.
- C. Approved equal.

### **PART 3 - EXECUTION**

#### **3.01 INSPECTION**

- A. Examine substrate and conditions under which water repellent is to be applied and advise contractor in writing of unsatisfactory conditions.
- B. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to installer.

#### **3.02 PREPARATION**

- A. Prior to performance of water repellent work, prepare a small area in an unobtrusive location to demonstrate final effect for Architect's review.
- B. Proceed with work only After Architect's review of test application.
- C. Clean substrate of substances which might interfere with penetration of adhesion of water repellent.

- D. Test for moisture content in accordance with manufacturer's instructions to ensure that surfaces are sufficiently dry to receive repellent.
- E. Where feasible, apply repellent after installation of sealant in joints adjoining surfaces.
- F. Protect adjoining work, including sealant bond surfaces aluminum, glass, etc., from spillage or blow-over of repellent.
- G. Cover live plants with drop cloth.
- H. Clean repellent from adjoining surfaces immediately after spillage.
- I. Comply with manufacturer's directions for cleaning.

### **3.03 INSTALLATION**

- A. Comply with manufacturer's recommendations, using airless spraying procedure.
- B. Apply heavy coat of repellent to point of refusal.
- C. Apply second coat after first coat has dried but not less than 3 hours after its application.
- D. Consult manufacturer's technical representative if printed recommendations are not applicable to job conditions.

**END OF SECTION 07 19 00**



## **SECTION 07 21 00 - INSULATION**

### **PART 1 - GENERAL**

#### **1.01 RELATED DOCUMENTS**

Drawings, Technical Specifications, TSUS construction specifications Division 1, TSUS uniform general conditions for construction contract, safety requirements of OSHA and prevailing building codes & city, state and county.

#### **1.02 DESCRIPTION OF WORK**

- A. Extent of work of this section is shown on drawings.
- B. Application of insulation specified in this section include the following:
  - 1. Blanket type building insulation.
  - 2. Sound Insulation.
  - 3. Cavity wall insulation.

#### **1.03 QUALITY ASSURANCE**

- A. Where insulation is identified by "R" or "U" value, provide appropriate thickness.
- B. Comply with fire-resistance, flammability and insurance ratings indicated, and comply with governing regulations as interpreted by authorities.

#### **1.04 SUBMITTALS**

- A. If requested, manufacturer's specifications and installation instructions for each type of insulation required.
- B. If requested, furnish affidavit from manufacturer certifying that materials used meet the requirements specified.

#### **1.05 PRODUCT HANDLING**

- A. Do not allow materials to become wet, soiled, or covered with ice or snow.
- B. Comply with manufacturer's recommendations for handling storage and protection during installation.

### **PART 2 - PRODUCTS**

#### **2.01 MATERIALS**

- A. Thermal insulation
  - 1. Thermafibre Blankets as manufactured by United States Gypsum Co.
  - 2. Kraft-Face Fiberglass Blankets as manufactured by Johns-Manville.
  - 3. Kraft-Face Fiberglass Blankets as manufactured by Owens-Corning.
- B. Sound Insulation
  - 1. Commercial Wall Insulation Batts, 3-1/2" thick as manufactured by Owens Corning.
  - 2. Premium Sound Attenuation Batts, 2.5 Density 3-1/2" thick as manufactured by Rockwool Industries, Inc.
  - 3. Sound Control Batts 3-1/2" thick as manufactured by Johns-Manville.

- C. Cavity Wall Insulation:
  - 1. Relecto-Foam, 1" reflective sheathing board, foil one side as manufactured by Emerson Plastics.
  - 2. Thermax 1" aluminum foil faced sheathing as manufactured by Celotex Corp.
- D. Mechanical Fasteners: Type and size as recommended by manufacturer for type of application and condition of substrate.
- E. Adhesive and sealant: Non asphalt type as recommended by manufacturer.

### **PART 3 - EXECUTION**

#### **3.01 INSPECTION**

- A. Examine substrate and conditions under which insulation work is to be performed and notify Contractor of unsatisfactory conditions.
- B. Do not proceed with work until unsatisfactory conditions have been corrected.

#### **3.02 INSTALLATION**

- A. General
  - 1. Comply with manufacturer's instructions for particular conditions of installation in each case.
  - 2. Extend insulation full thickness over entire area to be insulated.
  - 3. Remove projections which interfere with placement.
- B. Thermal Insulation
  - 1. Install where shown on plans.
  - 2. Fill entire stud space with insulation.
  - 3. Seek vapor barrier faced units with vapor barrier to warm side of construction.
  - 4. Fit insulation tightly around all obstructions and penetrations and fill voids.
  - 5. Provide permanent placement and support of units.
- C. Sound Insulation
  - 1. Install in walls noted on plans.
  - 2. Fill entire stud space from slab to roof deck.
  - 3. Fit tightly around all obstructions.
- D. Cavity Wall Insulation
  - 1. Apply with adhesive to cavity side of interior concrete masonry wythe from floor slab to roof slab.
  - 2. Seal all punctures with approved sealant.
  - 3. Lap or foil tape all joints.

**END OF SECTION 07 21 00**

## **SECTION 07 26 00 - SHEET WATERPROOFING**

### **PART 1 - GENERAL**

#### **1.01 RELATED DOCUMENTS**

Drawings, Technical Specifications, TSUS construction specifications Division 1, TSUS uniform general conditions for construction contract, safety requirements of OSHA and prevailing building codes & city, state and county.

#### **1.02 DESCRIPTION OF WORK**

Extent of sheet waterproofing is shown on drawings and is hereby defined to include all sheet materials applied with sealed joints and flashing as needed to form concealed waterproof membrane.

#### **1.03 QUALITY ASSURANCE**

- A. Obtain primary materials from a single manufacturer.
- B. Provide secondary materials only as recommended by manufacturer of primary materials.

#### **1.04 SUBMITTALS**

Submit data substantiating that material complies with requirements.

#### **1.05 JOB CONDITIONS**

- A. Proceed with waterproofing work only when existing and forecasted weather conditions will permit work to be performed in accordance with manufacturer's recommendations.
- B. Proceed with work only when substrate construction meets with approval of installer of waterproofing work.

### **PART 2 - PRODUCTS**

#### **2.01 MATERIALS**

- A. General: Provide waterproofing materials recognized to be of generic type indicated or provide other similar materials certified in writing to be equal to specified material.
- B. Membrane Waterproofing:
  - 1. Through wall, lintels and other sheet membrane flashing:
    - a) Nervastral 300 as manufactured by Rubber and Plastics Compound Co., Inc.
    - b) Approved equal.
- C. Adhesive: Nerva-Plast and Nerva-Kote PV 30 as manufactured by Rubber and Plastics Compound Co., Inc.
- D. Primers: Provide type recommended by manufacturer of sheet waterproofing material.

## PART 3 - EXECUTION

### 3.01 INSPECTION

- A. Examine substrate and conditions under which work is to be performed and notify contractor in writing of unsatisfactory conditions.
- B. Do not proceed until conditions acceptable in installer exist.

### 3.02 INSTALLATION

- A. Comply with manufacturer's instructions for handling and installation of waterproofing materials.
- B. Coordinate installation of waterproofing materials and associated work to provide complete system complying with combined recommendations of manufacturers and installers involved in work.
- C. Extend waterproofing sheet and flashing as shown to provide complete membrane over area indicated to be waterproofed.
- D. Seal to projections and penetrations through membrane and seal seams.
- E. Bond to vertical surfaces and also where shown or recommended by manufacturer, bond to horizontal surfaces.

### 3.03 PERFORMANCE REQUIREMENTS

- A. It is required that waterproofing membranes be watertight and not deteriorate in excess of limitations published by manufacturer.
- B. Before completed membranes on horizontal surfaces are covered by protection course or other work, test for leaks with 2" depth of water maintained for 24 hours. Repair any leaks revealed by examination of substructure and repeat test until no leaks are observed.

**END OF SECTION 07 26 00**

**SECTION 07 27 20 - FLUID-APPLIED AIR & WATER-RESISTIVE BARRIER SYSTEM  
FOR NEW CONSTRUCTION**

**PART 1 - GENERAL**

**1.1 SUMMARY:**

- A. Work of this section includes window and door flashing, air and water-resistive barrier membrane system, and accessory materials for application to exterior building envelope substrates as indicated on the drawings.
- B. Related work:
  - 1. Concrete.
  - 2. Masonry.
  - 3. Sheathing.
  - 4. Exterior wall finish materials.
  - 5. Flashings.
  - 6. Joint sealants.
  - 7. Doors and frames.
  - 8. Storefronts.
  - 9. Curtain walls.
  - 10. Windows.
  - 11. Stucco.

**1.2 PERFORMANCE REQUIREMENTS:**

- A. Performance requirements: Comply with the specified performance requirements and characteristics as herein specified.
- B. Performance description:
  - 1. The building envelope shall be constructed with a continuous, air and water-resistive barrier to control water and air leakage into and out of the conditioned space.
  - 2. Joints, penetrations and paths of water and air infiltration shall be made watertight and airtight.
  - 3. System shall be capable of withstanding positive and negative combined wind, stack and HVAC pressures on the envelope without damage or displacement.
  - 4. System shall be installed in an airtight and flexible manner, allowing for the relative movement of systems due to thermal and moisture variations.

**1.3 SUBMITTALS:**

- A. Product data: Submit manufacturer's product data including membrane and accessory material types, technical and test data, composition, descriptions and properties, installation instructions and substrate preparation requirements.
- B. Shop Drawings: Provide Installation Guideline Illustrations.

**1.4 QUALITY ASSURANCE:**

- A. Applicable standards, as referenced herein: ASTM International (ASTM).
- B. Manufacturer's qualifications: Air and water-resistive barrier systems shall be manufactured and marketed by a firm with a minimum of five (5) years' experience in the production and sales of air and water-resistive barrier system.

- C. Manufacturers proposed for use, but not named in these specifications, shall submit evidence of ability to meet all requirements specified, and include a list of projects of similar design and complexity completed within the past five years.
- D. Installer's qualifications: The installer shall demonstrate qualifications to perform the work of this section by submitting the following:
  - 1. Verification that installer has been trained by and is approved to perform work as herein specified by air and water-resistive barrier system manufacturer.
  - 2. A firm experienced in applying similar materials on similar size and scoped projects.
  - 3. Evidence of proper equipment and trained field personnel to successfully complete the project.
- E. Inspection and testing: Cooperate and coordinate with the Owner's inspection and testing agency. Do not cover installed products or assemblies until they have been inspected, tested and approved.
- F. Sole source: Obtain materials from a single manufacturer.
- G. Regulations: Provide products which comply with all state and local regulations controlling use of volatile organic compounds (VOC).
- H. Pre-installation conference: Prior to beginning installation of air and water-resistive barrier system, hold a pre-installation conference to review work to be accomplished.
  - 1. Contractor, Architect, installing subcontractor, membrane system manufacturer's representative, and all subcontractors who have materials penetrating membrane system or finishes covering membrane system shall be present.
  - 2. Contractor shall notify Architect at least seven days prior to time for conference.
  - 3. Contractor shall record minutes of meeting and distribute to attending parties.
  - 4. Agenda: As a minimum discuss:
    - a. Surface preparation.
    - b. Substrate condition and pretreatment.
    - c. Minimum curing period.
    - d. Special details and sheet flashing.
    - e. Sequence of construction, responsibilities, and schedule for subsequent operations.
    - f. Installation procedures.
    - g. Inspection procedures.
    - h. Protection and repair procedures.
    - i. Review and approval of all glazing applications.

**1.5 DELIVERY, STORAGE, AND HANDLING:**

- A. Deliver materials and products in labeled packages. Store and handle in strict compliance with manufacturer's instructions and recommendations. Protect from damage, weather, excessive temperatures and construction operations. Remove damaged material from site and dispose of in accordance with applicable regulations.
- B. Protect air and water-resistive barrier components from freezing and extreme heat.

- C. Sequence deliveries to avoid delays, and to minimize on-site storage.
- 1.6 PROJECT CONDITIONS:**
- A. Weather conditions: Perform work only when existing and forecasted weather conditions are within the limits established by the manufacturer of the materials used.
    - 1. Apply at surface and ambient temperatures recommended by the manufacturer. See manufacturer's product data sheets for best practices.
    - 2. Proceed with installation only when the substrate construction and preparation work are complete and in condition to receive the membrane system.
    - 3. Exposure limitations: Schedule work to ensure that air and water-resistive barrier system is covered and protected from UV exposure within 180 days of installation. If air and water-resistive barrier membrane system cannot be covered within 180 days after installation, apply temporary UV protection as recommended by membrane manufacturer.
- 1.7 WARRANTY:**
- A. Manufacturer's warranty requirements: Submit manufacturer's written warranty stating that installed air and water-resistive barrier materials are watertight, free from defects in material and workmanship, and agreeing to replace defective materials and components.
  - B. Warranty period: Five years from Date of Substantial Completion.

## **PART 2 – PRODUCTS**

### **2.1 MANUFACTURER:**

- A. PROSOCO, Inc, or approved equal.

### **2.2 R-GUARD GYPPRIME WATER BASED PRIMER FOR RAW GYPSUM BOARD EDGES:**

- A. Acceptable product: PROSOCO R-GUARD® GypPrime
- B. Description: GypPrime consolidates and seals the cut edges of gypsum wall boards where they are exposed in rough openings for windows and doors. The sealed edge makes a compatible surface for easy application of R-GUARD Joint & Seam Filler fiber-reinforced fill coat and seam treatment for through-wall components. GypPrime brushes or sprays on easily and is usually dry in 30 minutes.
- C. Characteristics:
  - 1. Form: milky blue liquid, mild odor
  - 2. Specific Gravity: 1.01
  - 3. pH: 8.5
  - 4. Weight per Gallon: 8.41 pounds
  - 5. Active Content: 18 percent
  - 6. Total Solids: 18 percent ASTM-D-2369
  - 7. Volatile Organic Content (VOC): less than 100 grams per Liter

8. Flash point: greater than 212 degrees Fahrenheit (greater than 100 degrees Celsius) ASTM-D-3278
9. Freeze Point: 32 degrees Fahrenheit (0 degrees Celsius)
10. Shelf Life: 1 year in tightly sealed, unopened container

### **2.3 R-GUARD JOINT & SEAM FILLER FIBER REINFORCED FILL COAT AND SEAM FILLER:**

- A. Acceptable product: PROSOCO R-GUARD® Joint & Seam Filler
- B. Description: Joint & Seam Filler is a high modulus, gun-grade, crack and joint filler, adhesive and detailing compound that combines the best silicone and polyurethane properties. This single-component, 99% solids, fiber-reinforced, Silyl-Terminated-Poly-Ether (STPE) is easy to gun, spread and tool.
- C. Characteristics:
  1. Thickness: Apply according to manufacturer's instructions. See product data sheet.
  2. Hardness: Shore A, 45-50 when tested in accordance with ASTM C661.
  3. Water vapor permeability: Minimum 14 perms when tested in accordance with ASTM E-96.
  4. Tensile strength: 225 psi when tested in accordance with ASTM D412.
  5. Lap shear strength: 275 psi when tested in accordance with ASTM D1002.
  6. Elongation at break: 275% when tested in accordance with ASTM D412.
  7. Peel strength: 30 pli when tested in accordance with ASTM D1781.
  8. Shrinkage: None.
  9. Form: pale red, gun-grade sealant
  10. Specific gravity: 1.40 to 1.50
  11. pH: not applicable
  12. Weight per gallon: 11.8 pounds
  13. Active content: 99 percent
  14. Total solids: 99 percent
  15. Volatile organic content (VOC): 30 grams per Liter, maximum
  16. Flash point: no data
  17. Freeze point: no data
  18. Shelf life: 1 year in tightly sealed, unopened container

### **2.4 R-GUARD FASTFLASH® LIQUID-APPLIED FLASHING MEMBRANE**

- A. Acceptable product: PROSOCO R-GUARD® FastFlash®
- B. Description: FastFlash® is a gun-grade waterproofing, adhesive and detailing compound that combines the best of silicone and polyurethane properties. This single component, 99% solids, Silyl-Terminated-Poly-Ether (STPE) is easy to gun, spread and tool to produce a highly durable, seamless, elastomeric flashing membrane in rough openings of structural walls.
- C. Characteristics:
  1. Thickness: Apply according to manufacturer's instructions.
  2. Water vapor permeability: Minimum 14 perms when tested in accordance with ASTM E96.
  3. Water penetration (cyclical static air pressure difference): No uncontrolled water penetration when tested in accordance with ASTM E547.
  4. Hardness: Shore A, 40-45 when tested in accordance with ASTM C661.



5. Tensile strength: 180 psi when tested in accordance with ASTM D412.
6. Elongation at break: 400% when tested in accordance with ASTM D412.
7. Peel strength: 25 pli when tested in accordance with ASTM D1781.
8. Form: Brick Red, Gun Grade Sealant.
9. Specific gravity: 1.45 to 1.60
10. pH: not applicable
11. Weight per gallon: 12.5 pounds
12. Active content: 99 percent
13. Total solids: 99 percent
14. Volatile organic content (VOC): 30 grams per Liter, maximum
15. Flash point: no data
16. Freeze point: no data
17. Shelf life: 1 year in tightly sealed, unopened container

**2.5 R-GUARD CAT 5<sup>®</sup> EXTREME WEATHER AIR AND WATER-RESISTIVE BARRIER:**

- A. Acceptable product: PROSOCO R-GUARD<sup>®</sup> Cat 5<sup>®</sup>
- B. Description: Cat 5<sup>®</sup> Air & Water-Resistive Barrier is a fluid applied, waterproofing and air barrier that combines the best of silicone and polyurethane properties. This single component, 98% solids Silyl-Terminated-Poly-Ether (STPE) is roller applied to produce a highly durable, seamless, elastomeric weatherproofing membrane on structural sheathing and back-up CMU walls. Cat 5<sup>®</sup> is proven to prevent water and air penetration of the building envelope in conditions ranging from everyday weather to the drenching rains and 155 mph winds of a Category 5 hurricane.
- C. Characteristics:
  1. Thickness: Apply in accordance with manufacturer's instructions. See product data sheet.
  2. Air infiltration: Less than 0.004 cfm per square foot (0.02 L/s/sq m) when tested in accordance with ASTM E2178 or ASTM E283.
  3. Water vapor permeability: Minimum 23 perms when tested in accordance with ASTM E96.
  4. Structural performance: Air and water-resistive barrier system shall withstand positive and negative wind pressure loading when tested in accordance with ASTM E330.
  5. Water penetration (static pressure): No uncontrolled water penetration when tested in accordance with ASTM E331, with differential static pressure not less than 6.24 psf.
  6. Water penetration (cyclical static air pressure difference): No uncontrolled water penetration when tested in accordance with ASTM D547.
  7. Hardness: Shore A, 20-25 when tested in accordance with ASTM C661.
  8. Tensile strength: 110 psi when tested in accordance with ASTM D412.
  9. Elongation at break: 300% when tested in accordance with ASTM D412.
  10. Peel strength: 30 pli when tested in accordance with ASTM D1781 or C794.
  11. Shrinkage: None.
  12. Form: adobe brown heavy liquid
  13. Specific gravity: 1.5 to 1.7
  14. pH: not applicable

15. Weight per gallon: 13.312 pounds
16. Active content: 98 percent
17. Total solids: 98 percent
18. Volatile organic content (VOC): 30 grams per Liter, maximum
19. Flash point: greater than 200 degrees Fahrenheit (greater than 93 degrees Celsius)
20. Freeze point: not applicable
21. Shelf life: 1 year in tightly sealed, unopened container

**2.6 R-GUARD AIRDAM® AIR AND WATERPROOF SEALANT FOR WINDOWS AND DOORS:**

- A. Acceptable product: PROSOCO R-GUARD® AirDam®
- B. Description: AirDam® is a medium modulus sealant that combines the best silicone and polyurethane properties. This single component, 98% solids Silyl-Terminated-Poly-Ether (STPE) is easy to gun and tool in all weather conditions. AirDam® cures quickly to produce a durable, high performance, high movement elastomeric interior air sealant
- C. Characteristics:
  1. Hardness: Shore A, 20-25 when tested in accordance with ASTM C661.
  2. Tensile strength: 110 psi when tested in accordance with ASTM D412.
  3. Elongation at break: 1300% when tested in accordance with ASTM D412.
  4. Peel strength: 30 pli when tested in accordance with ASTM D1781.
  5. Type: Type S, Grade NS, Class 50 when tested in accordance with ASTM C920.
  6. Shrinkage: None.
  7. Form: heavy white paste, mild odor
  8. Specific gravity: 1.3 to 1.4
  9. pH: not applicable
  10. Weight per gallon: 11.648 pounds
  11. Active content: 98 percent
  12. Total solids: 98 percent
  13. Volatile organic content (VOC): 30 grams per Liter, maximum
  14. Flash point: greater than 200 degrees Fahrenheit (greater than 93 degrees Celsius)
  15. Freeze point: not applicable
- D. Shelf life: 1 year in tightly sealed, unopened container  
 Backer rod: Compressible, closed cell rod stock as recommended by manufacturer for compatibility with sealant. Provide size and shape of rod to control joint depth.

**PART 3 - EXECUTION**

**3.1 EXAMINATION:**

- A. Verify that surfaces and conditions are ready to accept the Work of this section. Notify design professionals in writing of any discrepancies. Commencement of the Work or any parts thereof shall mean acceptance of the prepared substrates.

- B. All surfaces must be sound, clean and free of grease, dirt, excess mortar or other contaminants. Fill or bridge damaged surfaces, voids or gaps larger than one-half (1/2) inch with mortar, wood, metal, sheathing or other suitable material, as necessary. Fill voids and gaps measuring one-half (1/2) inch or less with R-GUARD Joint & Seam Filler as necessary to ensure continuity.
  - 1. Surfaces to receive R-GUARD Spray Wrap, MVP, TMVP and VB may be dry or damp. Do not apply to surfaces which are sufficiently wet to transfer water to the skin when touched. Surfaces must be protected from rain for 2 hours following application.
  - 2. Surfaces to receive R-GUARD Cat 5®, FastFlash®, Joint & Seam Filler, and AirDam® may be dry, damp or wet to the touch. Brush away any standing water which may be present before application. The products will tolerate rain immediately after application
- C. Where curing materials are used, they must be clear resin based without oil, wax or pigments
- D. Condition materials to room temperature prior to application to facilitate extrusion and handling.

### **3.2 SURFACE PREPARATION:**

- A. Air, water-resistive and waterproofing membrane and accessories may be applied to green concrete 16 hours after removal of forms.
- B. Refer to manufacturer's product data sheets for requirements for condition of and preparation of substrates.
  - 1. Surfaces shall be sound and free of voids, spalled areas, loose aggregate and sharp protrusions.
  - 2. Remove contaminants such as grease, oil and wax from exposed surfaces.
  - 3. Remove dust, dirt, loose stone and debris.
  - 4. Use repair materials and methods that are acceptable to manufacturer of the air and water-resistive barrier system.
  - 5. The PROSOCO R-GUARD® product line includes several options for preparing structural walls to receive the primary air and water resistive barrier. Refer to manufacturer's product data sheets and R-GUARD Installation Guidelines for additional information.
- C. Exterior sheathing:
  - 1. Ensure that sheathing is properly installed with ends, corners and edges properly fastened.
  - 2. Mechanical fasteners used to secure sheathing boards or penetrate sheathing boards shall be set flush with sheathing, fastened and spotted with R-GUARD Joint & Seam Filler and fastened into solid backing.
  - 3. Consolidate and seal the cut edges of gypsum wall boards exposed in rough openings for windows and doors at corners. The treated edge provides a suitable surface for application of R-GUARD Joint & Seam Filler fiber-reinforced coat and seam treatment.
- D. Masonry and concrete substrates:
  - 1. Masonry head and bed joints should be fully filled and tooled.

2. Mechanically remove loose mortar fins, mortar accumulations and protrusions, and debris.

### **3.3 INSTALLATION OF JOINT TREATMENT(PREPARE):**

- A. Apply R-GUARD Joint & Seam Filler for seams, joints, cracks, gaps, primed rough gypsum edges at sheathing, rough openings:
  1. Fill or repair cracks larger than one-half inch.
  2. Fill surface defects and over driven fasteners with R-GUARD Joint & Seam Filler.
  3. Using a dry knife, trowel or spatula, tool and spread the product. Spread one inch beyond seam at each side to manufacturer's recommended thickness. See product data sheet.
  4. Allow to skin before installing other waterproofing or air barrier components.
  5. Apply in accordance with manufacturer's Application Guideline illustrations.

### **3.4 R-GUARD FASTFLASH® FLASHING AT WINDOWS, DOORS, OPENINGS AND PENETRATIONS (PREPARE):**

- A. Apply R-GUARD FastFlash® over surfaces prepared with R-GUARD Joint & Seam Filler to seal and waterproof rough openings:
  1. Apply a thick bead of R-GUARD FastFlash® over any visible gaps in the prepared rough opening.
  2. Immediately press and spread the wet product into gaps.
  3. Allow treated surface to skin.
  4. Starting at the top, apply a thick bead of R-GUARD FastFlash® in a zigzag pattern to the structural wall surrounding the rough opening.
  5. Spread the wet product to create an opaque, monolithic flashing membrane which surrounds the rough opening and extends 4 to 6 inches over the face of the structural wall. Apply and spread additional product as needed to create an opaque, monolithic flashing membrane free of voids and pin holes.
  6. Apply additional product in a zigzag pattern over a structural framing inside the rough opening.
  7. Apply R-GUARD FastFlash® within temperature and weather limitations as required by manufacturer.
  8. Apply R-GUARD FastFlash® to perimeters, sills and adjacent sheathing and building face, in accordance with manufacturer's product data sheet and R-GUARD Installation Guidelines illustrations.
  9. Extend flashing onto building face 4 to 6 inches.
  10. Install preparation products in accordance with manufacturer's Application Guideline illustrations.

### **3.5 R-GUARD AIR & WATER-RESISTIVE BARRIER INSTALLATION (PROTECT)**

- A. Apply appropriate R-GUARD air and water-resistive barrier to a clean, dry substrate (clean, dry, and/or damp substrates – R-GUARD Cat 5® waterproofing air-barrier membrane), within temperature and weather limitations as required by manufacturer.

1. Apply to recommended thickness. Proper thickness is achieved when coating is opaque.
2. Allow product to cure and dry.
3. Inspect membrane before covering. Repair any punctures, translucent or damaged areas by applying additional material.
4. Specifier Note: If air or surface temperature exceed 95 degrees Fahrenheit (35 degrees Celsius), apply to shaded surfaces and before daytime air and surface temperatures reach their peak.
5. On CMU wall construction back roll as necessary to ensure there are no pinholes, voids or gaps in the membrane. Do not back roll R-GUARD TMVP. R-GUARD Cat 5<sup>®</sup> is roller applied.

### **3.6 R-GUARD FLASHING TRANSITIONS (TRANSITION)**

- A. Apply R-GUARD Joint & Seam Filler and R-GUARD FastFlash<sup>®</sup> as a liquid flashing membrane to waterproof the transitions in rough opening and between dissimilar materials.
  1. Fill any voids between the top of the flashing leg and the vertical wall with R-GUARD Joint & Seam Filler. Tool to direct water from the vertical wall to the flashing.
  2. Apply a generous bead of FastFlash<sup>®</sup> to the top edge of the flashing leg.
  3. Spread the wet products to create a monolithic “cap-flash” flashing membrane extending 2 inches up the vertical face of the structural wall and 1 inch over the flashing membrane extending. Apply additional product as needed to achieve a void and pinhole free surface. This “liquid termination bar” helps secure the flashing and ensures positive drainage from the wall surface to the flashing.
  4. Allow treated surfaces to skin before installing other wall assembly, waterproofing or air barrier components.

### **3.7 R-GUARD AIRDAM<sup>®</sup> AIR AND WEATHER BARRIER SEALANT FOR WINDOWS AND DOORS INSTALLATION**

- A. Install R-GUARD AirDam<sup>®</sup> with professional grade caulking gun in continuous beads without air gaps or air pockets.
  1. Apply R-GUARD AirDam<sup>®</sup> to a clean, dry or damp surface
  2. Install Backer rod: Compressible, closed cell rod stock as recommended by manufacturer for compatibility with sealant. Provide size and shape of rod to control joint depth
  3. Install AirDam<sup>®</sup> to provide uniform, continuous ribbons without gaps or air pockets, with complete wetting of the joint bond surfaces.
  4. Tool sealant immediately to ensure complete wetting of joint bond surface and to produce a smooth, concave joint profile flush with the edges of the adjacent surfaces. Where horizontal and vertical surfaces meet, tool sealant to create a slight cove so as to not trap moisture or debris.
  5. Do not allow materials to overflow onto adjacent surfaces. Prevent staining of adjacent surfaces.
  6. Remove excess and misplaced materials as work progresses. Clean the adjoining surfaces to remove misplaced materials, without damage to adjacent surfaces or finishes.

### **END SECTION 07 27 20**

## **SECTION 07 40 00 SINGLE PLY ROOFING**

### **PART I - GENERAL**

#### **1.01 DESCRIPTION**

- A. Scope: Work of this Section shall include all materials and installation necessary to provide Single-Ply Roofing as shown and detailed on the Drawings and specified herein, including:
  - 1. Felt back PVC single-ply membrane over an existing built-up roof/mineral cap sheet.
  - 2. PVC single-ply membrane over new poly-iso board insulation, over existing built-up roof with granule surface spud off.
  - 3. PVC single-ply membrane over new poly-iso board insulation over existing concrete deck.
- B. Related Work: The work includes but is not necessarily limited to the installation of:
  - 1. Fasteners
  - 2. Roof Membrane
  - 3. Roof Membrane Flashings
  - 4. Walkways
  - 5. Metal Flashings
  - 6. Sealants and Adhesives
  - 7. Insulation (at new crickets and at specified roof areas)

#### **1.02 QUALITY ASSURANCE**

- A. This roofing system shall be applied only by a Contractor authorized by the respective PVC single-ply manufacturer prior to bid.
- B. Contractor shall provide as follows: Upon completion of the installation, and the delivery to the PVC single-ply manufacturer by the Contractor of a certification that all work has been done in strict accordance with the contract specifications and manufacturers' requirements, an inspection shall be made by a representative of the manufacturer to observe the roofing system.
- C. All work shall be completed by personnel trained and authorized by the PVC single-ply manufacturer.
- D. All work must be inspected by UCD Fire Department.

#### **1.03 CODE REQUIREMENTS**

- A. The roofing Contractor shall submit evidence that the proposed roofing system will meet the identified requirements of the following recognized code approval or testing agencies. These requirements are minimum standards and no roofing work shall commence without written documentation of the system's compliance, as required in the "Submittals" section of this specification.
  - 1. Factory Mutual Research Laboratories, Norwood, Massachusetts.

- a. F. M. Class I system acceptance.
- b. F. M. I-90 wind uplift resistance.
- 2. Underwriters Laboratories, Chicago, IL.
  - a. U. L. Class A membrane.
- 3. All work to comply with Title 24.

#### **1.04 SUBMITTALS**

- A. After the notice to proceed the roofing Contractor shall submit to the University's Representative the following:
  - 1. Copies of Specification.
  - 2. Samples of each material to be used in the roof system including each component of manufacturer's literature.
  - 3. Specimen copy of warranty – material and labor and Contractor's warranty per Division 1.
  - 4. Dimensional shop drawings which shall include:
    - a. Outline of roof and roof size.
    - b. Profile details of flashing methods for penetrations and terminations.
    - c. Technical acceptance from PVC manufacturer.
  - 5. Written approval from the PVC manufacturer for this application on system specified.
  - 6. Letter from PVC manufacturer stating Contractor is an approved applicator.
  - 7. MSDS sheets for all adhesives are to be submitted to UCD Fire Department for review.

#### **1.05 PRODUCT DELIVERY, STORAGE AND HANDLING**

- A. All products delivered to the job site shall be in the original unopened containers or wrapping
- B. Handle all materials to prevent damage. Place all materials on pallets and fully protected from moisture.
- C. Membrane roofs shall be stored lying down on pallets, and fully protected from moisture with clean canvas tarpaulins.
- D. Bonding adhesives shall be stored at temperatures above 40°F.
- E. All flammable materials shall be stored in a cool, dry area away from sparks and open flames. Follow precautions outlined on container or supplied by material manufacturer/supplier. The proposed storage site for flammable solvents must be off-site or a minimum of 20' from the Hospital. The site must be approved by UCD Fire Department prior to delivery.
- F. All materials which are determined damaged by the University's Representative are to be removed from the job site and replaced at no cost to the University.

#### **1.06 PROJECT CONDITIONS**

- A. PVC single-ply materials may be installed under the following weather conditions (extreme temperatures, moisture, humidity), but only after consultation with PVC

- manufacturer and University's Representative, as performance of PVC single-ply materials, as well as installation costs and production may be affected.
- B. Only as much of the new roofing as can be made weather tight each day, including all flashings, and metal work shall be installed.
  - C. All work shall be scheduled and executed without exposing the interior building areas to the effects of inclement weather. The existing building and its contents shall be protected against all risks.
  - D. All surfaces to receive new insulation, membrane or flashings shall be thoroughly dry. Should surface moisture occur, the Contractor shall provide the necessary equipment to dry the surface prior to application.
  - E. All new temporary construction, including equipment and accessories, shall be secured in such a manner, at all times, as to preclude wind blow-off or damage.
  - F. Temporary waterstops shall be installed at the end of each day's work, and shall be removed before proceeding with day's work. Waterstops shall be compatible with all materials and shall not emit dangerous or incompatible fumes.
  - G. The Contractor is cautioned that certain PVC single-ply membranes are incompatible with asphalt, coal tar and oil based materials and cements. Creosote and penta-based materials are also incompatible. Such materials should not come in contact with PVC membranes at any time. If such contacts occur, the material shall be cut out and discarded. The Contractor should consult PVC manufacturer with respect to material compatibility, precautions, and recommendations.
  - H. Arrange work sequence to avoid use of newly-constructed roofing for storage, walking surface, and equipment movement. Where such access is absolutely required, the Contractor shall provide all necessary protection and barriers to segregate the work area and to prevent damage to adjacent areas. Both polywood and polyester felt protection shall be provided for all new and existing roof areas which receive traffic during construction.
  - I. Prior to and during application, all dirt, debris and dust shall be removed from surfaces either by vacuuming, sweeping, blowing with compressed air and/or similar methods.
  - J. All roofing, insulation, flashings and metal work removed for construction shall be immediately taken off the site to a legal dumping area authorized to receive such materials,
  - K. The Contractor shall follow all safety regulations as recommended by OSHA.
  - L. The Contractor should take care during application and storage that overloading of deck and structure does not occur.
  - M. Liquid materials such as solvents and adhesives shall be stored and used away from open flames, sparks and excessive heat.
  - N. Contaminants, such as grease, fats, oils, and solvents, shall not be allowed to come into contact with the PVC single-ply roofing membrane except as noted and at specified area and only as delineated within the contract documents. Any other such contact shall be reported to the University's Representative.



- O. Contractor shall verify that all roof drain lines are unblocked before starting work. Report any such blockages to the University's Representative in writing.
- P. If any unusual or concealed condition is discovered, stop work and notify University's Representative immediately in writing.
- Q. Site clean-up, including both interior and exterior building areas which have been affected by construction, shall be completed to the University's satisfaction.
- R. All landscaped areas affected by construction activities shall be returned to their pre-construction state.
- S. The degree to which the roof deck allows air infiltration into the roof assembly may add to the uplift forces on the roof system:
  - 1. If any wall openings greater than 10% of the wall surface, contact PVC manufacturer for recommendations.
  - 2. The effects of positive pressure inside the building must be considered. For conditions of positive pressure greater than .5" of water inside the building, contact PVC manufacturer for recommendations.
- T. No work is to proceed until a formal Interim Life Safety Measure, approved by UCD Fire Department is in place.
- U. No fumes from the adhesives are to be drawn into the Hospital HVAC system.

#### **1.07 WARRANTY**

- A. Furnish to University a written guarantee for the single-ply roofing system from the single-ply manufacturer against all defects in materials and workmanship, for 10 years from date of acceptance.
- B. Furnish to University a written guarantee for the single-ply roofing system from the Contractor against all defects in workmanship, including without limitation to roofing, flashings, or metal work, for 3 years from date of acceptance.

### **PART II - PRODUCTS**

#### **2.01 GENERAL**

- A. Components of the PVC single-ply fully adhered roof system are to be products on one PVC single-ply manufacturer.

#### **2.02 APPROVED MEMBRANE SYSTEMS**

- A. Sarnafil G410L/Felt, manufactured by Sarnafil Inc., 48 mils nominal (.048") thickness, polyester reinforced membrane with an acrylic coating to repel dirt, and with a polyester 18 oz. felt laminated to the back. Exposed color of PVC membrane shall be gray.
- B. Sarnafil G410L, manufactured by Sarnafil Inc., 48 mils nominal (.048") thickness, polyester reinforced membrane with an acrylic coating to repel dirt. Exposed color of PVC membrane shall be gray.

- C. Trocal SR-60/Felt, manufactured by Trocal Inc., 50 mils nominal (.050") thickness, polyester reinforced membrane with an acrylic coating to repel dirt, and with a polyester 18 oz. felt laminated to the back. Exposed color of PVC membrane shall be gray.
- D. Trocal SR-60, manufactured by Trocal Inc., 50 mils nominal (.050") thickness, polyester reinforced membrane with an acrylic coating to repel dirt. Exposed color of PVC membrane shall be gray
- E. Or equal, See Section 01630 Product Options and Substitutions for procedures to request substitution.

### **2.03 MEMBRANE**

- A. Membrane shall conform to ASTM D4434 (LATEST REVISION) Standard for poly (vinyl chloride) sheet roofing. Classification: Type II, Grade I, Color shall be gray.
- B. Contractor must provide evidence that Manufacturer has comparable successful systems in place equal to that specified for a minimum of 5 years.

### **2.04 ACCESSORY PRODUCTS**

- A. Contractor shall obtain from the PVC single-ply manufacturer the following products:
- B. Flashing Membrane: Flashing Membrane shall be as supplied by PVC single-ply manufacturer. Flashing membranes shall be the same material as provided for the roofing membrane without the felt back.
- C. Flashing Membrane Adhesive: Adhesive for bonding the flashing membrane to substrates shall be a contact adhesive supplied by the PVC single-ply manufacturer.
- D. Walkpads: Polyester reinforced PVC membrane, .096" thick for traffic areas.
- E. Clad Metal: .020" thick membrane laminated to 25 gauge galvanized sheet metal.
- F. Felt: Non-asphaltic polyester felt used as an asphalt barrier, leveling layer and slip sheet.
- G. Welder: Automatic hot air welding apparatus for seaming of sheets.
- H. Prefabricated details: Inside/outside corners or vent stacks (2 - 5" diameters).
- I. Solvent Cleaner: Solvent Cleaner for removal of contaminates (adhesives) from the single-ply membrane.
- J. Flatbar/turnbar: 14 gauge galvanized steel bar, channel shaped, punched 1" on center.

### **2.05 RELATED MATERIALS**

- A. Insulation: where specified or required, insulation shall be installed to form crickets.
  1. Insulation for use in a fully adhered PVC membrane system shall be a Factory Mutual Class I fire rated, I-90 uplift approved board.
  2. Insulation shall meet all identified code requirements.
  3. Insulation shall be approved in writing by insulation manufacturer for intended use, and for use with PVC membrane materials.
  4. Insulation shall be compatible with PVC membrane.
- B. The following list of insulation boards are acceptable or equal:
  1. Isocyanurate Insulations:
    - a. SarnaTherm II isocyanurate insulation as supplied by Sarnafil, Inc.

- b. SaraTherm I isocyanurate insulation as supplied by Sarnafil, Inc.
  - c. Energy I isocyanurate as manufactured by NRG Barriers, Inc.
  - d. Isoleck GF isocyanurate as manufactured by Carpenter.
  - e. Multi-max isocyanurate as manufactured by R-Max, Inc.
  - f. Apache Pyrox isocyanurate as manufactured by Apache Building Products.
2. Insulation thickness shall be 1" or as required to form crickets identified in the specifications and construction documents.
- C. Wood Nailers: Treated wood nailers shall be installed at the perimeter of the entire roof and around such other roof projections and penetrations as specified on the project drawings. Height of the nailers shall be matched to that of the insulation thickness being used.
- 1. Wood nailers shall be treated for fire and rot resistance (wolmanized or osmose treated), #2 or better lumber. Creosote or asphaltic-treated lumber is not acceptable.
  - 2. Wood nailers shall conform to Factory Mutual's Loss Prevention Data 1-49.
  - 3. All wood shall have a maximum moisture content of 19% by weight on a dry weight basis.

## **2.06 ACCEPTED FASTENERS FOR ATTACHMENT OF INSULATION**

- A. The following fastener is approved for steel deck construction:
- 1. SFS Isofast IF2 Fasteners with 3" round galvanized plates.
- B. Fastener Manufacturer's Warranty:
- 1. Fasteners and plates shall be Factory Mutual approved and meet F. M. Standard 4470 for corrosion resistance.
  - 2. Fastener manufacturer shall warranty the performance of the fastener and plates for the duration of the warranty.
  - 3. Fastener and plates shall be approved in writing by fastener manufacturer for intended use, and for use with manufacturer's products.

## **2.07 WALKWAYS**

- A. Walkways shall consist of the following:
- 1. Polyester reinforced PVC membrane .096" thick fully adhered to membrane. Only manufacturers walkways are permitted; i.e. SarnaTread or equal.

## **2.08 SEALANTS**

- A. The following caulking/sealants are accepted based on chemical compatibility with PVC single-ply membranes: TREMCO, Monolastomeric, one-part acrylic, Dow Corning/General Electric Co., Silpruf, one-part silicone sealant, Gates Engineering Co., GACO AS-3 one-part acrylic, or equal.

## **2.09 MISCELLANEOUS FASTENERS AND ANCHORS**

- A. All fasteners shall be of the same type as metal being secured. In general, all fasteners, anchors, nails, straps, shall be of zinc or cadmium plated steel, galvanized, or stainless

steel. All fasteners and anchors shall have a minimum embedment of 1-1/4" and shall be approved for such use by the fastener manufacturer. Fasteners for attachment of metal to wood blocking shall be annular ring nails. Fasteners for attachment of metal to masonry shall be expansion type fasteners. All fasteners shall meet Factory Mutual Standard 4470 for corrosion resistance.

## **PART III - EXECUTION**

### **3.01 GENERAL**

- A. The Contractor shall coordinate the installation so that each area is made watertight at the end of each work period.

### **3.02 DECK PREPARATION**

- A. Preparation of Existing Roof shall be as follows:
  1. On smooth surfaced roofs, the surface shall be clean and dry. All blisters shall be cut, laid back and sealed with an approved sealant.
  2. On granule roof surfaces, gravel shall be spud off, sweep clean, all blisters shall be cut, laid back and sealed with approved sealant.
  3. On foam roofs, remove all roofing, clean down to concrete deck and prepare substrate for insulation board installation.

### **3.03 SUBSTRATE PREPARATION**

- A. A proper substrate shall be provided to receive the PVC single-ply fully adhered membrane system.
- B. The roofing Contractor shall inspect the roofing surface for defects such as excessive surface roughness, contaminated surfaces, structurally unsound substrates, etc., that will adversely affect the quality of work and prep areas as required to receive membrane/felt back system.
- C. The substrate shall be clean, smooth, dry, free of flaws, sharp edges, loose and foreign material, oil and grease. Roofing shall not start until all defects have been corrected.
- D. All roof surfaces shall be free of water, ice and snow.

### **3.04 INSTALLATION OF PVC SINGLE-PLY MEMBRANE**

- A. General
  1. Over the properly prepared substrate surface, manufacturer approved contact adhesive shall be applied using recommended solvent resistant 3/4" nap paint rollers, the adhesive shall be applied at a rate of approximately 3/4 to 1-3/4 gallons per 100 square feet depending on the substrate being adhered to. The Contractor shall use the rate specified by the manufacturer. The adhesive shall be applied in a smooth, even coating with no holidays, globs, puddles, or similar irregularities. Only an area which can be

completely covered in the same day's operations shall be coated with adhesive. The adhesive shall be allowed to dry completely prior to installing the membrane.

2. When the adhesive on the substrate is dry, a second coat of adhesive will be applied, the 18 oz. felt back or membrane will be rolled into the fresh adhesive. Immediately after placing the membrane, the entire surface area must be rolled with a foam covered water-filled lawn roller.

3. No bonding adhesive shall be applied in lap areas. All sheets shall be applied in the same manner, lapping all sheets as required by hot air welding techniques.

**B. FM-90 System Perimeter and Corners**

1. Over the properly installed and prepared substrate surface, PVC single-ply membrane half sheets are to be installed around the entire perimeter edge, per manufacturers' recommendations.

**3.05 HOT AIR WELDING OF LAP AREAS**

**A. General:**

1. Adjacent sheets shall be welded in accordance with PVC single-ply manufacturers' written instruction. All side and end lap joints shall be hot-air welded. Lap areas shall be a minimum of 3" wide when machine welding, and a minimum of 4" wide when hand welding.

2. Welding equipment shall be obtained from or approved by PVC manufacturer. All mechanics intending to use the equipment shall have successfully completed a course of instruction provided by PVC manufacturer's representative prior to welding.

3. All surfaces to be welded shall be clean according to PVC manufacturer recommendations, and dry. No adhesive shall be present within the lap areas.

**B. Hand Welding:** Hand welded seams shall be completed in three stages. Equipment shall be allowed to warm up for at least one minute prior to start of welding.

1. The lap shall be tack welded every 3 feet to hold the seam in place.

2. The back edge of the lap shall be welded with a thin, continuous weld to prevent loss of hot air during the final welding.

3. The hot air nozzle, shall be inserted into the lap at a 45° angle. Once the proper welding temperature has been reached and the material starts to flow, the hand roller shall be applied at a right angle to the welding gun and pressed lightly. For straight laps, the 1-½" wide nozzle shall be used. For corners and compound connections, the ¾" wide nozzle shall be used.

**C. Machine Welding:** Machine welded seams may be achieved by the use of PVC manufacturers' various automatic welding equipment. When using this equipment, the manufacturer's instructions shall be followed and local codes for electric supply, grounding and over current protection observed. The automatic welding machines require 218 to 230 volts at 3040 amps. The use of a portable generator is recommended.

**D. Quality Control of Welded Seams:** all completed welded seams shall be checked by the Contractor after cooling for continuity using a rounded screwdriver or other suitable blunt object. Visible evidence that welding is proceeding acceptably is smoke during the

welding operation, shiny membrane surfaces, and an uninterrupted flow of black material from the edge of completed joints. On-site evaluation of welded seams shall be made daily by the Contractor to locations as directed by the University's Representative or Manufacturer's Representative. Two-inch wide cross-section samples shall be taken three times a day minimum through completed seams. Correct welds display failure from shearing of the membrane prior to separation of the weld. Each testy cut shall be patched by the Contractor at no extra charge to the University.

### **3.06 INSULATION INSTALLATION**

#### **A. General Criteria:**

1. Install Insulation in accordance with manufacturer's instructions.
2. Insulation shall be neatly cut to fit around penetrations and projections.
3. Fully adhere insulation to form crickets where stipulated with contact adhesive. PVC single-ply membrane to be fully adhered to insulation.
4. Install Tapered Insulation around drains creating a drain sump.
5. Do not install more Insulation than can be covered with membrane by the end of the day, or onset of inclement weather.
6. Mechanical Attachment.

- a. FM I-90 Approved Perimeter Fastening Pattern-Insulation panels which fall in the perimeter and corner areas of the building shall be fastened at a minimum rate of six fasteners for every 4' x 8' insulation panel, or according to the insulation manufacturer's requirements, whichever is more stringent. The perimeter area shall be defined as the strip of the roof around the outside perimeter of the building having a width defined by the least of the following parameters: 1) 10% of the building length; 2) 10% of the building width; 3) 40% of the building height. In any case, the perimeter width shall not be less than 4'.
- b. Fasteners are to be installed in accordance with fastener manufacturer's recommendations. Fasteners are to have minimum penetration into structural deck recommended by fastener manufacturer and PVC manufacturer.
- c. Use fastener tools with a depth location as recommended or supplied by fastener manufacturer to ensure proper installation.
- d. Provide pullout tests to verify deck condition and actual pullout values. Provide data to Architect and University's Representative.

#### **B. Re-Roofing with Removal of Existing Roofing**

1. Normal Humidity - Single Layer of Insulation without Vapor Retarder: one layer of insulation shall be mechanically fastened to the deck with accepted fasteners and plates. The insulation shall be laid in parallel courses with end joints staggered.

#### **C. Fully adhere insulation to form crickets where stipulated with contact adhesive. PVC single-ply membrane to be fully adhered to insulation. Contractor may form crickets with treated plywood as an alternative and then fully adhere membrane over.**

### **3.07 WOOD NAILERS INSTALLATION**

- A. Install continuous treated wood nailers at the perimeter of the entire roof and around roof projections and penetrations as specified on the project drawings.
- B. Nailers shall be anchored to resist a minimum force of 175 pounds per linear foot in any direction. A ½" space shall be provided between nailer lengths. Individual nailer lengths shall not be less than 3' long. Fasteners spacing shall be a maximum of 3' on center. Fasteners shall be installed within 6" of each end. Spacing and fastener embedment shall conform to Factory Mutual Loss Prevention Data 1-49.
- C. Thickness shall be as required to match substrate or insulation height/
- D. Any existing woodwork which is to be reused shall be firmly anchored in place (shall resist a minimum force of 175 pounds per linear foot in any direction) and free of rot. Only woodwork designated to be reused in detail drawings shall be left in place and all other woodwork shall be removed.

### **3.08 WALKWAY INSTALLATION**

- A. Walkways shall be provided for regular maintenance of rooftop equipment and for roof areas subject to foot traffic.
  - 1. Roofing membrane to receive walk pads shall be clean and dry.
  - 2. Chalk lines on deck sheet to indicate location of walk pads.
  - 3. Walk pad shall be unrolled and positioned within chalk lines.
  - 4. Hot-air weld the perimeter of the walk pad to the PVC membrane deck sheet. Check all welds with a rounded screwdriver. Reweld any inconsistencies.

### **3.09 MEMBRANE FLASHINGS**

- A. All flashings shall be installed concurrently with the roof membrane as the job progresses. No temporary flashings shall be allowed without the prior written approval of the University's Representative. Approval shall only be for specific locations on specific dates. Flashings shall be adhered to compatible, dry smooth, and solvent-resistant surfaces.
- B. Contact Adhesive for Flashings
  - 1. Over the properly installed and prepared substrate surface, contact adhesive shall be applied using approved solvent-resistant ¾" nap paint rollers. The adhesive shall be applied in smooth, even coatings with no holidays, globs, puddles or similar irregularities. Only an area which can be completely covered in the same day's operations shall be coated with adhesive. The surface with adhesive coating shall be allowed to dry completely prior to installing the membrane.

Note: Drying time increases with cooler temperature. Also, the Contractor is cautioned against work on days of high humidity because of extremely slow evaporation of the solvent. The contractor shall check with the PVC manufacturer's technical representative prior to roof operations on such days.
  - 2. When the surface is dry, the PVC flashing membrane is cut to a workable length and the underside shall be evenly coated with contact adhesive at a rate of ½ gallon per

100 sq. ft. When the adhesive had dried sufficiently to produce strings when touched with a dry finer, the coated membrane shall be rolled onto the previously-coated substrate being careful avoid wrinkles. Do not allow adhesive on the underside of the membrane to completely dry. The amount of membrane that can be coated with adhesive before applying to substrate will be determined by ambient temperature, humidity, and manpower. Adjacent sheets shall be overlapped a minimum of 4". Flashings shall extend 5" onto the roofing membrane. The bonded sheet shall be pressed firmly in place with a hand roller.

3. No bonding adhesives shall be applied in lap areas that are to be welded to flashing or adjacent sheets. All sheets shall be applied in the same manner, lapping all sheets as required by welding techniques.
- C. All flashings shall extend a minimum of 8" above roofing level unless previously accepted by University's Representative.
- D. All flashing membranes shall be fully adhered to substrates. All interior and exterior corners and miters shall be cut and hot-air welded at their joints and at their connections with the roof membrane.
- E. All flashings shall be hot-air welded at their joints and at their connections with the roof membrane.
- F. All flashing membranes shall be mechanically fastened along the tip edge through tin discs spaced a maximum of 1' on center, or pre-drilled metal strips where so specified in the specifications. Expansion pins with nylon sheaths set in pre-drilled holes shall be used to secure flashings to masonry and concrete surfaces.

### **3.10 METAL FLASHINGS**

- A. Metal details, fabrication practices and installation methods shall conform to the applicable requirement of the following:
  1. Factory Mutual Loss Prevention Data Sheet 1-49 (latest issue).
  2. Sheet Metal and Air Conditioning Contractors National Association (SMACCA), (latest issue).
- B. Complete all metal work in conjunction with roofing and flashings so that a watertight condition exists daily
- C. Metal shall be installed to provide adequate resistance to bending and allow for normal thermal expansion and contraction.
- D. Metal joints shall be watertight.
- E. Metal flashings shall have a 4" minimum nailing flange and shall be fastened into solid wood blocking with fasteners of the same type with two rows of annular ring nails, 4" on center, staggered. Fasteners shall penetrate the wood nailer a minimum if 1-1/4".
- F. Continuous metal hook strips are required if clad metal fascia exceeds 5" in width. Hook strip is to be fastened 12" on center into wood nailer or masonry wall.



### **3.11 TEMPORARY CUT-OFF**

- A. All flashings shall be installed concurrently with the roof membrane in order to maintain a watertight condition as the work progresses. When a break in the day's work occurs in the central area of a roof, a temporary waterstop shall be constructed to provide a 100% watertight seal. The new membrane shall be carried into the waterstop. The waterstop shall be sealed to the deck and/or substrate so that water will not be allowed to travel under the new or existing roofing. The edge of the membrane shall be sealed in a continuous heavy application of roof cement of 6" girth. When work resumes, the contaminated PVC membrane shall be cut out. All sealant, contaminated membrane, insulation fillers, etc., shall be removed from the work area and disposed of off site. None of these materials shall be used in the new work.
- B. If inclement weather occurs while a temporary waterstop is in place, the Contractor shall provide the labor necessary to monitor the situation to maintain a watertight condition.
- C. If any water is allowed to enter under the newly-completed roofing, the affected area shall be removed and replaced at the Contractor's expense.

### **3.12 COMPLETION**

- A. Prior to demobilization from the site, the work shall be reviewed by the University's Representative and Contractor. All defects noted, non-compliance with the specifications or the recommendation of University's Representative shall be itemized in a punch list. These items must be corrected immediately by the Contractor prior to demobilization to the satisfaction of the University's Representative.
- B. All warranties, as required in Division 1 "Closeout Submittals" of this specification shall be submitted for approval prior to final payment.
- C. Contractor shall perform a flood test at the completion of the work to demonstrate the watertight integrity of the finished product to the satisfaction of the University's Representative.
- D. Inspections by UCD Fire Department must be completed and the job finalized as a condition of completion.

**END OF SECTION 07 53 0**

## **SECTION 07 52 16 - MODIFIED BITUMINOUS MEMBRANE ROOFING**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings, Technical Specifications, TSUS construction specifications Division 1, TSUS uniform general conditions for construction contract, safety requirements of OSHA and prevailing building codes & city, state and county.

#### **1.2 SUMMARY**

- A. This Section includes the following:
  - 1. Work includes all labor, materials, equipment and services necessary for installation of cold-applied SBS modified bituminous membrane roofing system.
- B. Related Sections include the following:
  - 1. Section 06 10 00 "Rough Carpentry"
  - 2. Section 07 01 50.19 "Preparation for Re-Roofing".
  - 3. Section 07 62 00 "Sheet Metal Flashing and Trim".

#### **1.3 REFERENCES**

- A. American Society of Civil Engineers (ASCE):
  - 1. ASCE 7-05, Minimum Design Loads for Buildings and Other Structures.
- B. American Society for Testing and Materials (ASTM):
  - 1. ASTM D41 Standard Specification for Asphalt Primer Used in Roofing, Damp Proofing and Waterproofing.
  - 2. ASTM D312 Standard Specification for Asphalt Used in Roofing.
  - 3. ASTM D451 Standard Test Method for Sieve Analysis of Granular Mineral Surfacing for Asphalt Roofing Products.
  - 4. ASTM D1079 Standard Terminology Relating to Roofing, Waterproofing and Bituminous Materials.
  - 5. ASTM D1227 Standard Specification for Emulsified Asphalt used as a Protective Coating for Roofing.
  - 6. ASTM D1863 Standard Specification for Mineral Aggregate used as a Protective Coating for Roofing.
  - 7. ASTM D2178 Standard Specification for Asphalt Glass Felt used as a Protective Coating for Roofing.
  - 8. ASTM D2822 Standard Specification for Asphalt Roofing Cement.
  - 9. ASTM D2824 Standard Specification for Aluminum-pigmented Asphalt Roof Coating.
  - 10. ASTM D4601 Standard Specification for Asphalt Coated Glass Fiber Base Sheet used in Roofing.
  - 11. ASTM D5147 Standard Test Method for Sampling and Testing Modified Bituminous Sheet Materials.
  - 12. ASTM D6162 Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials using a combination of Polyester and Glass Fiber Reinforcements.
  - 13. ASTM D6163 Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials using Glass Fiber Reinforcements.
  - 14. ASTM E108 Standard Test Methods for Fire Test of Roof Coverings.
- C. Factory Mutual Research (FM):
  - 1. Roof Assembly Classifications.

- D. National Roofing Contractors Association (NRCA):
  1. Roofing and Waterproofing Manual.
- E. Underwriters Laboratories, Inc. (UL):
  1. Fire Hazard Classifications.
- F. Warnock Hersey (WH):
  1. Fire Hazard Classifications.

#### **1.4 ADMINISTRATIVE REQUIREMENTS**

- A. Pre-installation Meeting: Conduct at Project Site.
  1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
  2. Review methods and procedures related to roofing installation, including set up and mobilization areas for stored material and work area.
  3. Review safety procedures and site-specific requirements relating to the work and areas to be accessed.
  4. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
  5. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
  6. Review structural loading limitations of roof deck during and after roofing.
  7. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.
  8. Review governing regulations and requirements for insurance and certificates if applicable.
  9. Review temporary protection requirements for roofing system during and after installation.
  10. Review roof observation and repair procedures after roofing installation.
  11. Review notification procedures for weather or non-working days.

#### **1.5 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this Section with not less than 15 years documented experience and have ISO 9001 certification.
- B. Installer Qualifications: Company specializing in modified bituminous roofing installation with not less than 5 years experience and authorized by roofing system manufacturer as qualified to install manufacturer's roofing materials.
- C. Installer's Field Supervision: Maintain a full-time Supervisor/Foreman on job site during all phases of roofing work while roofing work is in progress. Supervisor/Foremen must be fluent in the English language and maintain proper supervision of workmen.
- D. Maintain a copy of the Contract Documents in the possession of the Supervisor/Foreman and on the roof at all times.
- E. Source Limitations: Obtain all components of roof system from a single manufacturer. Secondary products that are required shall be recommended and approved in writing by the roofing system Manufacturer.

1. Upon request of the Architect or Owner, submit Manufacturer's written approval of secondary components in list form, signed by an authorized agent of the Manufacturer.
  2. Manufacturer shall have direct authority and control over all fabrication of steel components as well as the raw materials used in their fabrication.
- F. Source Quality Control: Manufacturer shall have in place a documented, standardized quality control program such as ISO-9001 approval.
- G. Engage the Manufacturer's Field Representative to conduct required periodic inspections of work in progress as described herein and shall furnish written documentation of all such inspections.
- H. Manufacturer shall provide the project Owner with a written statement that they will provide site inspections three days per week that confirms that the project is being constructed as specified, by an experienced, full time employee of the company.

## **1.6 SUBMITTALS**

- A. Comply with pertinent provisions of Division 01 Section "Submittal Procedures, unless otherwise indicated."
- B. Manufacturer's Installation Instructions: Submit installation instructions and recommendations indicating special precautions required for installing the membrane.
- C. Manufacturer's Certificate: Certify that roof system furnished is approved by Factory Mutual, Underwriters Laboratories, Warnock Hersey or approved third party testing facility in accordance with ASTM E108, Class [A] for external fire and meets local or nationally recognized building codes.
- D. Manufacturer's Certificate: Certify that the roof system furnished is approved or accepted by Factory Mutual Approval Standard 4470.
- E. Manufacturer's Certificate: Certify that materials are manufactured in the United States and conform to requirements specified herein, are chemically and physically compatible with each other, and are suitable for inclusion within the total roof system specified herein.
- F. Manufacturer's Certificate: Submit a certified copy of the roofing manufacturer's ISO 9001 compliance certificate.
- G. Test Reports: Submit test reports, prepared by an independent testing agency, for all modified bituminous sheet roofing, indicating compliance with ASTM D5147.
- H. Written certification from the roofing system manufacturer certifying the applicator is currently authorized for the installation of the specified roof system.
- I. Design Loads: Submit copy of manufacturer's minimum design load calculations according to ASCE 7-05, Method 2 for Components and Cladding, sealed by a registered professional engineer. In no case shall the design loads be taken to be less than those detailed in Design and Performance Criteria article of this specification.
- J. Specimen Warranty: Provide an unexecuted copy of the warranty specified for this Project, identifying the terms and conditions required of the Manufacturer and the Owner.

## **1.7 CLOSEOUT SUBMITTALS**

- A. General: Comply with Requirements of Division 01 Section Closeout Submittals.

- B. Special Project Warranty: Provide specified warranty for the Project, executed by the authorized agent of the Manufacturer.
- C. Roofing Maintenance Instructions: Provide a manual of manufacturer's recommendations for maintenance of installed roofing systems.

#### **1.8 DELIVERY, STORAGE AND HANDLING**

- A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.
- B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
  - 1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.
- C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.
- D. Handle and store roofing materials, and place equipment in a manner to avoid permanent deflection of deck.

#### **1.9 WARRANTY**

- A. Upon completion of installation, and acceptance by the Owner and Architect, the Manufacturer will supply to the Owner an "NDL" warranty, without monetary limitations in which manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period: Thirty (30) years from date of Substantial Completion.
- B. Installer's Warranty: Provide roofing installers warranty, to the membrane manufacturer, in which the roofing installer will, at his own expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in a watertight condition.
  - 1. Warranty Period: Two (2) years from date of Substantial Completion.
- C. The Roof System Manufacturer shall provide annual inspection of the roof for the duration of the warranty at no fee to the Owner

#### **1.10 MANUFACTURER'S FIELD REPRESENTATION**

- A. Manufacturer's Field Representative: An authorized, full-time employee of the roof system manufacturer shall be assigned to the project to conduct field observations during the installation phase.
- B. Regularly scheduled site observations shall be required by the manufacturer's field representative a minimum of three (3) days per week during the roofing installation period; exceptions being made for inclement weather, holidays, etc.
- C. Observation reports shall include the following:
  - 1. Written report/documentation of the installation progress at the time of the site visit to be delivered to the architect and owner within 48 hours of the site visit.

2. This report shall include documentation of any issues/question and resolution.
  3. This report shall include record of directives given to the roofing contractor.
  4. Digital photographic documentation of the roofing progress; including documentation of specific issues and areas of concern.
  5. Each report shall contain project name, architect's project number, and date/time/duration of site visit.
- D. In addition to the progress observations, the manufacturer's representative must:
1. Attend the roofing trade start-up meeting.
  2. Inspect and approve the roof substrate/deck prior to the start of roofing work.
- E. All observation reports shall be kept current and shall be delivered electronically to the architect and contractor within five (5) calendar days after the observation. Progress payments for roofing work may be withheld if observation report submissions are not current.
- F. After completion of all roofing work, and prior to acceptance of the roofing installation, the manufacturer's representative shall conduct an observation to document all roofing work to be corrected as a condition of acceptance.
1. Each item requiring corrective work shall be identified (including specific location) and required corrective action shall be noted.
  2. The final observation report must be produced in writing with photographic back-up. Marking corrective items on the roof alone shall not be acceptable.
- G. Any failure by the Architect, the Owner's Representative, the Project Manager, or the roofing manufacturer's Technical Field Representative to observe, detect, pinpoint, or object to any defect or noncompliance with the requirements of the Roofing Manufacturer's requirements, the Contract Documents, the Project Specifications, the approved Shop Drawings and Engineering Data, and/or the Roofing Manufacturer's standard details – of work in progress or completed work – shall not relieve the Contractor of, or reduce, or in any way limit, his responsibility of full performance of the work required of him under the requirements of the Roofing Manufacturer, the Contract Documents, the Project Specifications, the approved Shop Drawings and Engineering Data, and/or the Roofing Manufacturer's standard details.

## 1.11 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.
- B. Do not apply roofing insulation or membrane to damp deck surface.
- C. Do not expose materials subject to water or solar damage in quantities greater than can be weatherproofed during same day.
- D. Phased Construction will not be accepted.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Basis of Design Manufacturer: **The Garland Company, Inc.**
  1. 3800 East 91<sup>st</sup> Street, Cleveland, OH, 44105
  2. Manufacturer's Representative:
    - a. Blake Dieste; [bdieste@garlandind.com](mailto:bdieste@garlandind.com); (M) 832-488-4783
  3. Alternate Manufacturers: Must meet and/or exceed physical and performance properties as specified herein. Panel systems proposed as an alternate to the

Basis of Design must be approved in writing by the Architect and Owner prior to bid. Acceptance will be based on Warranty Terms/Duration, Physical and Performance Properties, Manufacturer's mandatory Field Services and compliance with Substitution Requirements as specified herein. An alternate manufacturer being listed in this specification does not constitute acceptance without prior approval.

- a. Simon Roofing Products
  - b. Ecology Roof Systems
- B. Modified bituminous roofing shall include but not be limited to:
1. Base Ply Sheet Modified Membrane: Type III membrane complying with ASTM 6162, Grade S. Physical requirements below.
  2. Cap Ply Sheet Modified Membrane: Type III membrane complying with ASTM 6162, Grade G. Physical requirements below.
- C. Basis of Design Materials, manufacturer's product designations, and/or manufacturer's names specified herein shall be regarded as the minimum standard of quality required for work of this Section. Comply with all manufacturer and contractor/fabricator quality and performance criteria specified in Part 1.

## 2.2 ROOFING SHEET MATERIALS

- A. Base Ply Sheet Modified Membrane: ASTM D 6162, Grade S, Type III, : 80 mil SBS (Styrene-Butadiene-Styrene) rubber modified roofing base sheet that utilizes KEVLAR fibers and reinforced with a dual polyester and fiberglass matt composite scrim; suitable for application method specified, and as follows: FlexBase E 80.
1. Tensile Strength, ASTM D 5147:
    - a. 2 in/min. @ 73.4 +/- 3.6 deg. F MD 550 lbf/in XD 550 lbf/in
    - b. 50 mm/min. @ 23 +/- 2 deg. C MD 96.2 kN/m XD 96.2 kN/m
  2. Tear Strength, ASTM D 5147:
    - a. 2 in/min. @ 73.4 +/- 3.6 deg. F MD 1,000 lbf XD 1,000 lbf
    - b. 50 mm/min. @ 23 +/- 2 deg. C MD 4,448 N XD 4,448 N
  3. Elongation at Maximum Tensile, ASTM D 5147:
    - a. 2 in/min. @ 73.4 +/- 3.6 deg. F MD 9% XD 9%
    - b. 50 mm/min. @ 23 +/- 2 deg. C MD 9% XD 9%
  4. Low Temperature Flexibility, ASTM D5147, Passes -40 deg. F (-40 deg. C)
- B. Granule-Surfaced Roofing Cap Sheet: ASTM D 6162, Grade G, Type III, 160 mil SBS and SIS (Styrene-Butadiene-Styrene and Styrene-Isoprene-Styrene) rubber modified membrane incorporating post-consumer recycled rubber, fire retardant additives and reinforced with KEVLAR fibers and a fiberglass and polyester composite scrim. Surfaced with the highly reflective Sunburst white mineral; suitable for application method specified, and as follows: Stressply EUV FR Mineral.
1. Tensile Strength, ASTM D 5147:
    - a. 2 in/min. @ 73.4 +/- 3.6 deg. F MD 700 lbf/in XD 750 lbf/in
    - b. 50 mm/min. @ 23 +/- 2 deg. C MD 122.5 kN/m XD 131.25 kN/m
  2. Tear Strength, ASTM D 5147:
    - a. 2 in/min. @ 73.4 +/- 3.6 deg. F MD 1300 lbf XD 1400 lbf
    - b. 50 mm/min. @ 23 +/- 2 deg. C MD 5783 N XD 6227 N
  3. Elongation at Maximum Tensile, ASTM D 5147:
    - a. 2 in/min. @ 73.4 +/- 3.6 deg. F MD 6.0% XD 6%
    - b. 50 mm/min. @ 23 +/- 2 deg. C MD 6% XD 6%
  4. Low Temperature Flexibility, ASTM D 5147, Passes -30 deg. F (-34 deg. C)
  5. Reflectivity, ASTM C 1549: 73%

## 2.3 COLD-PROCESS INTERPLY ADHESIVE

- A. Field Adhesive - Green-Lock Membrane Adhesive: Cold applied solvent free membrane adhesive: zero V.O.C. compliant performance requirements:
  - 1. Non-Volatile Content ASTM D 4586 100%
  - 2. Density ASTM D 1475 11.4 lbs./gal. (1.36 g/m<sup>3</sup>)
  - 3. Viscosity Brookfield 20,000-50,000 cPs
  - 4. Flash Point ASTM D 93 400 deg. F min. (232 deg. C)
  - 5. Slope: up to 3:12
- B. Flashing Adhesive - Green-Lock Flashing Adhesive: Cold applied solvent free flashing adhesive: zero V.O.C.
  - 1. Non-Volatile Content ASTM D 4586 100%
  - 2. Density ASTM D 1475 11.8 lbs./gal. (1.17 g/m<sup>3</sup>)
  - 3. Viscosity Brookfield 400,000 cPs
  - 4. Flash Point ASTM D 93 400 deg. F min. (232 deg. C)

## 2.4 BITUMINOUS ROOFING MATERIALS

- A. General: Auxiliary materials provided or recommended by roofing system manufacturer for intended use and compatible with roofing.
- B. Liquid Flashing - Tuff-Flash: An asphaltic-polyurethane, low odor, liquid flashing material designed for specialized details unable to be waterproofed with typical modified membrane flashings.
- C. Asphalt Primer: ASTM D 41/D 41M. Garla-Prime.
- D. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required by roofing system manufacturer for application. Flashing-Bond.
- E. Mastic Sealant: Polyisobutylene, plain or modified bitumen; non-hardening, non-migrating, non-skinning, and non-drying. Garla-Flex.
- F. Miscellaneous Materials: Provide those recommended by roofing system manufacturer.

## 2.5 SURFACING

- A. Roofing Granules: Ceramic-coated roofing granules as provided by the prime material manufacturer, No. 11 screen size with 100 percent passing No. 8 (2.36-mm) sieve and 98 percent of mass retained on No. 40 (0.425-mm) sieve, color to match roofing.
- B. Reflective Base Flashing Coating: Water-based Acrylic with self-curing Latex Polymers. Pyramic .

## 2.6 ROOF BOARD INSULATION

- A. Base Layer Insulation: Rigid, closed cell polyisocyanurate rigid board insulation utilizing non-chlorine/non-ozone depleting blowing agent, bonded to non-asphaltic coated fiberglass facers, ASTM C 1289, Type II, Class 1, Grade 2 (20 psi), 4.4-inch total thickness (R-25); maximum board size 48" x 96" for mechanically attached applications: "VPG-CG" by Viking Products Group or pre-approved equal.
  - 1. Base insulation layer shall consist of one (2) 2.2-inch boards, all joints staggered.
- B. Tapered Insulation: Rigid, closed cell polyisocyanurate rigid board insulation utilizing non-chlorine/non-ozone depleting blowing agent, bonded to non-asphaltic coated fiberglass facers, ASTM C 1289, Type II, Class 1, Grade 2 (20 psi), tapered



- 1/4" per foot minimum: "Tapered VPG-CG" by Viking Products Group or pre-approved equal.
- C. Secondary Insulation Layer/Cover Board: Moisture resistant, 1/2-inch thick gypsum roof board, ASTM C 1278; provide 48" by 48" nominal size: "Securock" by US Gypsum or pre-approved equal.
  - D. Insulation Adhesive: Dual-component, VOC compliant, two-part reaction-cure urethane foam adhesive. "Insul-Lock HR" by The Garland Co., Inc. or pre-approved equal.

## **2.7 RELATED MATERIALS**

- A. Plumbing stacks should be 4lb (1.8kg) sheet lead formed and rolled.
- B. Nails and Fasteners: Non-ferrous metal or galvanized steel, except that hard copper nails shall be used with copper; aluminum or stainless steel nails shall be used with aluminum; and stainless steel nails shall be used with stainless steel. Fasteners shall be self-clinching type of penetrating type as recommended by the manufacturer of the deck material. Nails and fasteners shall be flush-driven through flat metal discs of not less than one (1) inch diameter. Omit metal discs when one-piece composite nails or fasteners with heads not less than one (1) inch diameter are used.
- C. Butyl Tape: 100% solids, asbestos free and compressive tape designed to seal as recommended and furnished by the membrane manufacturer.

## **2.8 PERFORMANCE REQUIREMENTS**

- A. General Performance: Installed roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roofing and base flashings shall remain watertight.
- B. Material Compatibility: Roofing materials shall be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roofing manufacturer based on testing and field experience.
- C. Solar Reflectance Index: Not less than 70 when calculated according to ASTM E 1980, based on testing identical products by a qualified testing agency.
- D. Fire-Resistance Ratings: Comply with fire-resistance-rated assembly designs indicated. Identify products with appropriate markings of applicable testing agency.

## **PART 3 - EXECUTION**

### **3.1 GENERAL INSTALLATION REQUIREMENTS**

- A. Cooperate with manufacturer, inspection and test agencies engaged or required to perform services in connection with installing the roof system.
- B. Insurance/Code Compliance: Where required by code, install and test the roofing system to comply with governing regulation and specified insurance requirements.
- C. Protect other work from spillage of roofing materials and prevent materials from entering or clogging drains and conductors. Replace or restore other work damaged by installation of the modified bituminous roofing system.
- D. Coordinate installation of roofing system so insulation and other components of the roofing system not permanently exposed are not subjected to precipitation or left uncovered at the end of the workday or when rain is forecast.

1. Provide tie-offs at end of each day's work to cover exposed roofing sheets and insulation with a course of coated felt set in roofing cement or hot roofing asphalt, with joints and edges sealed.
  2. Complete terminations and base flashings, and provide temporary seals to prevent water from entering completed sections of roofing system.
  3. Remove and discard temporary seals before beginning work on adjoining roofing.
- E. Substrate Joint Penetrations: Prevent bitumen from penetrating substrate joints, entering building, or damaging roofing system components or adjacent building construction.
- F. Apply roofing materials as specified by manufacturer's instructions:
1. Keep roofing materials dry before and during application.
  2. Do not permit phased construction.
  3. Complete application of roofing plies, modified sheet and flashing in a continuous operation.
  4. Begin and apply only as much roofing in one day as can be completed that same day.
- G. Cut-Offs (Waterstops): At end of each day's roofing installation, protect exposed edge of incomplete work, including ply sheets and insulation.
- H. Broadcast minerals into the bleed out of bitumen while bitumen is at its recommended EVT temperature to achieve a monolithic appearance.

### **3.2 EXAMINATION**

- A. Verify that deck surfaces and project conditions are ready to receive work of this Section.
- B. Verify that deck is supported and secured to structural members.
- C. Verify that deck is clean and smooth, free of depressions, projections or ripples, and is properly sloped.
- D. Verify that adjacent roof substrate components do not vary more than [1/4] inch in height.
- E. Verify that deck surfaces are dry.
- F. Verify that openings, curbs, pipes, conduit, sleeves, ducts, and other items which penetrate the roof are set solidly, and that cant strips, wood nailing strips, and reglets are set in place.

### **3.3 SBS MODIFIED BITUMINOUS BASE PLY MEMBRANE INSTALLATION**

- A. Install base ply according to roofing manufacturer's written instructions, starting at low point of roofing system. Extend roofing membrane sheets over and terminate beyond cants, installing as follows:
  1. Cut sheets into 18 foot lengths and allow to relax prior to installation.
  2. Lap ply sheet ends 8 inches. Stagger end laps 12 inches minimum.
  3. Solidly bond to the substrate and adjacent ply with specified cold adhesive at the rate of 2 to 2-1/2 gallons per 100 square feet.
  4. Roll must push a puddle of adhesive in front of it with adhesive slightly visible at all side laps. Use care to eliminate air entrapment under the membrane.
  5. Broom in base sheet immediately after application.
  6. Use a 50 lb. weighted roller to press the base sheet into the adhesive and remove air pockets.

7. Use weights for edges and corners that could potentially “crow up” on the sheets.
  8. Install subsequent rolls of modified across the roof as above with a minimum of 4 inch side laps and 8 inch staggered end laps, minimum 36” in the field. Lay modified membrane in the same direction as the underlayers but the laps shall not coincide with the laps of the base layers.
  9. Extend plies 2 inches beyond top edges of cants at wall and projection bases.
  10. Allow the one ply of base sheet to cure at least 30 minutes before installing the modified membrane.
  11. Install base flashing ply to all perimeter and projections details.
- B. Laps: Accurately align roofing sheets, without stretching, and maintain uniform side and end laps. Stagger end laps. Completely bond and seal laps, leaving no voids.
1. Repair voids in laps and lapped seams not completely sealed.
- C. Install roofing sheets so side and end laps shed water.

### **3.4 SBS MODIFIED BITUMINOUS CAP SHEET MEMBRANE INSTALLATION**

- A. Install modified bituminous cap sheet according to roofing manufacturer's written instructions, starting at low point of roofing system. Cut cap ply sheets into 18 foot lengths and allow plies to relax before installing. Install in interply adhesive applied at the rate required by the manufacturer. Shingle sheets uniformly over the prepared substrate to achieve the number of plies specified. Shingle in proper direction to shed water on each large area of roofing, installing as follows:
1. Lap ply sheet ends 8 inches. Stagger end laps 12 inches minimum.
  2. Solidly bond to the base layers with specified cold adhesive at the rate of 2 to 2-1/2 gallons per 100 square feet.
  3. Roll must push a puddle of adhesive in front of it with adhesive slightly visible at all side laps. Care should be taken to eliminate air entrapment under the membrane.
  4. Install subsequent rolls of modified across the roof as above with a minimum of 4 inch side laps and 8 inch staggered end laps. Lay modified membrane in the same direction as the underlayers but the laps shall not coincide with the laps of the base layers.
  5. Allow cold adhesive to set for 5 to 10 minutes before installing the top layer of modified membrane.
  6. Extend membrane 2 inches beyond top edge of all cants in full mopping's of the cold adhesive as shown on the Drawings.
  7. Hot air weld all membrane side and end laps.

### **3.5 BASE FLASHING AND STRIPPING INSTALLATION**

- A. Install base flashing over cant strips and other sloped and vertical surfaces, at roof edges, and at penetrations through roof, and secure to substrates according to roofing system manufacturer's written instructions. Minimum base-flashing height of 8 inches (200 mm) is required. Install modified bituminous roofing sheet and cap sheet according to roofing manufacturer's written instructions, starting at low point of roofing system. Extend roofing membrane sheets over and terminate beyond cants, installing as follows:
1. Seal all curb, wall and parapet flashings with an application of mastic and mesh on a daily basis. Do not permit conditions to exist that will allow moisture to enter behind, around or under the roof or flashing membrane.

2. Prepare all walls, penetrations, expansion joints [and where shown on the drawings] to be flashed with asphalt primer at the rate of one hundred (100) square feet per gallon. Allow primer to dry tack free.
  3. Adhere to the underlying base ply with specified flashing ply adhesive unless otherwise specified. Nail off at a minimum of 8 inches (203 mm) o.c. from the finished roof at all vertical surfaces.
  4. Solidly adhere the entire flashing ply to the substrate. Secure the tops of all flashings that are not run up and over curb through termination bar fastened at 6 inches (152 mm) O.C. and sealed at top.
  5. Seal all vertical laps of flashing ply with a three-course application of trowel-grade mastic and fiberglass mesh
  6. After the laps have been tested and complete positive bond has been achieved, the applicator shall heat the seam edge and trowel along the seam edge. Troweling shall continue until a sloped, beveled edge has been produced.
  7. Terminate all base flashings using extruded aluminum termination bar. Three-course all terminations with PVC Mesh and specified mastic.
- B. Install roofing cap-sheet stripping where metal flanges and edgings are set on roofing according to roofing system manufacturer's written instructions.

### **3.6 REFLECTIVE BASE FLASHING COATING APPLICATION**

- A. Base Flashing roofing plies and mastics shall be allowed to cure for thirty (30) days prior to application of the coating system.
- B. Prior to coating application, all existing non-embedded granule surfacing material shall be removed by means of a stiff bristle street broom, powered mechanical sweeper, or vacuuming. All loose dirt and dust remaining after granule removal must be broomed and/or vacuumed from the roof. All blisters, ridges and other imperfections must be secured so that the surface will be clean and dry and a secure base for coating application.
1. The first coat of the Base Coat shall be applied the same day as the surface is cleaned. In no case shall the coating be applied over a dirty surface.
  2. The coating system shall be roller applied in a cross hatch technique without causing runs or puddles.
  3. The coating system shall be evenly applied in at least 2 separate coats to achieve a minimum system of 22-32 mils dry film thickness. Allow thorough dry time between coats.
  4. No coating shall be applied if weather will not allow it to dry prior to exposure to precipitation or freezing temperatures.

### **3.7 ROOF DETAIL INSTALLATION**

- A. Coordinate counter flashing, cap flashings, expansion joints, and similar work with modified bitumen roofing work (as specified in other Sections).
- B. Coordinate roof accessories, miscellaneous sheet metal accessory items, including piping vents and other devices with the roofing system work (as specified in other Sections).
- C. Curb Detail:
1. Minimum curb height is eight (8) inches. Prime vertically at a rate of one hundred (100) square feet per gallon and allow to dry.
  2. Set cant in bitumen. Run all field plies over cant a minimum of two (2) inches.
  3. Install base flashing assembly.
  4. Install pre-manufactured counter-flashing with fasteners and neoprene washers or per manufacturer's recommendations.

- D. Flanged Penetration Detail:
1. Minimum stack height is twelve (12) inches.
  2. Run roof system over the entire surface of the roof. Seal the base of the stack with elastomeric sealant.
  3. Prime both surfaces of flange of new sleeve. Install properly sized sleeves set in (¼) inch bed of roof cement.
  4. Install stripping ply prior to cap sheet installation.

### **3.8 FIELD QUALITY CONTROL**

- A. Perform manufacturer's field inspection and as required a minimum of three (3) days per week.
- B. Correct defects or irregularities discovered during field inspection.
- C. Require attendance of roofing materials manufacturers' representatives at site during installation of the roofing system. A copy of the specification should also be on site at all times.

### **3.9 PROTECTING AND CLEANING**

- A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction does not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.
- B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.
- C. Remove bitumen adhesive drippings from all walls, windows, floors, ladders and finished surfaces.
- D. In areas where finished surfaces are soiled by asphalt or any other sources of soiling caused by work of this Section, consult manufacturer of surfaces for cleaning instructions and conform to their instructions.
- E. Repair or replace defaced or disfigured finishes caused by work of this Section.

### **3.10 CONSTRUCTION WASTE MANAGEMENT**

- A. Remove and properly dispose of waste products generated during roofing procedures. Comply with requirements of authorities having jurisdiction.

### **3.11 FINAL INSPECTION**

- A. At completion of roofing installation and associated work, meet with Contractor, Architect, installer, installer of associated work, Owner, roofing system manufacturer's representative, and other representatives directly concerned with performance of roofing system.
- B. Walk roof surface areas of the building, inspect perimeter building edges as well as flashing of roof penetrations, walls, curbs and other equipment. List all items requiring correction or completion and furnish copy of list to each party in attendance.
- C. The roofing system manufacturer reserves the right to request a thermographic scan of the roof during final inspection to determine if any damp or wet materials have been installed. The thermographic scan shall be provided by the Roofing Contractor.

- D. If core cuts verify the presence of damp or wet materials, the Roofing Contractor shall be required to replace the damaged areas at his own expense.
- E. Repair or replace deteriorated or defective work found at time above inspection as required to produce an installation which is free of damage and deterioration at time of Substantial Completion and according to warranty requirements.
- F. Notify the Owner and Architect upon completion of corrections.
- G. Following the final inspection, provide written notice of acceptance of the installation from the roofing system manufacturer.
- H. Immediately correct roof leakage during construction. If the Contractor does not respond within twenty four (24) hours, the Owner will exercise rights to correct the Work under the terms of the Conditions of the Contract.

**END OF SECTION 07 52 16**

## **SECTION 07 62 00 - FLASHING AND SHEET METAL**

### **PART 1 - GENERAL**

#### **1.01 RELATED DOCUMENTS**

Drawings, Technical Specifications, TSUS construction specifications Division 1, TSUS uniform general conditions for construction contract, safety requirements of OSHA and prevailing building codes & city, state and county.

#### **1.02 DESCRIPTION OF WORK**

The type of work specified in this section include the following:

- A. Metal base flashing and counter flashing.
- B. Gutters and scuppers.
- C. Metal caps and retainer clips.

#### **1.03 JOB CONDITIONS**

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

### **PART 2 - PRODUCTS**

#### **2.01 MATERIALS**

- A. Sheet Metal:
  - 1. AISI Type 302/304, ASTM A 167, 2D annealed finish stainless steel.
  - 2. Gauge as called for on drawings, minimum 28 Ga.
- B. Miscellaneous Materials:
  - 1. Solder: 60-40 tin/lead solder (ASTM B-32 with acid chloride type flux).
  - 2. Fasteners:
    - a) Same metal as flashing/sheet metal or other non-corrosive metal as recommended by sheet manufacturer.
    - b) Match finish of exposed heads with material being fastened.
  - 3. Sealant: Polyisobutylene, non-hardening, non-skinning, nondrying, non-migrating.
  - 4. Slip Sheet: 5 lb. rosin-sized building paper.
  - 5. Underlayment: 6 mil carbonated polyethylene film; FS L-P-512.
  - 6. Roofing cement: ASTM D 2822, asphaltic.

#### **2.02 FABRICATION**

- A. General:
  - 1. Shop fabricate work to greatest extent possible.
  - 2. Comply with details shown and with applicable requirements of Sheet Metal and Air Conditioning Contractors' National Association (SMACNA) and other recognized industry practices.
  - 3. Fabricate for waterproof and weather resistant performance.
  - 4. Provide expansion provisions for running work sufficient to permanently prevent leakage damage or deterioration of the work.
  - 5. Form work to fit substrate.

6. 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 lines.
- B. Seams:
    1. Fabricate nonmoving seams in sheet metal with flat lock seams.
    2. Form seams and solder.
    3. Caulk all seams.
  - C. Expansion joints: Where lapped expansion provisions in work cannot be used, form expansion joints at intermeshing hooked flanges, not less than 1" deep, filled with sealant.
  - D. Sealant joints: Where movable, non-expansion type joints are required, form metal to provide for proper installation of sealant in compliance with industry standards.
  - E. Separations: Provide for separation of metal from non-compatible metal or corrosive substrate by coating concealed surfaces at point of contact with bituminous coating.

### **PART 3 - EXECUTION**

#### **3.01 INSTALLATION**

- A. General:
  1. Comply with SMACNA "Architectural Sheet Metal Manual".
  2. Anchor units of work securely in place providing for thermal expansion.
  3. Use concealed fasteners where possible.
  4. Set work true to line and level as indicated.
  5. Install work with laps, joints and seams which will be permanently watertight and weatherproof.
- B. Underlayment:
  1. Where stainless steel is installed directly on cementitious or wood substrates, install a paper slip sheet and a course of polyethylene.
  2. Bed flanges of work in a thick coat of bituminous roofing cement.

**END OF SECTION 07 62 00**



## **SECTION 07 72 00 - ROOF ACCESSORIES**

### **PART 1 - GENERAL**

#### **1.01 RELATED DOCUMENTS**

Drawings, Technical Specifications, TSUS construction specifications Division 1, TSUS uniform general conditions for construction contract, safety requirements of OSHA and prevailing building codes & city, state and county.

#### **1.02 DESCRIPTION OF WORK**

- A. Extent and locations of roof accessories in indicated on the drawings and by provisions of this section.
- B. Types of units specified in this section include the following:
  - 1. Ventilators

### **PART 2 - PRODUCTS**

#### **2.01 MATERIALS, GENERAL**

- A. Zinc - Coated Steel
  - 1. Commercial quality with 0.20% copper.
  - 2. ASTM A 525, G90 hot dipped galvanized mill phosphate.
- B. Aluminum Sheet:
  - 1. ASTM B209, alloy 3003, temper as required for forming and performance.
  - 2. AA - C #2 A41 Clear anodized finish.
- C. Extruded Aluminum:
  - 1. Alloy 6063 - 752.
  - 2. 0.078" minimum thickness for primary framing.
  - 3. 0.062" minimum thickness for secondary framing.
  - 4. AA - G22A41 clear anodized finish.
- D. Insulation: Manufacturer's standard rigid or semi-rigid board of fiber glass of thickness indicated.
- E. Wood Nailers:
  - 1. Softwood lumber, pressure treated with waterborne preservatives.
  - 2. Comply with AWPB LP-2.
  - 3. Not less than 1-1/2" thick.
- F. Fasteners:
  - 1. Same metal as metal being fastened.
  - 2. Stainless steel or other non-corrosive metal.
  - 3. Where removal of exterior exposed fasteners affords access to building, provide non-removable fastener heads.
- G. Gaskets:
  - 1. Tubular or fingered design of neoprene or polyvinyl chloride.
  - 2. Block design of sponge neoprene.
- H. Bituminous Coating:
  - 1. FS TT-C494 or SSPC-Paint 12.
  - 2. Solvent type bituminous mastic, nominally free of sulfur.
  - 3. Compounded for 15 mil dry film thickness per coating.
- I. Sealant: Polyisobutylene, non-hardening, non-skinning, non-migrating.

- J. Elastomeric Sealant:
  - 1. Generic type recommended by unit manufacturer.
- K. Roofing Cement: ASTM D 2822, asphaltic.

## **2.02 VENTILATOR**

- A. General:
  - 1. Turbine type with 12" diameter throat.
  - 2. Galvanized steel construction.
  - 3. Ball bearing mounting.
  - 4. Provide galvanized steel base.
- A. B. Manufacturer: Leslie-Locke  
Building Products Division, Questor  
Corporation - Atlanta, Ga.

## **PART 3 - EXECUTION**

### **3.01 INSTALLATION**

- A. General:
  - 1. Comply with manufacturer's instructions and recommendations.
  - 2. Coordinate with the installation of roofing and other substrate to receive accessory units.
  - 3. Anchor units securely to supporting substrate to withstand lateral and thermal stresses as well as inward and outward loading pressures.
- B. Flange Seal: Set flanges of units in a thick bed of roofing cement.
- C. Operation:
  - 1. Test operate units with operable components.
  - 2. Clean and lubricate joints and hardware.
  - 3. Adjust for proper operation.

### **3.02 CLEANING AND PROTECTION**

- A. Clean exposed metal surfaces in accordance with manufacturer's directions.
- B. Touchup damaged metal counting's.

**END OF SECTION 07 72 00**

## **SECTION 07 75 00 - FORMED ALUMINUM COPING**

### **PART 1 - GENERAL**

#### **1.01 RELATED DOCUMENTS**

Drawings, Technical Specifications, TSUS construction specifications Division 1, TSUS uniform general conditions for construction contract, safety requirements of OSHA and prevailing building codes & city, state and county.

#### **1.02 DESCRIPTION OF WORK**

Extent and location of aluminum coping as shown on details of drawings and specified in this section.

#### **1.03 RELATED WORK OF OTHER SECTIONS**

- A. Coordinate work of this section with work of other sections to properly execute and to maintain satisfactory progress of the project.
- B. Sections with related work include:
  - 1. Insulated Wall System
  - 2. Metal Siding

#### **1.04 MANUFACTURERS**

- A. Architectural Products Company, Covington, Kentucky

#### **1.05 SUBMITTALS**

- A. Submit manufacturer's specification for fabrication and installation, including data substantiating that products comply with requirements.
- B. Provide shop drawings to show the following:
  - 1. Size of coping.
  - 2. Coping details.
  - 3. Metal gauges.
  - 4. Location and preparation of anchor plate and joint covers.
  - 5. Finishes.

### **PART 2 - PRODUCT**

#### **2.01 MATERIALS**

- A. AP Snap - Tight coping as manufactured by Architectural Products Company.
- B. Coping to be formed 5005-H34 Alloy Aluminum in 10'-0" lengths with 6" wide concealed joint covers and 12" wide 18 gauge galvanized anchor plates 5'-0" o.c.
- C. Coping to be supplied with Butyl strips to form an integral gutter system.
- D. Finish to be standard Kynar 500. Color to be selected by Engineer.
- E. Throat Dimension: Sufficient to accommodate wall thickness.

PART 3 - EXECUTION

**3.01** JOB CONDITIONS

- A. Examine conditions to receive aluminum coping and notify contractor of any unsatisfactory conditions.
- B. Do not proceed with work until unsatisfactory conditions have been corrected.

**3.02** INSTALLATION

- A. Install coping straight and true and in accordance with manufacturer's instructions.

**END OF SECTION 07 75 00**

## **SECTION 07 84 00 - FIRESTOPPING**

### **PART 1 - GENERAL**

#### **1.01 RELATED DOCUMENTS**

Drawings, Technical Specifications, TSUS construction specifications Division 1, TSUS uniform general conditions for construction contract, safety requirements of OSHA and prevailing building codes & city, state and county.

#### **1.02 DESCRIPTION OF WORK**

- A. The extent of fireproofing includes but not limited to seal all penetration through concrete.
- B. Floors and all conduit penetrations through rated walls.

#### **1.03 QUALITY ASSURANCE**

- A. Installer of sprayed-on fireproofing to be licensed or otherwise approved by manufacturer of primary fireproofing materials.
- B. Provide products which have been tested in accordance with ASTM E119 UL 263, ANSI A2.1 or NFPA 251 for fire-resistance and rated by UL or other industry recognized agency for the required resistance.
- C. Provide products which have been tested and listed by UL for required surface burning characteristics in accordance with ASTM E-84.
- D. Unless otherwise noted provide completed installation rated at a maximum flame-spread of 25.

#### **1.04 SEQUENCE AND COORDINATION**

- A. Schedule fireproofing work with other trades so that it will not be exposed to weather and other damaging ambient conditions.
- B. Install at such time that work will not be exposed to unnecessary abrasion or other damage by other trades.
- C. Install prior to installation of enclosing or concealing work.

#### **1.05 WARRANTY**

- A. Submit written warranty, signed by General Contractor and Subcontractor agreeing to repair or replace faulty fireproofing due to materials or workmanship.
- B. Warranty period will be for ten (10) years after date of occupancy by owner or date of substantial completion whichever comes first.

### **PART 2 - PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. Subject to compliance with requirements provide products of one of the following:
  - 1. Air-O-Therm Application Co., Inc.; Elk Grove Village Illinois.
  - 2. American Energy Products Corp.; Edison, N.J.
  - 3. Conwed Corp.; St. Paul Minn.
  - 4. Delvon Corp.; Mishawaka, Ind.
  - 5. United States Mineral Products Co.; Stanhope, N.J.

## **2.02 MATERIALS**

- A. Fireproofing Materials:
  - 1. Mineral fibers (exclusive of asbestos) plus manufacturer's standard binders, fillers and additives for spray-on applicator mixing with water and air at spray nozzle.
  - 2. Form a rigid, porous noncombustible covering of uniform density and thickness.
  - 3. Apply in one or more courses to provide fire endurance ratings specified.
- B. Auxiliary Fireproofing Materials:
  - 1. Substrate Primers: Coordinate with structural steel supplier for compatibility with fireproofing materials and adhesives.
  - 2. Adhesive: Type recommended by fireproofing manufacturers and complying with selection requirements of applicable fire endurance tests.
  - 3. Toppings:
    - a) Hard coat: Fireproofing manufacturer's recommended standard high density cementitious finish coat for 1/8" thick minimum application. Compound to provide increased surface hardness.
    - b) Sealer: Fireproofing manufacturer's recommended standard spray-on type resinous sealer, designed to reduce dusting, flaking and spalling but without increasing surface burning on fireproofing.

## **PART 3 - EXECUTION**

### **3.01 PREPARATION**

- A. Examine substrate and conditions under which fireproofing work is to be performed.
- B. Notify General Contractor in writing of any unsatisfactory conditions.
- C. Do not proceed with fireproofing work until unsatisfactory conditions have been corrected in a manner acceptable to installer.
- D. Clean substrates of substances which might be incompatible with or interfere with bond of fireproofing.
- E. Prime substrates where recommended by fireproofing manufacturer to receive direct contact application except where acceptable shop primer is in satisfactory conditions to receive fireproofing.
- F. Cover other work which might be damaged by fallout or over spray.
- G. Provide temporary enclosures as may be required to confine operations, protect environment and ensure ambient conditions including minimum temperature of 55° F (13° C).
- H. Maintain substrate temperatures of 40° F (4° C)

### **3.02 INSTALLATION**

- A. General:
  - 1. Comply with manufacturer's instructions for particular conditions of installation.
  - 2. Consult with manufacturer's technical representative for conditions not covered by printed instructions.
  - 3. Coat substrate with bonding adhesive where direct bonding of fireproofing is required or recommended by manufacturer.
- B. Application:

1. Apply thickness of fireproofing required to provide a 2 hour fire rating.
2. Applicable code is the Southern Building Code, Type II Construction for Small Assembly Occupancy. Non-Working Stage, 1982 Edition.
3. Apply to all columns and all beams framing between columns. (under side of deck and steel joists not required).
4. Tamp freshly placed fireproofing to level surfaces, increase surface density and provide medium smooth texture.
5. Apply topping as required.

### **3.03 QUALITY CONTROL**

- A. Engage an independent testing laboratory to sample and test completed fireproofing work for density and thickness.
- B. Tests Required:
  1. Provide fifteen (15) tests where directed by Engineer.
  2. Provide any other test required for reason of poor test results at no cost to Owner.
  3. Submit test reports to Engineer.
- C. Patch voids where test samples were removed.
- D. Test in accordance with procedures of ASTM E 306.
- E. Repair or replace any work found to be below compliance requirements.

### **3.04 CLEANING, PATCHING, PROTECTION**

- A. Cleaning:
  1. Immediately upon completion of spray operations in each area, remove over-spray from surfaces of other work.
  2. Clean surfaces to remove evidence of soiling.
  3. Repair or replace damaged work to acceptable condition.
- B. Patching:
  1. Patch fireproofing which has been cut away to facilitate installation of other work.
  2. Trowel-applied fireproofing materials are acceptable for patching of work.
  3. Do not allow work requiring patching to be concealed before patching is accomplished.
- C. Protection:
  1. Advise General Contractor of protection requirements for fireproofing work.
  2. Provide protection from reasonably predictable harmful exposures.

**END OF SECTION 07 84 00**

## **SECTION 07 92 00 - JOINT SEALERS**

### **PART 1 - GENERAL**

#### **1.01 RELATED DOCUMENTS**

Drawings, Technical Specifications, TSUS construction specifications Division 1, TSUS uniform general conditions for construction contract, safety requirements of OSHA and prevailing building codes & city, state and county.

#### **1.02 DESCRIPTION OF WORK**

- A. The extent of each form and type of joint sealer is indicated on drawings and by provisions of this section.
- B. The applications for joint sealers as work of this section include the following:
  - 1. Walk and paving joints.
  - 2. Exterior wall joints.
  - 3. Flashing and coping joints.
  - 4. Joints at window and door frames, inside and outside.
  - 5. Interior wall and ceiling joints.
  - 6. Counter tops.

#### **1.03 SUBMITTALS**

Submit manufacturer's product specifications, handling, installation and curing instructions, and performance tested data sheets.

#### **1.04 JOB CONDITIONS**

- A. Do not install sealant under unfavorable weather conditions.
- B. Install elastomeric sealant when temperature is in lower third of temperature range recommended by manufacturer for installation.

### **PART 2 - PRODUCTS**

#### **2.01 MATERIALS**

- A. General:
  - 1. Provide colors as selected by Engineer from manufacturer's standard colors.
  - 2. Select materials for compatibility with joint surfaces and other indicated exposures, and except as otherwise indicated select modules of elasticity and hardness or grade recommended by manufacturer for application indicated.
  - 3. Where exposed to foot traffic, select marketing materials of sufficient strength and hardness to withstand stiletto heel traffic without damage or deterioration of sealer system
- B. Elastomeric Sealant: Silicone rubber-based, one-part elastomeric sealant, complying with FS-TT-S-001543, Class A; recommended by manufacturer for exterior joints.
  - 1. Provide nonacid, porous-bond type silicone rubber sealant where one or both joint faces are masonry, stone, concrete or other porous material.
  - 2. Provide acid, nonporous-bond type silicone rubber sealant where one or both joint faces are metal, glass, plastic or other non-porous material.



- C. Bituminous Sealant (walks and paving)
  - 1. Sonneborn SL1 self-leveling or non-self-leveling for horizontal applications (verify color).
- D. Joint Filler: Key Load transfer board by Marine Lumber Co., and board backer.

## **2.02 MISCELLANEOUS MATERIALS**

- A. Joint primer/sealer: Provide type recommended by sealant manufacturer for the joint surface to be primed or sealed.
- B. Bond breaker tape: Polyethylene or other plastic tape recommended by sealant manufacturer to be applied to sealant-contact surfaces where bond to the substrate or joint filler must be avoided. Provide self-adhesive tape.
- C. Backer rod: Compressible rod stock of polyethylene foam or material recommended by sealant manufacturer.

## **PART 3 - EXECUTION**

### **3.01 MANUFACTURER'S INSTRUCTIONS**

- A. Comply with manufacturer's printed instructions except where more stringent requirements are shown or defined.

### **3.02 JOINT PREPARATION**

- A. Clean joint surfaces immediately before installation of sealant of any substance which would interfere with bond of sealant.
- B. Etch concrete or masonry joint surfaces as recommended by sealant manufacturer.
- C. Roughen vitreous and glazed joint surfaces as recommended by sealant manufacturer.
- D. Prime or seal joint surfaces as recommended by sealant manufacturer.
- E. Do not allow primer/sealer to spill or migrate onto adjoining surfaces.

### **3.03 INSTALLATION**

- A. Set joint filler and backer rods at proper depth and position to receive bond breaker and sealant.
- B. Install joint fillers and backer rods without leaving voids.
- C. Install bond breaker tape where indicated or required by manufacturer's recommendations to ensure proper performance of sealant.
- A. Employ proven installation techniques which will ensure that sealant are deposited in uniform, continuous ribbons without gaps or air pockets, with "wetting" of joint bond surfaces equally on opposite sides.

Fill sealant rabbet to a slightly concave surface.

- D. Where horizontal joint is between a horizontal and vertical surface, fill joint to form cove to prevent joint from trapping moisture and dirt.
- E. Install sealant to depths as shown or recommended by sealant manufacturer but within the following limitations, measured at center of bead.
  - 1. Walk and drives: Fill joints to a depth equal to 75% of joint width, but not more than 5/8" or less than 3/8" deep.
  - 2. Moving joints: Fill joints to a depth equal to 50% of joint width, but not more than 1/2" or less than 1/4" deep.

### **3.04 PROTECTION AND CURING**

- A. Do not allow sealant to overflow or spill onto adjoining surfaces.
- B. Clean adjoining surfaces by whatever means may be necessary to eliminate evidence of spillage.
- C. Cure sealant in compliance with manufacturer's instructions and recommendations.

**END OF SECTION 07 92 00**

## **SECTION 08 11 13 - STEEL DOORS AND FRAMES**

### **PART 1 - GENERAL**

#### **1.01 RELATED DOCUMENTS**

Drawings, Technical Specifications, TSUS construction specifications Division 1, TSUS uniform general conditions for construction contract, safety requirements of OSHA and prevailing building codes & city, state and county.

#### **1.02 DESCRIPTION OF WORK**

- A. Extent of standard steel doors and frames is shown and scheduled on drawings.
- B. Builder's Hardware is specified elsewhere in Division 8.

#### **1.03 QUALITY ASSURANCE**

- A. Provide doors and frames complying with Steel Door Institute "Recommended Specifications: Standard Steel Doors and Frames" (SDI-100) and as herein specified.
- B. Provide steel doors and frames by a single manufacturer specializing in this type of work.

#### **1.04 SUBMITTALS**

- A. Submit manufacturer's specifications for fabrication and installation, including data substantiating that products comply with requirements.
- B. Shop Drawings:
  - 1. Provide schedule of doors and frames using same reference numbers for details and openings as those on contract drawings.
  - 2. Shop drawings to show the following:
    - a) Details of each frame type.
    - b) Elevations of door design types.
    - c) Location and installation requirements of finish hardware and reinforcements.
    - d) Details of joints, connections and show gauges.
    - e) Show anchorage and accessory items.

#### **1.05 HANDLING**

- A. Carton or crate door units to provide protection during transit and job storage.
- B. Remove and replace or repair damaged items as directed by Engineer.
- C. Store doors and frames at site in weatherproof building.
- D. Place doors in storage on runners to prevent rust or damage.
- E. Do not use plastic or canvas shelters which could create humidity chamber.
- F. Provide minimum 1/4" space between units for air circulation.

## **PART 2 - PRODUCTS**

### **2.01 MATERIALS**

- A. Galvanized Steel Sheets: (Exterior Doors Only) Zinc-coated carbon steel sheets of commercial quality, complying with ASTM A-526 with ASTM A-525, G60 zinc coating, mill phosphatized.
- B. Supports and Anchors: Fabricate of not less than 16 gauge sheet metal, galvanized for exterior doors.
- C. Inserts, Bolts, and Fasteners:
  - 1. Interior walls: Manufacturer's standard units.
  - 2. Exterior walls: Hot-dip galvanized complying with ASTM A153, Class C or D for exterior doors.
- D. Paint: Prime units with rust-inhibiting enamel suitable as a base for defined finishes.
- E. Glass and Glazing: Defined elsewhere in Division 8.

### **2.02 FABRICATION**

- A. Flush seamless doors:
  - 1. Inner Reinforcing
    - a) Continuous 20 gauge channel or hat shaped stiffeners full length of doors (space not over 6" o.c. for hat-shaped stiffeners).
    - b) Spot weld stiffeners uniformly to face sheets.
    - c) 18 gauge channel reinforcing at all edges welded to face sheets.
  - 2. Cap Channel: Provide channel at top of all exterior doors, installed with legs down.
  - 3. Edge Reinforcing:
    - a) Join and reinforce both edges with a 10 gauge continuous strip for full height of door, offset at hinge locations, drilled and tapped to receive hinges.
    - b) Weld joints continuously at edges, fill with metallic filler and grind smooth.
  - 4. Seams: Exposed seams on edges, corners, and/or faces not acceptable.
  - 5. Hardware Preparation:
    - a) Mortise, cope, cut out, reinforce, drill and tap doors at factory to receive and secure finish hardware.
    - b) Reinforcement at hinges 9 gauge.
    - c) Reinforcement of lock sets 12 gauge.
    - d) All other reinforcement 14 gauge.
  - 6. Door Faces: (galvanize exterior door faces) 16 gauge
    - a) Exterior doors refer to drawings.
    - b) Interior door refer to drawings.
  - 7. Vision Panels:
    - a) Provide hollow metal moldings to secure glazing by others.
    - b) Fixed molding welded to security side of door.
    - c) Loose stops not less than 20 gauge steel with butt joints and secured to frame with cadmium or zinc coated countersunk screws.

- B. Door Frames: 14 gauge (galvanize exterior doors)
  - 1. Form to design shown on drawings with integral stops.
  - 2. All joints mitered and where welded, ground smooth.
  - 3. Hardware Reinforcement
    - a) For hinges 9 gauge.
    - b) For lock strikes, closers and brackets 12 gauge
    - c) For all other hardware 14 gauge.
    - d) Provide 26 gauge mortar guards over mortised hardware reinforcements.
  - 4. Anchors
    - a) Provide frame with fixed or adjustable anchors of type required by wall construction.
    - b) Provide one (1) anchor for each 2'6" of frame height or fraction thereof.
    - c) Provide 14 gauge floor clips welded to each jamb and punched to receive floor anchor.
  - 5. Spreaders:
    - a) Furnish all frames with a temporary, removable steel spreader at sill.
    - b) Do not remove until frame is anchored, square and plumb.
  - 6. Head reinforcing: Reinforce frames 42" wide and over with a continuous 13 gauge steel channel welded inside the head section.
  - 7. Finish: Phosphate etch doors and frames and bake on 2 coats zinc chromate primer.
  - 8. Silencers:
    - a) Drill stops to receive 3 silencers on strike jamb of single-swing frames and 4 silencers on heads of double-swing frames.
    - b) Install plugs to keep holes clear during construction.

## **PART 3 - EXECUTION**

### **3.01 GENERAL**

- A. Verify all conditions affecting work of this section.
- B. Obtain accurate dimensions of openings and finished floor elevations.
- C. Fit doors in their respective frames within tolerances specified in SDI-100.

### **3.02 INSTALLATION**

- A. Erect frames plumb, square and in proper alignment.
- B. Secure frames to floor with suitable anchors.
- C. Brace frames and maintain in accurate position until permanently anchored.
- D. Remove spreaders and bracing after permanent anchorage is secured.
- E. Do not install doors in frames until closers or stops can be installed.
- F. Touch up all blemishes with zinc chromate primer immediately after installation.
- G. Adjust doors for proper clearance at top, sides and bottom.

## **END OF SECTION 08 11 13**

## **SECTION 08 15 13 - PLASTIC FACED WOOD DOORS**

### **PART 1 - GENERAL**

#### **1.01 RELATED DOCUMENTS**

Drawings, Technical Specifications, TSUS construction specifications Division 1, TSUS uniform general conditions for construction contract, safety requirements of OSHA and prevailing building codes & city, state and county.

#### **1.02 DESCRIPTION OF WORK**

Extent and location of plastic faced wood doors is shown on drawings and in schedules. Present doors and frames to be reset are shown and rescheduled.

#### **1.03 QUALITY ASSURANCE**

Comply with the requirements of NWMA Industry Standards 1S-1 "Wood Flush Doors" of the National Woodwork Manufacturer's Association.

#### **1.04 SUBMITTALS**

A. Submit samples of plastic laminate for Engineer's selection for color, finish and pattern.

#### **1.05 DELIVERY, STORAGE AND HANDLING**

- A. Protect plastic faced doors during transit, storage and handling to prevent damage, soiling and deterioration.
- B. Package each door at the factory in a separate heavy paper type carton.
- C. Store at job site in protected, waterproof and conditioned space.

### **PART 2 - PRODUCTS**

#### **2.01 MATERIALS**

- A. Core to comply to NWMA core design per 1S-1.
  - 1. Mat formed plywood meeting the requirements of CS-236 for Type 1, Density C, Class 1.
  - 2. Edge-glued, kiln-dried softwood lumber of one species.
- B. Stiles and rails: 1-1/4" minimum hardwood.
- C. Faces: NEMA LD-1 General-purpose Type, 1/16" minimum thickness plastic laminate, color and pattern as selected by Engineer.
- D. Glue: Type II highly water resistant.

#### **2.02 FABRICATION**

Meet or exceed Architectural Woodwork Institute 1300-G-3 PC, 1300 S-1, LLL D 581D Type 1 Class D, Industry Standard I.S. 1-78.

## **PART 3 - EXECUTION**

### **3.01 INSPECTION**

- A. Examine door frames and verify that frames are of the correct type and have been installed as required for proper hanging of doors.
- B. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner.

### **3.02 INSTALLATION**

- A. Install doors in accordance with door manufacturer's recommendation and approved installation instructions.
- B. Job Fit Doors:
  - 1. Fit door to frame for proper fit and uniform clearance at each edge and machine for hardware.
  - 2. Seal cuts after fitting and machining.
  - 3. Bevel strike edge of door 1/8" in 2".
- C. Glass and glazing: Refer to another section of Division 8.
- D. Clearances:
  - 1. Jambs and head: 1/8".
  - 2. Meeting stiles for pairs of doors: 1/8".
  - 3. Sill:
    - a) At threshold: 1/4" bottom of door to top of threshold.
    - b) No threshold: 1/2" bottom of door to top of floor finish or floor covering.
    - c) See door schedule for doors to be undercut for return air.

### **3.03 ADJUSTMENT AND PROTECTION**

- A. Rehang or replace doors that do not swing or operate freely.
- B. Replace doors damaged during installation as directed.
- C. Protect doors from damage and deterioration until acceptance of building by Owner.

**END OF SECTION 08 15 13**

## **SECTION 08 32 13 – SLIDING ALUMINUM-FRAMED GLASS DOORS**

### **PART 1 - PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

Drawings, Technical Specifications, TSUS construction specifications Division 1, TSUS uniform general conditions for construction contract, safety requirements of OSHA and prevailing building codes & city, state and county.

#### **1.2 PERFORMANCE REQUIREMENTS**

- A. Product Standard: Comply with AAMA/WDMA/CSA 101/I.S.2/A440 for minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.
  - 1. Product Certification: AAMA certified with label attached to each door.
- B. Performance Class and Grade: AAMA/WDMA/CSA 101/I.S.2/A440 as follows:
  - 1. Minimum Performance Class: [As indicated on Drawings].
  - 2. Minimum Performance Grade: [As indicated on Drawings].

#### **1.3 SUBMITTALS**

- A. In accordance with the requirements of Division 01 section “Common Product Requirements,” submit a complete listing of all manufacturers, products, model numbers, and designs proposed for use in the Work of this Section.
- B. Maintain all submittals at the Project Site for use during construction and for distribution to the Owner, through the Architect, upon completion of the Work.
- C. Submit only the items listed below to the Architect for review in accordance with Conditions of the Contract and Division 01 sections.
- D. Product Data: For each type of product.
- E. Shop Drawings: For sliding aluminum-framed glass doors.
- F. Samples: For each exposed product and for each color specified, 12-inch-long (300-mm-long) section with weather stripping, glazing bead, and factory-applied color finish.
- G. Product test reports.

#### **1.4 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: A manufacturer capable of fabricating sliding aluminum-framed glass doors that meet or exceed performance requirements indicated and of documenting this performance by inclusion in lists and by labels, test reports, and calculations.

#### **1.5 WARRANTY**

- A. General: Special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Manufacturer's standard form in which manufacturer agrees to repair or replace components of sliding aluminum-framed glass doors that fail in materials or workmanship within specified warranty period.
  - 1. Sliding Door: 10 years from date of Substantial Completion.
  - 2. Insulating-Glass Units: 10 years from date of Substantial Completion.
  - 3. Laminated Glass: 5 years from date of Substantial Completion.



4. Aluminum Finish 10 years from date of Substantial Completion.

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURER**

- A. To establish standards of manufacture, operation, performance, and appearance, Drawings and Specifications are based on products of Kawneer North America, 990 Series. Provided compliance with Project requirements, and prior approval by the Owner and the Architect of a properly documented substitution request, **<products of other manufacturers will also be acceptable><products of the following manufacturers will also be acceptable>**.
  1. Arcadia Architectural Products, Inc.
  2. Fleetwood Windows & Doors.
  3. Jeld-Wen, Inc.
  4. Milgard Manufacturing, Inc.
  5. Solar Innovations, Inc.
  - 6.

### **2.2 SLIDING ALUMINUM-FRAMED GLASS DOORS**

- A. Frames and Door Panels: Fabricated from aluminum extrusions complying with AAMA/WDMA/CSA 101/I.S.2/A440.
  1. Thermally Improved Construction: Fabricate frames and door panels with an integral, concealed, low-conductance thermal barrier located between exterior and interior surfaces in a manner that eliminates direct metal-to-metal contact.
- B. Threshold and Sill Cap/Track: Provide extruded-aluminum threshold and track of thickness, dimensions, and profile indicated; designed to comply with performance requirements indicated with manufacturer's standard finish.
  1. Low-Profile Floor Track: ADA-ABA compliant.

### **2.3 GLAZING**

- A. Glass and Glazing: Manufacturer's standard glazing system that produces weathertight seal.
  1. Glass: ASTM C 1036, Type 1, q3, Category II safety glass complying with testing requirements in 16 CFR 1201.
  2. Safety Glazing Labeling: Permanently mark safety glazing with certification label of [the manufacturer].
    - a. Indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
  3. Insulating-Glass Units: ASTM E 2190[, certified through IGCC as complying with requirements of IGCC].
    - a. Low-E coating.

### **2.4 HARDWARE**

- A. General: Provide manufacturer's standard hardware, fabricated from a corrosion-resistant material compatible with aluminum complying with AAMA 907 and designed to smoothly operate, tightly close, and securely lock sliding aluminum-framed glass doors.
- B. Lock: Install manufacturer's keyed cylinder lock and locking device on each movable panel, lockable from the outside. Adjust locking device to allow unobstructed movement of the panel across adjacent panel in the direction indicated.

## **2.5 ACCESSORIES**

- A. Anchors, Clips, and Accessories: Provide anchors, clips, and accessories of aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron for sliding aluminum-framed glass doors, complying with ASTM B 456 or ASTM B 633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated.
  - 1. Windborne-Debris Resistance: Provide anchors of same design used in windborne-debris resistance testing.
- B. Polyamide Epoxy Coating: Two-part, high-build, fast curing epoxy.
  - 1. Solids: 83 percent +/- 2 percent by weight.
  - 2. VOC: <100 g/L.

## **2.6 FABRICATION**

- A. Fabricate sliding aluminum-framed glass doors in sizes indicated. Include a complete system for assembling components and anchoring doors.
- B. Weather Stripping: Provide full-perimeter weather stripping for each door panel.
- C. Weep Holes: Provide weep holes and internal drainage passages to conduct infiltrating water to exterior.
- D. Factory-Glazed Fabrication: Glaze sliding aluminum-framed glass doors in the factory where practical and possible for applications indicated. Comply with requirements in Division 08 section "Glazing" and with AAMA/WDMA/CSA 101/I.S.2/A440.

## **2.7 ALUMINUM FINISHES**

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- C. Clear Anodic Finish: AAMA 611 or thicker.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Verify that surfaces and site conditions are ready to receive Work. Verify that debris and foreign matter has been completely removed and substrates are sound.
- B. Do not proceed with Work until unsatisfactory conditions have been corrected.

### **3.2 INSTALLATION**

- A. Comply with Drawings, Shop Drawings, and manufacturer's written instructions for installing doors, hardware, accessories, and other components.
- B. Windborne Debris Resistance: Anchor sliding aluminum-framed glass doors that have been tested for windborne debris resistance to structure using anchoring method, fastener type, and fastening frequency identical to that used in windborne debris resistance testing.
- C. Install sliding aluminum-framed glass doors level, plumb, square, true to line, without distortion, without warp or rack of frames and panels, and without impeding thermal movement; anchored securely in place to structural support; and in proper relation to wall flashing, vapor retarders, air barriers, water/weather barriers, and other adjacent construction.
- D. Set sill members in bed of sealant or with gaskets, as indicated, to provide weathertight construction.

- E. Install sliding aluminum-framed glass doors and components to drain condensation, water penetrating joints, and moisture migrating within doors to the exterior.
- F. Metal Protection:
  - 1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape or installing nonconductive spacers as recommended by manufacturer for this purpose.
  - 2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with polyamide epoxy coating.
- G. Adjust operating panels and screens to provide a tight fit at contact points and weather stripping for smooth operation, without binding, and a weathertight closure. Adjust hardware for proper alignment, smooth operation, and proper latching without unnecessary force or excessive clearance.

**END OF SECTION 08 32 13**

## **SECTION 08 41 13 - ALUMINUM ENTRANCES AND FRAMING**

### **PART 1 - GENERAL**

#### **1.01 RELATED DOCUMENTS**

Drawings, Technical Specifications, TSUS construction specifications Division 1, TSUS uniform general conditions for construction contract, safety requirements of OSHA and prevailing building codes & city, state and county.

#### **1.02 DESCRIPTION OF WORK**

- A. Extent of aluminum entrances and framing is shown on the drawings.
- B. Refer to Glass and Glazing Section of Division 8 for glazing requirements for aluminum entrances and framing.

#### **1.03 QUALITY ASSURANCE**

- A. Comply with applicable provisions of "Metal Curtain Wall, Window, Storefront and Entrance Guide Specifications Manual" by AAMA.
- B. Provide aluminum entrances and framing system produced by a single manufacturer.
- C. Provide aluminum entrances and framing of one of the following manufacturers"
  - 1. Amarlite Anaconda Div., Anaconda Aluminum Co.
  - 2. Kawneer Company, Inc.
  - 3. PPG Industries, Inc.
- D. The requirements shown by details are intended to establish basic dimensions and profiles for doors and framing. Within these limitations, contractor is responsible for the design and make whatever modifications and additions to the details as may be required to fulfill the performance requirements.

#### **1.04 SUBMITTALS**

Submit shop drawings for fabrication and installation of aluminum entrances and framing, including elevations, detail sections of typical composite members, anchorage, reinforcement, expansion provisions and glazing.

### **PART 2 - PRODUCTS**

#### **2.01 MATERIAL (Plate numbers listed are from Amarlite Catalog).**

- A. Medium Stile Doors (type X Model 73).
  - 1. Sizes as shown on drawings.
  - 2. 3-3/4" vertical stile and top rail and 6-1/2" bottom rail by 1-3/4" thick.
  - 3. Reinforce to receive hardware.
  - 4. Finish: #40 Dark Bronze integral color conforming to Aluminum Association Standard AA-M12 C22A42.
  - 5. Use 6063-T5 alloy for extrusions.
  - 6. Use aluminum or stainless steel for all fasteners, and if exposed, provide in same finish as doors.
  - 7. Use EPDM elastomeric extrusions for glazing gaskets.
  - 8. Provide perimeter weather-stripping.
- B. Frames:

1. Sizes as detailed.
2. Amarlite sections as detailed.
3. Reinforce mullions as required.
4. Use 6063-T5 alloy for extrusions.
5. Use aluminum or stainless steel for all fasteners and if exposed, provide in same finish as frames.
6. Use EPDM elastomeric extrusions for glazing gaskets.
7. Finish: #40 Dark Bronze integral color conforming to Aluminum Association Standard AA-M23 C22A42.
8. Performance Requirements:
  - a) Air Infiltration
    - 1) Test in accordance with ASTM E283.
    - 2) Not to exceed .06 CFM per square foot.
  - b) Structural
    - 1) Maximum deflection of 1/175 of span.
    - 2) Allowable stress with 1.65 safety factor.
    - 3) Perform to the above criteria under the applicable component and cladding wind load per ASCE 7.
- C. Hardware: Match finish of doors.
  1. Cylinders furnished under Section 08700 - Builders Hardware.
  2. LCN 4040 surface mounted closer for Model 73 (medium stile).
  3. Style C8 push and C7 pull for Model 73 doors (medium stile).
  4. 4 1/2" x 4" ball bearing butts.
  5. Dor-o-matic 1090 dark bronze finish exit devices for door 304.
  6. Removable mullion door 304.
  7. Top and bottom flush bolts on inactive leaf door 308.
  8. Sealant: Bronze Dow Corning 999 or GE-SCS 1000.

## **PART 3 - EXECUTION**

### **3.01 INSTALLATION**

- A. Comply with manufacturer's instructions and recommendations for installation of aluminum framing members.
- B. Set members plumb, level and true to line, without warp or rack of framing members.
- C. Anchor securely and separate aluminum from sources of corrosion or electrolytic action at points of contact with other materials.
- D. Set sill members in bed of sealant.

### **3.02 CLEANING AND PROTECTION**

- A. Clean aluminum framing completely inside and out after erection and installation of glass.
- B. Remove excess glazing and sealant compounds, dirt, and other substances from aluminum surfaces.
- C. Institute protective measures and other precautions required to assure that entrances and framing will be without damage or deterioration at time of acceptance.

## **END OF SECTION 08 41 13**

## **SECTION 08 71 00 - BUILDER'S HARDWARE**

### **PART 1 - GENERAL**

#### **1.01 RELATED DOCUMENTS**

Drawings, Technical Specifications, TSUS construction specifications Division 1, TSUS uniform general conditions for construction contract, safety requirements of OSHA and prevailing building codes & city, state and county.

#### **1.02 DESCRIPTION OF WORK**

- A. Furnish detailed hardware schedule for all doors shown on plans.
- B. Furnish and install all hardware as shown on plans and schedule.

#### **1.03 QUALITY ASSURANCE**

Obtain each kind of hardware (latch and lock sets, hinges, closers, etc.) from only one manufacturer, although several may indicate as offering products complying with requirements.

#### **1.04 SUBMITTALS**

- A. Submit rough draft of hardware schedule and sample for design, color and texture for Engineer's review.
- B. After review furnish final hardware schedule listing each item of hardware required for each door.
- C. Key locks to match existing system.

#### **1.05 PRODUCT HANDLING**

- A. Package hardware in containers marked with set numbers corresponding to those used in hardware schedule.
- B. Two or more identical sets may be packed in the same container.

### **PART 2 - PRODUCTS**

#### **2.01 HARDWARE ALLOWANCE**

- A. Hardware will be selected by the Engineer and be supplied for such amounts as provided for under - Allowance Section and other general provisions of the Contract.
- B. Provide required Product Data, Hardware Schedule and Keying Schedule dates to process submittals, to furnish templates and to deliver hardware.

### **PART 3 - EXECUTION**

#### **3.01 INSTALLATION**

- A. Install hardware in accordance with manufacturer's instructions.
- B. Do not install surface mounted items until finishes are completed on the substrate.
- C. Set units level, plumb and true to line and location.

- D. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.
- E. Drill and countersink units which are not factory prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.

**3.02 ADJUSTMENTS**

- A. Adjust and check each operating item of hardware for each door, to ensure proper operation or function of every unit.
- B. Replace units which cannot be adjusted to operate freely and smoothly as intended for the application made.

**END OF SECTION 08 71 00**

## **SECTION 08 73 00 - DOOR ACCESSORIES**

### **PART 1 - GENERAL**

#### **1.01 RELATED DOCUMENTS**

Drawings, Technical Specifications, TSUS construction specifications Division 1, TSUS uniform general conditions for construction contract, safety requirements of OSHA and prevailing building codes & city, state and county.

#### **1.02 DESCRIPTION OF WORK**

Furnish and install the following:

- A. Weather-stripping for exterior doors.
- B. Thresholds for exterior doors.

#### **1.03 QUALITY ASSURANCE**

- A. Provide continuous stripping at exterior openings without unnecessary interruptions at door corners and hardware.
- B. Provide units which will not become ineffective as seals because of misalignment of corners, minor out of adjustment on doors, temperature variations and normal wear and aging of materials.
- C. Provide weather-stripping of one of the following manufacturers:
  - 1. Accurate Metal Weather-strip Co.
  - 2. National Guard Products, Inc.
  - 3. Argil J. May Manufacturing Co.
  - 4. Zero Weather Stripping Co., Inc.
- D. Provide thresholds of one of the following manufacturers:
  - 1. National Guard Products, Inc.
  - 2. Argil J. May Manufacturing Co.
  - 3. Zero Weather Stripping Co., Inc.

#### **1.04 SUBMITTALS**

Submit manufacturer's standard details, specifications and installation instructions for each type of product required.

### **PART 2 - PRODUCTS**

#### **2.01 MATERIALS AND FABRICATION**

- A. Provide type indicated of sizes, shapes and mounting system recommended by manufacturer for application indicated.
- B. Provide fasteners to match finish of stripping and seals if they are exposed whether door is open or closed.

#### **2.02 WEATHER-STRIPPING**



- A. At head and jambs, provide bumper type resilient insert and metal retainer strips, surface-mounted of following metal finish and resilient bumper material.
  - 1. Extruded aluminum with natural anodized finish, 0.062" minimum thickness of main walls and flanges.
  - 2. Closed-cell sponge neoprene insert 1/4" x 3/4".
- B. At door bottoms provide threshold-contact type resilient insert and metal housing of design and size shown of the following metal, finish and resilient seal strip.

### **2.03 THRESHOLDS**

- A. Extruded aluminum, smooth commercial finish.
- B. Surface pattern of grooved thread, manufacturer's standard.
- C. Width as indicated on drawings, but not less than 4".
- D. Extrusion thickness:
  - 1. Direct tread surfaces: 0.25".
  - 2. Secondary thread surfaces: 0.1875".
  - 3. Unexposed flanges and legs: 0.125".
- E. Single piece unit construction.
- F. Provide manufacturer's standard unit which conforms with minimum size and profile requirements shown on drawings.
- G. Drill and countersink units for anchor screws at 12" o.c. and 3" from ends.

## **PART 3 - EXECUTION**

### **3.01 WEATHER-STRIPPING INSTALLATION**

- A. Provide fasteners which are compatible with metal of stripping and frame.
- B. Provide only smooth exposed fastener heads which will not snag clothing.
- C. Set plumb and level and at optimum location for maintaining a permanent seal.
- D. Comply with manufacturer's instructions and recommendations.

### **3.02 THRESHOLD INSTALLATIONS**

- A. Comply with manufacturer's instructions.
- B. Cut to accurate length and cope to fit tight against door frames.
- C. Cut thresholds with a fine toothed saw and remove burrs.
- D. On concrete or similar substrate, install lead shield anchors, accurately placed to receive machine screws at location pre-drilled and evenly spaced.
- E. Attach with No. 10 or larger screws of bronze or stainless steel.
- F. Set in rubber silicone sealant.
- G. Set level and align with frames and doors and at proper elevation for door operation.
- H. If shims are required, provide full continuous support of threshold at edge and intermediate legs.
- I. Use shims of non-corrosive metal or plastic.

**END OF SECTION 08 73 00**

## **SECTION 08 80 00 - GLASS AND GLAZING**

### **PART 1 - GENERAL**

#### **1.01 RELATED DOCUMENTS**

Drawings, Technical Specifications, TSUS construction specifications Division 1, TSUS uniform general conditions for construction contract, safety requirements of OSHA and prevailing building codes & city, state and county.

#### **1.02 DESCRIPTION OF WORK**

- A. Glass includes prime glass, process glass and fabricated glass products.
- B. Glazing includes glass installation and materials used to install glass.
- C. Types of work in this section include glass for the following:
  - 1. Aluminum store front Construction.
  - 2. Aluminum entrance doors.
  - 3. Vision panels in doors.
  - 4. Interior partitions.
  - 5. Window unit.
  - 6. Casework.
  - 7. Mirrors.

#### **1.03 QUALITY ASSURANCE**

- A. Manufacturers:
  - 1. ASG Industries, Inc.
  - 2. Binswanger
  - 3. Ford Glass Co.
  - 4. Libbey-Owens-Ford Co.
  - 5. PPG Industries, Inc.
- B. Prime Glass Standard: FS-DD-G-451.
- C. Heat-Treated Glass Standard: FS-DD-G-1403.
- D. Safety-Glass Standard: CPSC 16 CFR 1201.
- E. Spandrel Glass Standard: GSA-PBS-4-0885.

#### **1.04 JOB CONDITIONS**

- A. Do not perform work under adverse weather or job conditions.
- B. Install liquid sealants when temperatures are within lower 2/3 of temperature range recommended by manufacturers.

#### **1.05 WARRANTY**

Provide insulating glass manufacturer's written warranty for 10 years after seal date imprinted on unit to furnish replacement units, FOB job site, for glass units that have defective seals.

## **PART 2 - PRODUCTS**

### **2.01 GLASS PRODUCTS**

- A. Float/Plate Glass: Type 1, quality q3, 1/4" thick unless otherwise noted.
  - 1. Clear.
  - 2. Heat Absorbing: Blue-green tint, 78% light transmittance and 56% maximum solar energy transmittance for 3/16".
  - 3. Gray: 49% to 51% light transmittance and 56% maximum solar energy transmittance for 3/16".
  - 4. Bronze: 56% to 59% light transmittance and 56% maximum solar energy transmittance for 3/16".

### **2.02 PROCESSED GLASS**

- A. Tempered Glass: 1/4" thick.
  - 1. Prime glass of color indicated.
  - 2. Heat treated to strengthen glass in bending to not less than 4.5 times annealed strength.
- B. Spandrel Glass: 1/4" thick.
  - 1. Prime glass of color indicated.
  - 2. Processed to fuse a ceramic coating on one face.
- C. Mirror Glass: 1/4" thick.
  - 1. 1/4" quality q2 clear float glass.
  - 2. Full silver coating, copper coating and organic coating.

### **2.03 PROCESSED GLASS UNITS**

- A. Laminated Safety Glass: 1/4" thick unless otherwise noted.
  - 1. By heat plus pressure process laminate 2 sheets of clear float glass with a 30 mil film of polyvinyl buteral.
  - 2. Exclude all dirt, air pockets and foreign substances.
- B. Heat-Glare-Light Reducing Insulating Glass: Provide 2 sheets of glass with 1/2" dry air or gas filled space with edge construction to maintain a hermetic seal as follows:
  - 1. Exterior Glass:
    - a) Heat strengthened silver/chrome-coated bronze float glass.
    - b) Quality q3, 1/4" thick.
    - c) Place coating in air space.
  - 2. Interior Glass:
    - a) Clear float glass.
    - b) Quality q3, 1/4" thick.
  - 3. Edge Construction:
    - a) Twin primary seal, of polyisobutylene and tubular or spacer bar frame with welded or solder corners.
    - b) Secondary seal outside of bar bonded to both sheets of glass and bar of polysulfide, silicone or hot-melt butyl elastomeric sealant.

- C. Fused-Glass-Edged Insulating Glass:
  1. Double pane unit with 3/16" dry air or gas filled space with -20 ° F (-31 ° C) dew point.
  2. Fuse glass sheets together at edges.
  3. Fabricate with 2 sheets of clear sheet glass Quality q5 or 2 sheets of clear float glass Quality q3.

## 2.04 GLAZING SEALANTS AND COMPONENTS

- A. General: Provide color as selected by Engineer from standard colors.
- B. Two-part Polysulfide Glazing Sealant:
  1. Elastomeric polysulfide sealant complying with FS-TT-S-227, Class A, Type 2.
  2. Compounded and tested to show minimum 20 years resistance to deterioration.
- C. One-Part Silicone Rubber Glazing Sealant:
  1. Elastomeric silicone sealant complying with FS-TT-S-001543, Class A, non-sag.
  2. Provide acid type recommended by manufacturer where only non-porous bond surfaces are contacted.
- D. One Part Polysulfide Glazing Sealant:
  1. Polysulfide elastomeric sealant complying with FS- TT-S-00230, Class A, Type II.
  2. Compounded specifically for exterior exposed glazing.
- E. One Part Acrylic Glazing Sealant:
  1. Thermoplastic solvent-based acrylic terpolymer, complying with FS-TT-S-00230, Class B, Type II.
  2. Solid of 95% acrylic.
- F. Acrylic-Emulsion Glazing Sealant:
  1. Emulsion of acrylic, with or without latex rubber modifications.
  2. Compounded specifically for glazing.
  3. Non-hardening, non-staining and non-bleeding.
- G. Butyl Rubber Glazing Sealant:
  1. Compound of polymerized butyl rubber and inert fillers.
  2. Solvent-based, 75% solids complying with FS-TT-S-001657.
  3. Tack-free on 24 hours, paintable, non-staining.
- H. Pre-formed Butyl Rubber Glazing Sealant:
  1. Compound of polymerized butyl rubber and inert fillers with or without polyisobutylene modification.
  2. Solvent-based, 95% solids, formed and coiled on release paper.
  3. Tack-free in 24 hours, paintable, non-staining.
  4. Plain, pre-shimmed or reinforced as required for proper installation and setting of glass.
- I. Oleo-Resinous Glazing Compound:
  1. Oil-based glazing compound, non-staining, non-bleeding.
  2. Comply with FS-TT-G-410 for face glazing compound.

## **2.05 GLAZING GASKETS**

- A. Structural Rubber Glazing Gaskets
  - 1. Neoprene extrusions fabricated into frames with molded corner units and zipper lock strips.
  - 2. Comply with ASTM C 542.
- B. Molded Neoprene Glazing Gaskets:
  - 1. Molded or extruded neoprene gaskets of the profile and hardness required for watertight construction.
  - 2. Comply with ASTM D 2000 Designation 2BC-415 to 3BC 620, black.
- C. Polyvinyl Chloride Glazing Gaskets:
  - 1. Extruded, flexible PVC gaskets of the profile and hardness required for watertight construction.
  - 2. Comply with ASTM C 509, Type II, black.
- D. Cellular Neoprene Glazing Gaskets:
  - 1. Extruded/molded, closed-cell integral-skinned neoprene of profile to maintain watertight seal.
  - 2. Comply with ASTM C 509, Type II, black.
- E. Vinyl Foam Glazing Tape:
  - 1. Closed cell, flexible, self-adhesive, non-extruding, polyvinyl chloride foam tape.
  - 2. Comply with ASTM D 1667.

## **2.06 MISCELLANEOUS GLAZING MATERIALS.**

- A. Cleaner, Sealers, and Primers: Type recommended by sealant or gasket manufacturer.
- B. Setting Blocks:
  - 1. Neoprene or EPDM, 70-90 durometer hardness.
  - 2. Compatible with sealants used.
- C. Spacers:
  - 1. Neoprene or EPDM, 40-50 durometer hardness.
  - 2. Compatible with sealants used.
- D. Compressible Filler Pad:
  - 1. Closed-cell or waterproof jacketed rod stock of synthetic rubber or plastic foam.
  - 2. 5-10 psi compression strength for 25" deflection.
  - 3. Compatible with sealant used.

## **PART 3 - EXECUTION**

### **3.01 STANDARDS AND PERFORMANCE**

- A. Install glass to withstand temperature changes, wind loading, impact loading without failure including loss or breakage of glass or failure of sealant.
- B. Protect glass from edge damage during handling and installation.
- C. Discard units with significant edge damage or other imperfections.
- D. Install tempered or safety glass in all locations below 7'0" both on the interior and exterior in doors, windows, fixed panels, side lights, vision panels, etc.
- E. Dimensions shown are intended to provide for necessary bite on glass, minimum edge clearance, and adequate sealant thickness. Adjust as required by job conditions at time of installation.

### **3.02 PREPARATION FOR GLAZING**

- A. Clean framing members that are to receive glass immediately before glazing.
- B. Remove coatings which are not bonded securely to substrate.
- C. Remove lacquer from metal surfaces where elastomeric sealants are used.
- D. Apply primer or sealant to joint surfaces where recommended by sealant manufacturer.

### **3.03 GLAZING**

- A. Install setting blocks of proper size located 1/4 of glass width from each corner.
- B. Provide spacers inside and out of proper size and spacing for glass sizes larger than 50 united inches.
- C. Provide 1/8" minimum bite of spacers on glass and use thickness equal to sealant width.
- D. Force sealants into channel to eliminate voids and to ensure complete "wetting" or bond of sealant to glass and channel surfaces.
- E. Tool exposed surfaces of glazing compounds to provide a substantial "wash" away from glass.
- F. Clean and trim excess glazing materials from glass and stops or frames promptly after installation.

### **3.04 CLEANING**

- A. Remove non-permanent labels.
- B. Wash and polish glass on both faces.
- C. Remove and replace glass that is broken, chipped, cracked, abraded or damaged during construction including natural causes, accidents or vandalism.

**END OF SECTION 08 80 00**

## **SECTION 09 21 16 - GYPSUM DRYWALL**

### **PART 1 - GENERAL**

#### **1.01 RELATED DOCUMENTS**

Drawings, Technical Specifications, TSUS construction specifications Division 1, TSUS uniform general conditions for construction contract, safety requirements of OSHA and prevailing building codes & city, state and county.

#### **1.02 DESCRIPTION OF WORK**

Work of this section includes, but not necessarily limited to, the furnishing and installing of the metal stud system and the gypsum board as indicated on the drawings and specified in this section.

#### **1.03 RELATED WORK**

Coordinate work of this section with work of the following sections to properly execute to work and maintain satisfactory progress of work of these sections:

- A. Acoustical Ceilings: Section 09 51 00.
- B. Painting: Section 09 91 00.
- C. Prefabricated Aluminum Door Frames: Section 08 11 13.
- D. Mechanical Systems: Division 15.
- E. Electrical Systems: Division 16.
- F. Specialties: Division 10.
- G. Insulation: Section 07 21 00.

#### **1.04 QUALITY ASSURANCE**

- A. Tolerances of drywall work:
  - 1. Do not exceed a variation of 3/16" in 8'-0" from plumb, level and flat.
  - 2. Do not exceed 1/16" offset of planes at joints between panels.
  - 3. Shim as necessary to comply with tolerances.

#### **1.05 PRODUCT HANDLING**

- A. Deliver in manufacturer's unopened containers, bundles, or packages, fully identified with manufacturer's name, brand, type and grade.
- B. Protect from weather, soiling and damage from handling equipment.

### **PART 2 - PRODUCTS**

#### **2.01 MATERIALS**

- A. Steel Drywall Framing:
  - 1. Studs:
    - a) Screw type "C" galvanized complying with ASTM C 645.
      - 1) 25 gauge for interior partitions less than 15'.
      - 2) 20 gauge for interior partitions over 15'.
      - 3) 20 gauge for exterior walls.
    - b) Minimum face 1-5/16" with 1/4" hemmed edge.
    - c) Sizes as indicated on drawings.

2. Floor and ceiling track:
  - a) Minimum flange 1-1/4".
  - b) 25 gauge hot-dipped galvanized.
3. Furring Channels:
  - a) Face 1-3/8" depth 7/8", back width 2 1/2".
  - b) 25 gauge galvanized.
  - c) Hemmed edges.
4. Wall board:
  - a) Regular: 1/2" or 5/8" x 4' x 8' Taper edge, Type III grade X, class 1 complying with ASTM Designation C-36.
  - b) Moisture resistant: 5/8" x 4' x 8' Moisture resistant (green) complying with ASTM C-360.
5. Accessories:
  - a) Joint tape: Plain or perforated complying with ASTM C475.
  - b) Joint Compound: Adhesive with or without fibers complying with ASTM C475.
  - c) Corner bead: Smooth rigid metal nose bonded to paper tape flanges.
  - d) Casing: Square metal edge casing bead, type as indicated on drawings.
  - e) Fasteners: Phillips head screws, self-drilling self-tapping, comparable to USG-Type S.
  - f) Adhesive: As recommended by wall board manufacturer.

## **PART 3 - EXECUTION**

### **3.01 INSTALLATION OF STEEL DRYWALL FRAMING**

- A. Install metal framing and accessories in accordance with manufacturer's printed instructions.
- B. Where partitions abut ceiling, deck or vertical structural elements, provide a cushion-type joint to prevent transfer of structural loads or movements to partitions.
- C. See drawings for termination of top of partitions.
  1. Where partitions abut suspended ceiling provide tape sealant.
  2. Where ceiling abut partitions, extend partition minimum of 6" above ceiling and provide braces from top runner to structure at 4'0" o.c.
  3. Where partitions are to abut structure or deck seal space between structure or deck and top runner.
- D. Align top and bottom runner tracks to the partition layout.
- E. Anchor runner to floor with power driven pins or approved anchors at 24" o.c.
- F. Space studs at 16" o.c., anchor to floor and ceiling runners at corners, intersection and openings using 3/8" self-tapping screw.
- G. Provide additional studs at corners, partition intersections openings.



- H. Framing at openings:
  - 1. Provide full length studs each side of opening.
  - 2. Provide head track at all openings and sill track at window openings.
  - 3. Cut tracks to length, split flanges, bend web at ends for flange overlap and screw to jamb studs.
  - 4. Install cut-to-length intermediate studs above and below opening at same spacing as full-length studs.
- I. Furring Channels:
  - 1. Space at 16" o.c.
  - 2. Attach with power driven pins at 24" o.c. staggered on alternate flanges.
- J. Provide necessary blocking for attaching work of other trades.

### **3.02 INSTALLATION OF GYPSUM DRYWALL BOARD**

- A. General
  - 1. Comply with requirement of ANSI A 97.1 "Standard Specifications for the Application and Finishing of Wallboard".
  - 2. Provide gypsum board of thickness indicated on drawings.
  - 3. Cut and fit gypsum board neatly around electrical boxes, air conditioning openings, access panels, etc.
  - 4. Apply face layer with adhesive and provide sufficient fasteners to hold gypsum board until adhesive is dry.
- B. Accessories:
  - 1. Tape: Apply to all face joints and internal corners.
    - a) Embed tape into 4" wide strip of joint compound and allow to dry.
    - b) Apply second layer of compound, feather out 3" past first application, and allow to dry.
    - c) Apply third layer of compound, feather out 3" past second application and allow to dry.
    - d) Sand smooth after each application.
  - 2. Metal Corner Bead:
    - a) Apply at all external corners in single length from floor to ceiling.
    - b) Apply in same manner as tape.
  - 3. Metal Casing:
    - a) Apply at tops of wall board abutting ceilings at edges of wall board abutting other finishes and at bottom of wall board not covered with base.
    - b) Apply in same manner as tape.
  - 4. Fasteners:
    - a) Spot exposed dimples with 3 applications of joint compound.
    - b) Allow compound to dry thoroughly before next application.
    - c) Sand smooth after each application.

**END OF SECTION 09 21 16**

## **SECTION 09 30 00 - TILE WORK**

### **PART 1 - GENERAL**

#### **1.01 RELATED DOCUMENTS**

Drawings, Technical Specifications, TSUS construction specifications Division 1, TSUS uniform general conditions for construction contract, safety requirements of OSHA and prevailing building codes & city, state and county.

#### **1.02 DESCRIPTION OF WORK**

- A. Tile includes ceramic surfacing units made from clay or other ceramic materials.
- B. The types of work of this section include:
  - 1. Ceramic mosaic tile.
  - 2. Glazed tile walls and base.
  - 3. Quarry Tile.

#### **1.03 QUALITY ASSURANCE**

- A. Provide products of one of the following manufactures:
  - 1. Dal-Tile
  - 2. The Decorating Depot.
  - 3. Crossville.
- B. Furnish tile complying with Standard Grade requirements TCA 137.1.
- C. Provide materials obtained from one source for each type of tile, grout and setting materials.

#### **1.04 SUBMITTALS**

Submit manufacturer's color chart consisting of actual tiles showing full range of colors available for Engineer's selection.

#### **1.05 PRODUCT HANDLING**

- A. Deliver packaged materials and store in original containers with seals unbroken and labels intact until time of use, in accordance with manufacturer's instructions.
- B. Maintain environmental conditions and protect work during and after installation in accordance with referenced standards and manufacturers printed recommendations.

### **PART 2 - PRODUCTS**

#### **2.01 TILE**

- A. Ceramic Tile, unless specifically shown otherwise on drawings use the following:
  - 1. Floors: Unglazed ceramic tile with smooth all-purpose edge not less than 1/4" thick and in colors as selected by Engineer.
  - 2. Walls: Standard grade matte glazed with square edges and in colors as selected by Engineer.
  - 3. Top trim - 2" x 12" with round top, glazed.
  - 4. Accent trim, 1"x12", matte glazed.

- B. Adhesive:
  - 1. Floors: Epoxy in accordance with ANSI A118.3.
  - 2. Walls: Organic adhesive ANSI A136.1, Type I.
- C. Grout:
  - 1. Hydroment as manufactured by Upco Co.
  - 2. Colors as selected by Engineer.

## **PART 3 - EXECUTION**

### **3.01 INSTALLATION**

- A. Quarry tile:
  - 1. Clean concrete floors thoroughly.
  - 2. Apply adhesive with 5/32: V-notch trowel.
  - 3. Lay tile with all joints uniform in width.
  - 4. After adhesive has set fill joints with grout.
  - 5. Remove excess grout from face of tile immediately after filling joints.
  - 6. Install in accordance with ANSI A108.6 specifications.
- B. Ceramic tile:
  - 1. Floors:
    - a) Clean concrete floors thoroughly.
    - b) Apply adhesive with 5/32: V-notch trowel.
    - c) Lay tile in sheets, taking care to make joints between sheets uniform with joints on sheets.
    - d) After adhesive has set, moisten tile to remove paper.
    - e) Fill joints with grout and remove excess from face of tile immediately after filling joints.
    - f) Install in accordance with ANSI A108.6 specifications.
  - 2. Walls:
    - a) Seal surface of all taped joints.
    - b) Prime surface of gypsum board as directed by adhesive manufacturer.
    - c) Lay tile with continuous vertical and horizontal joints.
    - d) Allow 24 hours after tile is set before grouting.
    - e) Fill joints with grout and remove excess from face of tile immediately after filling joints.
    - f) Install in accordance with ANSI A108.4 specifications.

### **3.02 PROTECTION**

- A. Close areas to traffic until adhesive and grouting are completely set.
- B. Cover finish floors with heavy paper until final cleaning.

### **3.03 FINAL CLEANING**

- A. Point up or replace all defective or damaged work.
- B. Clean with a neutral chemical cleaner.
- C. Seal all mortar joints and clean.

END OF SECTION 09 30 00

## **SECTION 09 51 00 - ACOUSTICAL CEILINGS**

### **PART 1 - GENERAL**

#### **1.01 RELATED DOCUMENTS**

Drawings, Technical Specifications, TSUS construction specifications Division 1, TSUS uniform general conditions for construction contract, safety requirements of OSHA and prevailing building codes & city, state and county.

#### **1.02 DESCRIPTION OF WORK**

- A. Extent of acoustical ceiling is shown and scheduled on drawings.
- B. Type of acoustical ceiling work includes the following:
  - 1. Furnish and install exposed tee suspension system.
  - 2. Furnish and install lay-in acoustical panels.
  - 3. Use fire retardant ceiling system in fire rated corridors.

#### **1.03 RELATED WORK OF OTHER SECTIONS**

- A. Coordinate work of this Section with work of other sections as necessary to maintain satisfactory progress of the work of this and other sections.
- B. Mechanical and Electrical Fixtures installed in ceilings, see Divisions 15 & 16.

#### **1.04 QUALITY ASSURANCE**

- A. Maintenance Instructions:
  - 1. Submit manufacturer's recommendations for cleaning and refinishing acoustic units.
  - 2. Include precautions against materials and methods which may be detrimental to finishes and acoustic efficiency.
- B. Replacement Materials:
  - 1. When work is completed deliver stock of replacement material to Owner for each type of acoustic panels used in the work.
  - 2. Furnish full size units packaged and marked for identification.
  - 3. Furnish not less than one (1) percent of the total amount of each type of acoustic panel installed.

#### **1.06 PRODUCT DELIVERY, STORAGE AND HANDLING**

- A. Deliver acoustic ceiling materials to project site in original, unopened packages, bearing manufacturer's name and label identifying each type of acoustic unit.
- B. Comply with manufacturer's recommendations for storage of materials.

## **PART 2 - PRODUCTS**

### **2.01 SUSPENSION SYSTEM**

- A. General Requirements:
  - 1. Wire hangers: As recommended by manufacturer to comply with the specified structural classification.
    - a) Not less than 12 gauge (0.106 inch diameter) galvanized, soft annealed, mild steel wire.
    - b) Where hanger wires cannot be wire-tied directly to structure, provide attachment devices designed for type construction used and with a carrying capacity of not less than five (5) times the design loads involved.
  - 2. Protective Coatings: Manufacturer's standard coatings and finishes.
  - 3. Manufacturers offering suspension systems complying with either requirements include the following:
    - a) Chicago Metallic.
    - b) Donn Products.
    - c) Eastern Products.
    - d) Flangeklamp.
- B. Exposed Grid Suspension System:
  - 1. Structural Classification: Provide direct hung suspension system complying with ASTM C 635 minimum load-carrying capability for intermediate duty main runners.
  - 2. Main and Cross Runners: Steel with smooth matte white painted finish.
  - 3. Mouldings: Angle type with finish to match runners.

### **2.02 ACOUSTIC UNIT MATERIALS**

- A. Acoustical lay-in panels:
  - 1. Mineral fiber panels 24"x48" or 24"x24" x 5/8" thick.
  - 2. Density of not less than 10 lb. per cu. ft.
  - 3. Medium-course non-directional texture.
  - 4. NRC 0.50 to 0.60.
  - 5. STC 35 to 39.
  - 6. Light reflectance over 75%.
  - 7. Provide products of one of the following:
    - a) Minabord Cortega, Armstrong World Industries.
    - b) Safetone ND Fissuretone, Celotex Corp.
    - c) Regency, Conwed Crop.
    - d) Solitued ND, Gold Bond Building Products.
    - e) Auratone Filigree, U.S. Gypsum Co.
- B. Moisture Resistant Lay-in Panels:
  - Mineral fiber panels, 24"x48" x 5/8" thick
  - White, Medium Texture
  - Square ED6F Lay-in
  - Provide products equal to Armstrong fine Fissured Ceramaguard

## **PART 3 - EXECUTION**

### **3.01 INSPECTION**

- A. Examine conditions under which acoustical ceiling work is to be performed and notify contractor of unsatisfactory conditions.
- B. Do not proceed with work until conditions are corrected to installer's satisfaction.

### **3.02 PREPARATION**

Furnish layouts for inserts, clips or other supports required to be installed by other trades for support of suspended ceiling.

### **3.03 INSTALLATION**

- A. General:
  - 1. Compliance: Install suspension systems which are part of non-fire rated assemblies in accordance with manufacturer's instructions; the requirements of Article 2 "Installation of Components" of "Standard Recommended Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels ASTM C 636 and as specified below.
  - 2. Hangers:
    - a) Space not more than 6" from ends of main runners and not more than 4'-0" on centers.
    - b) Provide hangers at each corner of light fixtures or other items supported by the ceiling suspension system.
  - 3. Moldings:
    - a) Provide where ceilings abut walls or other vertical elements.
    - b) Cut and bend at inside corners and cut and butt neatly to conform to outside corners.
  - 4. Do not bear supporting members on walls or partitions.
- B. Exposed Grid System
  - 1. See reflected ceiling plan.
  - 2. Support main runners directly from hangers.
  - 3. Space main runners to support acoustic panels and other work as required to comply with specified performance requirements.
  - 4. Interlock cross-runners with either main runners or with cross-runners structurally classified as main runners.
  - 5. Install angle type molding with exposed leg in same plane as bottom flange of runners.
  - 6. Level system to tolerance of 1/8" in 12'-0".
  - 7. Balance border widths at opposite edges of each area ceiling and avoid use of less-than-half widths of tile at borders.
  - 8. Apply sealant on back of vertical leg before installing molding.
  - 9. Screw attach molding at 16" on center and within 3" of ends.

C. Acoustical Ceiling Units:

1. Do not install acoustic units until installation areas meet the following requirements:
  - a) Exterior openings are closed and roof is weather tight.
  - b) Work of other trades above ceiling has been completed.
  - c) Wet work has been installed.
  - d) Temperature and humidity are at levels that comply with acoustic material manufacturer's recommendations.
2. Install acoustical panels in coordination with suspension system with edges concealed.
3. Scribe and cut panels to fit accurately at borders and penetrations.
4. Install hold down clips where indicated on reflected ceiling plan.

**3.04 CLEANUP AND PROTECTION**

- A. Clean exposed surfaces of acoustical ceilings including suspension system complying with manufacturer's instructions.
- B. Remove and replace units and members which are damaged or cannot be cleaned.
- C. Advise Contractor of proper procedures required for protection of ceilings from damage or deterioration until acceptance of work.

**END OF SECTION 09 51 00**

## **SECTION 09 65 13 - RESILIENT FLOORING**

### **PART 1 - GENERAL**

#### **1.01 RELATED DOCUMENTS**

Drawings, Technical Specifications, TSUS construction specifications Division 1, TSUS uniform general conditions for construction contract, safety requirements of OSHA and prevailing building codes & city, state and county.

#### **1.02 DESCRIPTION OF WORK**

- A. Extent of resilient flooring and accessories is shown on drawings and in schedules.
- B. Work includes the following:
  - 1. Furnishing and installing vinyl composition floor.
  - 2. Furnishing and installing rubber base and accessories.

#### **1.03 SUBMITTALS**

- A. Submit samples for Engineer's selection of flooring and base.
- B. Submit copies of manufacturer's written instructions for recommended maintenance practices.

#### **1.04 JOB CONDITIONS**

- A. Maintain minimum temperature of 65° F (18° C) in spaces to receive resilient flooring for at least 48 hours prior, during and 48 hours after installation.
- B. Store materials in spaces where they will be installed 48 hours prior to installation.
- C. Install resilient flooring after other finishing operations have been completed, including painting.
- D. Do not install flooring until concrete slab is cured and sufficiently dry as determined by manufacturer's recommended bond and moisture test.

### **PART 2 - PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. Vinyl Composition Floor Tile
  - 1. Armstrong World Industries, Inc. – Premium grade Vinyl Composition Tile
  - 2. Mannington Commercial Essentials
  - 3. Kentile Floors, Inc. Architectural Criterion
- B. Rubber Base (Continuous roll with inside/outside corner trim)
  - 1. Burke Flooring Products
  - 2. Flexco Company
  - 3. The Johnson Rubber Co.
  - 4. Roppe Rubber Corporation

#### **2.02 MATERIALS**

- A. Colors and patterns as selected by Engineer.
- B. All materials must meet NFPA-255, Class A rating:



ASTM-E84, 25 or less flame spread and 450 or less smoke density. ASTM-E648, minimum .45 or above radiant panel ratings.

- C. Vinyl Composition Tile:
  - 1. FS SS-T-312, Type IV, 12" x 12"
  - 2. Composition 1 asbestos free.
  - 3. Gauge 1/8".
- D. Rubber Base
  - 1. FS SSW-40A, Type 1, 4 1/2" Coved Toe rolled type with pre-molded outside corners.
- E. Accessories:
  - 1. Resilient edge strip: 1/8" thick rubber composition, tapered, 1" wide minimum and of color as selected by Engineer.
  - 2. Adhesive: Waterproof, stabilized type as recommended by flooring manufacturer.
  - 3. Primer: Non-staining type as recommended by flooring manufacturer.
  - 4. Leveling compound: Latex type as recommended by flooring manufacturer.

## **PART 3 - EXECUTION**

### **3.01 INSPECTION**

- A. Examine areas and conditions under which flooring is to be installed and report to contractor any unsatisfactory conditions.
- B. Do not proceed with work until unsatisfactory conditions are corrected.

### **3.01 PREPARATION**

- A. Vacuum-sand floor surfaces to receive resilient flooring.
- B. Use leveling compound as recommended by flooring manufacturer for filling small cracks and depressions in subfloor.
- C. Apply concrete slab primer as recommended by flooring manufacturer, prior to application of adhesive.

### **3.03 INSTALLATION**

- A. General:
  - 1. Install flooring using methods indicated in strict compliance with manufacturer's recommendations.
  - 2. Extend flooring into toe and knee spaces of cabinets, door reveals, closets and similar openings.
  - 3. Use chalk or other non-permanent marking device to mark reference points, holes, or openings on finish flooring that was marked on sub-flooring.
  - 4. Tightly cement flooring to sub-base without open cracks, voids, raising and puckering at joints.
  - 5. Hand roll flooring from perimeter of each covered area to assure adhesion.

- B. Tile Floors:
  - 1. Lay tile from center marks established with principal walls, discounting minor offsets, so that tile at opposite sides of room are of equal width.
  - 2. Avoid use of cut widths less than 1/2 tile at room perimeters.
  - 3. Lay tile square to room axis, unless shown otherwise.
  - 4. Match tiles for color and pattern by using tile from cartons in same sequence as manufactured and packaged.
  - 5. Cut tile neatly around all fixtures.
  - 6. Do not use broken, cracked, chipped or deformed tiles.
  - 7. Lay tile with grain running in direction as directed by Engineer.
  
- C. Accessories:
  - 1. Apply base to walls, columns, pilasters, casework and other permanent fixtures in rooms scheduled to receive base.
  - 2. Install base in as long lengths as practicable with corners heat bent and fabricated from base materials.
  - 3. Bond base to backing throughout the length of each piece with continuous contact at horizontal and vertical surfaces.
  - 4. On masonry or irregular surfaces fill voids along top edge of base with manufacturer's recommended adhesive filler material.
  - 5. Install resilient edge strips to all unprotected edges of flooring.
  - 6. Install edge strip in one continuous piece at door openings.
  - 7. Butt edge strip tightly against flooring and secure with adhesive.

#### **3.04 CLEANING AND PROTECTION**

- A. Remove excess adhesive and other blemishes using type of cleaner recommended by flooring manufacturer.
- B. Protect floor from damage by covering with approved covering.
- C. Just prior to final inspection clean floors and accessories and apply type of wax and buff as recommended by flooring manufacturer.

**END OF SECTION 09 65 13**

## **SECTION 09 68 10 - TILE CARPETING**

### **PART 1 - GENERAL**

#### **1.01 RELATED DOCUMENTS**

Drawings, Technical Specifications, TSUS construction specifications Division 1, TSUS uniform general conditions for construction contract, safety requirements of OSHA and prevailing building codes & city, state and county.

#### **1.02 DESCRIPTION OF WORK**

Furnish and install tile carpeting as called for in the room finish schedule.

#### **1.03 SUBMITTALS**

- A. Submit manufacturer's data on carpet and carpeting materials and include recommendations for edge transition and accessory strips.
- B. Submit samples showing type, color, texture and pattern of carpet proposed for use on this project to Engineer for his selection.
- C. Submit full size carpet samples for selection.

#### **1.04 JOB CONDITIONS**

- A. Inspect substrate to receive carpet and notify contractor of any areas that are unacceptable.
- B. Do not proceed with work until unsatisfactory conditions have been corrected.
- C. Starting work constitutes acceptance of substrate as being suitable to receive materials of this section and acceptance of full responsibility for the quality and appearance of the finish work.

#### **1.05 PRODUCT DELIVERY AND STORAGE**

- A. Coordinate delivery of carpet with work of other trades to insure minimum amount of traffic on installed carpet.
- B. Deliver carpeting materials in protective wrapping, and store inside protected from weather, moisture and soiling.

#### **1.06 CLEANUP**

- A. Dispose of all packing crates, wrappings, and other trash in conjunction with carpeting.
- B. Avoid and be responsible for damage to the building, walls, and floors and materials of other trades during installation of carpet.
- C. Thoroughly vacuum clean carpeted area just prior to final inspection.
- D. Protect carpeted areas from traffic during the remainder of the construction period.

#### **1.07 MANUFACTURERS**

The following manufacturers and trade name carpets meet the basic specifications:

- A. J & J Commercial.
- B. Bigelow: Tuffpoint.
- C. Lees.

## **PART 2 - PRODUCTS**

### **2.01 MATERIALS**

- A. Carpet will be selected by the Engineer and be supplied and installed for such amounts as provided for under Section 01020 - Allowances and other provisions of the contract.
- B. Provide 10 sq. Yards extra carpet tiles in original packaged containers.

## **PART 3 - EXECUTION**

### **3.01 PRE-INSTALLATION REQUIREMENTS**

- A. Clear away debris and scrape up cementitious deposits from areas to receive carpet.
- B. Vacuum clean just prior to installation of carpet.
- C. Apply sealer where required to prevent dusting.

### **3.02 INSTALLATION**

- A. General:
  - 1. Comply with manufacturer's recommendations for seam locations and direction of carpet and maintain uniformity of lay of pile.
  - 2. Center seams under doors and do not place seams in traffic direction of doorways.
  - 3. Extend carpet under open-bottomed obstructions and under removable flanges, furnishings and into alcoves and closets if not scheduled otherwise.
  - 4. Provide cutouts where required and bind cut edges where not concealed by protective edge guards or overlapping flanges.
  - 5. Install carpet edge guard to exposed edges of carpet and anchor guards to substrate.
  - 6. Do not bridge expansion joints with continuous carpeting.

### **3.03 CLEANUP AND MAINTENANCE**

- A. Final Cleanup:
  - 1. Deliver any usable scraps of carpet to Owner's designated storage space.
  - 2. Usable scraps are identified to include pieces 8" wide or more.
  - 3. Dispose of smaller pieces as construction waste.
- B. Return in six (6) months, inspect installation, and repair any faults that may have occurred.

END OF SECTION 09 68 10

## **SECTION 09 91 00 - PAINTING**

### **PART 1 - GENERAL**

#### **1.01. RELATED DOCUMENTS**

Drawings, Technical Specifications, TSUS construction specifications Division 1, TSUS uniform general conditions for construction contract, safety requirements of OSHA and prevailing building codes & city, state and county.

#### **1.02 DESCRIPTION OF WORK**

- A. Extent of painting work is shown on drawings and schedules and as herein noted.
- B. The work includes painting and finishing of interior and exterior exposed items and surfaces throughout the project.
- C. Surface preparation, priming and coats of paint noted are in addition to shop coats.
- D. The work includes painting of exposed bare and covered pipes, ducts, hangers, exposed steel and iron work in areas that are shown to repaint in room finish schedule.
- E. Do not paint factory finished items such as toilet partitions, pre-finished partition systems, acoustic materials, finished mechanical and electrical equipment.
- F. Do not paint metal surfaces such as anodized aluminum, stainless steel, chromium plate, copper, bronze or similar finishes.
- G. Do not paint moving parts of operating units, mechanical and electrical parts, such as valve and damper operators, linkages, sensing devices, motor and fan shafts, etc.
- H. Do not paint over any code require labels, equipment identification, performance rating, name or nomenclature plates.
- I. Painting for parking and traffic lanes is specified in Division 2.

#### **1.03 SUBMITTALS**

- A. Submit color samples of approved manufacturer for Engineer's selection.
- B. Color selection and schedule will be furnished by the Engineer.

#### **1.04 JOB CONDITIONS**

- A. Examine substrate prior to first application and notify Contractor if any surfaces are unsatisfactory to receive finishes.
- B. Do not apply finishes until unsatisfactory conditions have been corrected.
- C. Apply water-based paints only when temperature of surfaces and surroundings air are between 45 ° F (7 ° C) and 90 ° F (35 ° C).

#### **1.05 QUALITY ASSURANCE**

- A. Provide best quality grade of various coatings required by one of the manufacturer's listed.
- B. Materials not displaying the manufacturer's identification as a first line, best grade product will not be accepted.

- C. Manufacturers:
  - 1. Sherwin-Williams Company
  - 2. Benjamin Moore and Co.
  - 3. Pittsburgh Plate Glass Co.
  - 4. Glidden Paint Co.
- D. Samples: Verify all finishes as to type, color, and sheen. Provide adequate sized paint outs for Engineer's approval before proceeding with work.

#### 1.06 DELIVERY AND STORAGE

- A. Deliver materials to job site in original, new and unopened packages and containers bearing manufacturer's name and label.
- B. Store materials not in actual use in tightly covered containers.
- C. Maintain containers used in storage of paint in a clean condition, free of foreign material and residue.
- D. Protect material from freezing.
- E. Keep storage area neat and orderly.
- F. Take all precautions to ensure that workmen and area are adequately protected from fire and health hazards resulting from handling, mixing, storage and application of paint.

### PART 2 - PRODUCTS

#### 2.01 MATERIAL - EXTERIOR PAINT SCHEDULE

- A. Provide materials that are comparable with the following Federal Specifications and Sherwin-Williams products listed, and are suitable for substrate types shown on drawings and noted in room finish schedule.
  - 1. Concrete and Masonry:
    - a) Lusterless (Flat) Acrylic Finish:
      - 1) First Coat: A-100 Exterior Latex Flat A6 series (TT-P-19)
      - 2) Second Coat: Same as first coat.
      - 3) Total dry film thickness: 2.5 mils.
    - b) Heavy-Duty Textured Coating:
      - 1) First Coat: VIP Elastomeric Texture Coating 8100 or (TT-C-555)
      - 2) Second Coat: Same as first coat.
      - 3) Total dry film thickness 15 to 18 mils.
  - 2. Concrete Masonry Units:
    - a) Heavy Duty Textured Coating:
      - 1) First Coat: VIP Elastomeric Texture Coating 8100 or (TT-C-555)
      - 2) Second Coat: Same as first
      - 3) Total dry film thickness: 15 to 18 mils.
    - b) Epoxy Finish:
      - 1) Filler Coat: Epoxy Ester Masonry Filler B61W2 (TT-F-1098)
      - 2) First Coat: Tile-Clad II Epoxy B62W2 (TT-C-535)
      - 3) Second Coat: Same as first coat.
      - 4) Total dry film thickness 6 to 8 mils. plus, filler.

3. Painted Wood:
  - a) Alkyd Gloss Finish:
    - 1) Prime Coat: A-100 Exterior Alkyd Primer Y24W520 (TT-P-25)
    - 2) First Coat: SWP Exterior Alkyd A2 series (TT-P-102)
    - 3) Second Coat: Same as first coat.
    - 4) Total dry film thickness 4 to 6 mils, plus primer
  - b) Silicone Alkyd Gloss Finish:
    - 1) Prime Coat: A-100 Exterior Alkyd Primer Y24W520 (TT-P-25)
    - 2) First Coat: Silicone Alkyd Enamel B562 (TT-E-1593B)
    - 3) Second Coat: Same as first coat.
    - 4) Total dry film thickness 4 mils. plus, primer
  - c) Low Luster Finish - Acrylic Emulsion
    - 1) Prime Coat: A-100 Exterior Alkyd Primer Y24W20
    - 2) First Coat: A-100 Exterior Latex Satin A82 series (TT-P-19)
    - 3) Second Coat: Same as first coat.
    - 4) Total dry film thickness 2.5 mils. plus, primer.
4. Wood Shakes and Rough Siding:
  - a) Low-Luster Finish
    - 1) First Coat: Exterior Solid Color Oil Stain A14 series (TT-P-52)
    - 2) Second Coat: Same as first coat.
5. Painted Plywood:
  - a) Lusterless (Flat) Acrylic Finish
    - 1) Prime Coat: A-100 Exterior Latex Primer B42W46
    - 2) First Coat: A-100 Exterior Latex Flat A6 series (TT-P-19)
    - 3) Second Coat: Same as first coat.
    - 4) Total dry film thickness 2.5 mils. plus, primer
6. Stained Wood:
  - a) Flat Stain
    - 1) First Coat: Exterior Semitransparent Oil Based Stain A14T5 (TT-S-708)
    - 2) Second Coat: Same as first coat.
7. Ferrous Metal:
  - a) High Gloss Alkyd Enamel
    - 1) Prime Coat: Kromik Metal Primer E41N1 (TT-P-86)
    - 2) First Coat: Industrial Enamel B54 series (TT-E-489)
    - 3) Second Coat: Same as first coat.
    - 4) Total dry film thickness 4 to 6 mils. plus, primer.
  - b) Semi-Gloss Alkyd Enamel:
    - 1) Prime Coat: Kromik Metal Primer E41N1 (TT-P-86)
    - 2) First Coat: Direct to Metal Enamel B55 series (TT-E-529)
    - 3) Second Coat: Same as first coat.
    - 4) Total dry film thickness 3.5 mils plus primer.

8. Galvanized Metal
  - a) High Gloss Alkyd Enamel:
    - 1) Prime Coat: Galvite B50W3 or (TT-P-641)
    - 2) First Coat: Industrial Enamel B54 series (TT-E-489)
    - 3) Second Coat: Same as first coat.
    - 4) Total dry film thickness 4 to 6 mils. plus, primer.
  - b) Semi-Gloss Alkyd Enamel:
    - 1) Prime Coat: Galvite B50W3 or (TT-P-641)
    - 2) First Coat: Direct to Metal Alkyd Enamel B55 series (TT-P-641)
    - 3) Second Coat: Same as first coat.
    - 4) Total dry film thickness 6 to 8 mils. plus, primer.
  - c) Lusterless (Flat) Alkyd Enamel
    - 1) Prime Coat: Galvite B50W3 or (TT-P-641)
    - 2) First Coat: Pro-Mar Exterior Alkyd Flat B38 series (TT-E-527)
    - 3) Second Coat: Same as first coat.
    - 4) Total dry film thickness 3.5 mile. plus, primer.

## 2.02 MATERIALS - INTERIOR PAINT SCHEDULE

- A. Provide materials that are comparable with the following Federal Specifications and Sherwin -Williams products listed for substrate types shown on drawings and noted in room finish schedule.
  1. Concrete, Plaster, Masonry
    - a) Semi-Gloss Enamel Finish
      - 1) Prime Coat: Pro-Mar Latex Primer B28W200 (TT-P-650)  
(Note-For plaster use Wall and Wood Primer B49W2)
      - 2) First Coat: Pro-Mar Alkyd Semi-Gloss B34 series
  2. Concrete Masonry Units
    - a) Solvent Based Epoxy Finish (Gloss or Semi-Gloss)
      - 1) Filler Coat: Epoxy Eater Masonry Filler B61W2 (TT-F-1098)
      - 2) First Coat: Tile Clad II B62 W2 series (TT-C-535)
      - 3) Second Coat: Same as first coat.
      - 4) Total dry film thickness 6 to 8 mils. plus, filler.
    - b) Water Based Epoxy Finish (Gloss or Semi-Gloss)
      - 1) Filler Coat: Heavy Duty Block Filler B42W46 (TT-F-1098)
      - 2) First Coat: Water Based Catalyzed Epoxy B70 series
      - 3) Second Coat: Same as first coat.
      - 4) Total dry film thickness 5 to 7 mils. plus, filler
  3. Gypsum Drywall
    - a) Semi-Gloss Alkyd Enamel Finish
      - 1) Texture Coat: Fine sand finish texture
      - 2) Primer Coat: Pro-Mar Latex Primer B28W200 (TT-P-600)
      - 3) First Coat: Pro-Mar Alkyd Semi-Gloss B34W200 (TT-E-509)
      - 4) Second Coat: Same as second coat
      - 5) Total dry film thickness 4 mils. plus, texture



- b) Semi-Gloss Latex Enamel Finish
  - 1) Texture Coat: Fine sand finish texture
  - 2) Primer Coat: Pro-Mar Latex Primer B28W200 (TT-P-650)
  - 3) First Coat: Pro-Mar Latex Semi-Gloss B31W200 (TT-P-15118-Type 1 Semi-Gloss)
  - 4) Second Coat: Same as first coat.
  - 5) Total dry film thickness 3.5 mils.
- c) Epoxy Finish - Solvent based (Gloss or Semi-Gloss)
  - 1) Texture Coat: Fine sand finish texture
  - 2) Primer Coat: Pro-Mar Latex Primer B28W200 (TT-P-650)
  - 3) First Coat: Tile-Clad II Epoxy B62H2 (TT-C-535)
  - 4) Second Coat: Same as first coat.
  - 5) Total dry film thickness 6 to 8 mils. plus, texture
- d) Epoxy Finish - Water-based (Gloss or Semi-Gloss)
  - 1) Texture Coat: Fine sand finish texture
  - 2) Primer Coat: Pro-Mar Latex Primer D20W200 (TT P 650)
  - 3) First Coat: Water-Based Catalyzed Epoxy B70 series
  - 4) Second Coat: Same as first coat.
  - 5) Total dry film thickness 5 to 7 mils. plus, primer.
- 4. Ferrous Metal: (Primer not required on shop primed items)
  - a) Lusterless (Flat) Finish
    - 1) Prime Coat: Kromik Metal Primer E41N1 (TT-P-86)
    - 2) First Coat: Pro-Mar Latex Flat B30W200 (TT-P-29)
    - 3) Second Coat: Same as first coat.
    - 4) Total dry film thickness 2.5 mils. plus, primer
  - b) Semi-Gloss Enamel Finish
    - 1) Prime Coat: Kromik Metal Primer E41N1 (TT-P-86)
    - 2) First Coat: Pro-Mar Enamel Undercoat B49W200 (TT-E-545)
    - 3) Second Coat: Pro-Mar Alkyd Semi-Gloss B34W200 (TT-E-509)
    - 4) Third Coat: Same as second coat.
    - 5) Total dry film thickness 3 to 4 mils. plus, primer
- 5. Galvanized Metal:
  - a) Lusterless (Flat) Latex Finish
    - 1) Prime Coat: DTM Acrylic Primer B66W1 or (TT-P-641)
    - 2) First Coat: Pro-Mar Latex Flat B30W200 (TT-P-20)
    - 3) Second Coat: Same as first coat.
    - 4) Total dry film thickness 3.5 mils.
  - b) Semi-Gloss Finish
    - 1) Prime Coat: Galvanite B50W3 or (TT-P-641)
    - 2) First Coat: Pro-Mar Alkyd Semi-Gloss B34W200
    - 3) Second Coat: Same as first coat.
    - 4) Total dry film thickness 3 to 4 mils. plus, primer

6. Painted Woodwork
  - a) Semi-Gloss Enamel Finish
    - 1) First Coat: Pro-Mar Enamel Undercoat B49W200 (TT-E-545)
    - 2) Second Coat: Pro-Mar Alkyd Semi-Gloss B34W200 (TT-E-509)
    - 3) Third Coat: Same as second coat.
    - 4) Total dry film thickness 3 to 4 mils.
7. Stained Wood:
  - a) Stained-Varnish Rubbed Finish
    - 1) First Coat: Interior Oil Stain A48 series (TT-G-711)
    - 2) Second Coat: Pro-Mar Varnish Sealer B26V3
    - 3) Third Coat: Natural Paste Wood Filler D70T1 (TT-F-336) (Required on open grained wood only)
    - 4) Fourth Coat: Oil Based Varnish Satin A66F1 (TT-V-86)
    - 5) Fifth Coat: Same as fourth coat.
  - b) Stained-Wax Polished Finish
    - 1) First Coat: Interior Oil Stain A46 series (TT-S-711)
    - 2) Second Coat: Clear/White Shellac (TT-S-300)
    - 3) Third Coat: Paste Wax (TT-P-W-158)
    - 4) Fourth Coat: Same as third coat.
8. Natural Finished Woodwork
  - a) Rubbed Varnish Finish
    - 1) First Coat: Pro-Mar Varnish Sealer B26V3
    - 3) Second Coat: Natural Paste Wood Filler D70T1 (TT-F-336) (Required on open grain wood only)
    - 4) Third Coat: Oil Base Varnish Satin A66F1 (TT-V-86)
    - 5) Fourth Coat: Same as third coat.
9. Wood Floors
  - a) Stained-Polyurethane Finish
    - 1) First Coat: Oil Stain A48 series (TT-S-711C)
    - 2) Filler Coat: Paste Wood Filler D70T1 (TT-F-336)
    - 3) Sealer Coat: Polyurethane Gloss A67V1 - reduced
    - 4) Fourth Coat: Same as sealer coat - unreduced
    - 5) Fifth Coat: Same as fourth coat - unreduced

(NOTE - For satin finish use Polyurethane varnish Satin A67F1 for fourth and fifth coat)
  - b) Natural-Polyurethane Finish
 Same as stained finish except eliminate stain application.
  - c) Painted Finish
    - 1) First Coat: Polyurethane Floor Enamel A33 series reduced 20% (TT-E-487E)
    - 2) Second Coat: Same as first coat - unreduced
    - 3) Third Coat: Same as second coat.
10. Concrete Floors
  - a) Solid Color Stain - Painted Appearance
    - 1) First Coat: H&C Concrete Stain (reduced per specs)
    - 2) Second Coat: H&C Concrete Stain (unreduced)

- b) Clear Sealer
  - 1) First Coat: Concrete and Terrazo Sealer B44V22
  - 2) Second Coat: Same as first coat.
- c) Epoxy Finish (Clear or Painted)
  - 1) First Coat: Armorseal 1000 Clear Epoxy B6701000
  - 2) Second Coat: Armorseal 1000 Epoxy B6701000  
(with anti-slip aggregate if required)

### **2.03 MISCELLANEOUS MATERIALS**

- A. Primer: Type as recommended by paint manufacturer.
- B. Turpentine: Comply with Federal Specification TT T 801
- C. Mineral Spirits: Comply with Federal Specification TT T 201 Grade 1
- D. Linseed Oil: Comply with Federal Specification TT-C-190
- E. Shellac: Comply with Federal Specification TT-S-300 4 pound cut
- F. Reducers: Type as recommended by paint manufacturer.

## **PART 3 - EXECUTION**

### **3.01 SURFACE PREPARATION**

- A. General:
  - 1. Remove or protect items such as hardware, accessories, fixtures, etc., that are not to be painted.
  - 2. Reinstall these items after completion of painting.
- B. Cementitious Material:
  - 1. Prepare surfaces by removing efflorescence, chalk, dust,
  - 2. Correct amount of alkalinity and moisture prior to application of paint.
- C. Wood:
  - 1. Clean surface to be painted of dirt, oil or other foreign substances with scrapers, mineral spirits, or sandpaper as required.
  - 2. Clean and scrape small, dry, seasoned knots and apply a thin coat of white shellac before application of primer.
  - 3. After priming fill holes and imperfections in finish surfaces with putty or plastic wood-filler and sand smooth.
  - 4. Prime, stain or seal wood required to be job painted immediately upon delivery to job.
- D. Ferrous Metals: Clean surfaces of oil, grease, dirt, loose mill scale, etc., by solvent or mechanical cleaning.
- E. Galvanized Surfaces: Clean surfaces of oil and contaminants with non-petroleum based solvent.

### **3.02 MATERIALS PREPARATION**

- A. Mix and prepare painting materials in accordance with manufacturer's directions.
- B. Store materials in tightly covered containers.
- C. Stir materials before and during application to produce a mixture of uniform density.
- D. Do not stir surface film into material, remove and if necessary, strain material before using.

### **3.03 APPLICATION**

- A. Apply painting and finishing materials in accordance with manufacturer's direction.
- B. Use applicators and techniques best suited for the materials and surfaces to which applied.
- C. Apply additional coats until undercoats, stains or other conditions and paint film is of uniform finish and color.
- D. Paint surfaces behind moveable equipment and furniture same as exposed surfaces and behind permanently fixed equipment with prime coat only.
- E. Paint interior of ducts, where visible through registers or grilles, with a flat black paint.
- F. Paint back sides of access panels, and removable or hinged covers to match exposed surfaces.
- G. Finish doors on tops, bottoms and side edges same as faces of painted, stained or natural finish doors and to match plastic clad doors.
- H. Apply each material at not less than the manufacturer's recommended spreading rate to provide a total dry film thickness of not less than 4.0 mils for the entire coating system.

### **3.04 CLEANUP PROTECTION**

- A. During progress of work, remove from site discarded paint materials, rubbish, cans and rags at end of each day's work.
- B. At completion of work, clean windows and other paint spattered surfaces by proper methods of washing and scraping, using care not to scratch or damage finished surfaces.
- C. Protect work of other trades whether to be painted or not and correct any damaged work.

**END OF SECTION 09 91 00**

## **SECTION 10 14 00 - SPECIALTY SIGNS, METAL LETTERS AND PLAQUE**

### **PART 1 - GENERAL**

#### **1.01 RELATED DOCUMENTS**

Drawings, Technical Specifications, TSUS construction specifications Division 1, TSUS uniform general conditions for construction contract, safety requirements of OSHA and prevailing building codes & city, state and county.

#### **1.02 DESCRIPTION OF WORK**

- A. Room identification.
- B. Informational and directional signage.
- C. Metal letters.
- D. Metal plaque.
- E. Exterior signage and building identifications.

#### **1.03 SUBMITTALS**

- A. Product Data: Submit manufacturer's technical data and installation instructions for each type of sign required.
- B. Samples: Submit samples of each color and finish of exposed materials and accessories required for specialty signs.
- C. Shop Drawings:
  - 1. Submit drawings for erection of specialty signs.
  - 2. Include plans, elevations and large scale details of sign working and lettering layout.
  - 3. Show anchorage's and accessory items.

### **PART 2 - PRODUCTS**

#### **2.01 GRAPHICS ALLOWANCE**

- A. Signs will be selected by the Engineer and be supplied and installed per drawing.
- B. Provide adhesive as recommended by manufacturer.
- C. Provide all necessary attachments as recommended by manufacturer.
- D. Exterior Signage:
  - 1. Cast aluminum letters with baked enamel finish.
  - 2. Letter style to be selected by Engineer.
  - 3. Provide letters color as selected from manufacturer's standard.
- E. Cast aluminum plaque to be 3'-0" wide x 2'-0" high and to bear the year, name of building, the names as per owners direction, Engineer and Contractor.
- F. Signage for handicapped.

#### **2.02 FABRICATION**

- A. Engineer to furnish sign and plaque layouts and colors from manufacturer's standards.
- B. Furnish signs with necessary accessories and fasteners required for proper installation.

### **PART 3 - EXECUTION**

**3.01 ROOM IDENTIFICATION**

- A. Mount signs on wall within 8" of strike side of jamb and 5'-0" to center line above floor.
- B. Install plumb, level and in accordance with manufacturer's directions.
- C. Signs to have Sans Serrif type and shall be accompanied with Grade 2 Braille as required by ADA 4.30. Signs to have 1/32" raised tactile letters no higher than 2".

**3.02 AREA IDENTIFICATION**

- A. Locate where directed by Engineer.

**3.03 EXTERIOR SIGNAGE**

- A. Mount metal letters on face of building or canopy.
  - 1. Mount flush with wall surface using anchors recommended by manufacturer.
- B. Handicapped graphics to identify handicapped accessible entrances with ADA approval decals on glass face.
- C. Handicapped parking to be identified with ADA approved metal signs.

**END OF SECTION 10 14 00**

## **SECTION 10 21 13 - TOILET PARTITIONS**

### **PART 1 - GENERAL**

#### **1.01 RELATED DOCUMENTS**

Drawings, Technical Specifications, TSUS construction specifications Division 1, TSUS uniform general conditions for construction contract, safety requirements of OSHA and prevailing building codes & city, state and county.

#### **1.02 DESCRIPTION OF WORK**

Extents of floor mounted overhead braced partitions are shown on the Drawings. All partitions to comply with ADA requirements.

#### **1.03 QUALITY ASSURANCE**

- A. Take field measurements prior to preparation of shop drawings and fabrication to ensure proper fitting of work.
- B. Pre-assemble items in the shop to the greatest extent possible, and yet facilitate handling and shipping.
- C. Provide products from or approved equal
  - Scranton Products
  - Accutec
  - Bobrick

#### **1.04 SUBMITTALS**

- A. Submit manufacturer's detailed materials and fabrications specifications and installation instructions.
- B. Submit shop drawings for fabrication and erection of toilet partitions and instruction for installation of anchorage devices built into other work.

### **PART 2- PRODUCTS**

#### **2.01 MATERIALS**

- A. General:
  1. Provide materials that exhibit surface flatness and smoothness, free of stains or discolorations or other imperfections.
- B. Doors, Panels, and Pilasters
  1. Construction of 1" thick solid polymer resin or as shown on drawings.
  2. Color and material homogeneous throughout.
  3. Selected from approved manufacturer.
- C. Panels are 55" high and anchored to walls and pilasters with 3-1<sup>1</sup>/<sub>2</sub>" aluminum stirrup brackets.
- D. Doors are 55" high and mounted to pilasters with 8" aluminum wrap-around hinges.
  1. Provide each door with one coat hook/bumper of heavy chrome plate's zamac and one aluminum slide latch.
  2. Handicap doors shall also include one door pull and door stop.

- E. Pilasters are 82" high and anchored to panels and walls with three (3) 1<sup>1/2</sup>" aluminum stirrup brackets, with no less than one level adjusting bolt on the bottom and attach to the floor in a stainless steel pilaster shoe. Pilasters are overhead braced with an aluminum head rail
- F. Aluminum hinges are 8" and fabricated from heavy-duty extruded aluminum (6463-T5 Alloy) with bright-dip anodized finish with wrap around flanges, surface mounted and through bolted to doors and pilasters with stainless steel, tamper resistant sex bolts, and with adjustable nylon cams.
- G. Aluminum Stirrup Brackets are 1<sup>1/2</sup>" long made of heavy-duty extruded aluminum (6463-T5 alloy) with bright-dip anodized finish, with mounting to panels with through-bolted stainless steel tamper resistant sex bolts. Anchor to adjacent wall construction with #14 x 1<sup>1/2</sup>" stainless steel tamper resistant screws and plastic anchors.
- H. Stainless steel pilaster shoes are 3" high, and constructed from 20 gauge stainless steel, anchored to floor with #14 x 1<sup>1/2</sup>" stainless steel tamper resistant screws and plastic anchors. Anchor to pilasters with through-bolts and stainless steel tamper resistant bolts.
- I. Latches are fabricated from heavy-duty extruded aluminum (6463-T5 alloy) with bright dip anodized finish. Slide and button with black anodized finish. Mount latch to door with tamper resistant stainless-steel sex bolts.
- J. Strike and keeper is 6" long and fabricated from heavy-duty extruded aluminum (6463-T5 alloy) with bright-dip anodized finish and wrap-around flanges. Mount to pilaster with stainless steel tamper resistant sex-bolts. The bumper is flexible vinyl.
- K. Head rail is made of heavy-duty extruded aluminum (6463-T5 alloy) with bright-dip anodized finish. Head rail is anti-grip and attaches to the top of the pilasters with stainless steel tamper resistant screws. Attach to adjacent wall construction with stainless steel head rail bracket.
- L. Head rail bracket is stainless steel and attached to adjacent wall construction with #14x1<sup>1/2</sup>" stainless steel tamper-resistant screws and plastic anchors.

## **2.02 FABRICATION**

- A. Colors to be selected by Engineer from Standard Colors.

## **PART 3 - EXECUTION**

### **3.01 INSPECTION**

- A. Examine areas to receive toilet partitions and notify contractor of any conditions that are detrimental to proper installation of work.
- B. Do not proceed with work until unsatisfactory conditions have been corrected.

### **3.02 INSTALLATION**

- A. General:
  1. Comply with manufacturer's recommended procedures and installation sequence.
  2. Install partitions rigid, straight, plumb and level.
  3. Provide clearances of not more than 1/2" between pilasters and panels and not more than 1" between panels and walls.
  4. Secure panels to walls with not less than two (2) stirrup brackets attached near top and bottom of panel.



5. Secure panels to pilaster with stirrup brackets aligned with brackets at walls.
- B. Overhead-Braced Partitions:
1. Secure pilasters to floor, and level, plumb and tighten installation with devices furnished.
  2. Secure overhead braces to each pilaster with at least two (2) fasteners.
  3. Hang doors and adjust so that tops are parallel with overhead brace when doors are in closed position.

**3.03 ADJUST AND CLEAN**

- A. Adjust and lubricate hardware for proper operation.
- B. Set hinges on in swinging doors to hold open approximately 20 degrees from closed position when unlatched.
- C. Set hinges on out swinging doors to return to fully closed position.
- D. Clean partition system using materials and methods recommended by manufacturer.
- E. Clean any pencil markings on walls.

**END OF SECTION 10 21 13**

## **SECTION 10 26 00 – WALL AND DOOR PROTECTION**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

Drawings, Technical Specifications, TSUS construction specifications Division 1, TSUS uniform general conditions for construction contract, safety requirements of OSHA and prevailing building codes & city, state and county.

#### **1.2 SUBMITTALS**

- A. In accordance with the requirements of Section 016100, submit a complete listing of all manufacturers, products, model numbers, and designs proposed for use in the Work of this Section.
- B. Maintain one copy of all shop drawings, product data, and samples, manufacturer's specifications, recommendations, installation instructions, and maintenance data at the Project Site.
  - 1. At Project Closeout, turn over copy to the Architect who will transmit to the Owner.
- C. Submit only the items listed below to the Architect for review in accordance with Conditions of the Contract and Division 01 sections.
- D. Samples for Initial Selection Purposes: Submit manufacturer's standard size samples showing full range of materials, colors, and textures available for each type of wall and corner guard and protection material required.
- E. Samples for Verification Purposes: Submit the following:
  - 1. 12" long samples of each type of wall and corner guard required.
  - 2. 6" x 6" square samples of each type wall protection required.
- F. Prepare samples from same material to be used for the work.

#### **1.3 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Firm (material producer) with not less than 2 years of production experience, whose published literature clearly indicates general compliance of products with requirements of this section.
- B. Installer Qualifications: Firm specializing in installation of wall protection systems with not less than 1 year experience in installations similar to that required for this project.
- C. Single Source Responsibility: Provide material produced by a single manufacturer for each wall and corner guard type.

#### **1.4 TESTING**

- A. Test Reports: Submit certified test reports evidencing compliance with requirements for the following:
  - 1. Fire performance characteristics.
  - 2. Physical properties indicated.
- B. Fire Performance Characteristics: Provide wall and corner guard and wall protection system material that is identical to that tested for the following fire performance requirements, according to test method indicated.
  - 1. Class A rated when tested in accordance with:
    - a. Flame Spread: Not more than 25.
    - b. Test Method: ASTM E 84.
    - c. Test Method: NFPA 255.

- C. Physical Properties: Provide wall and corner guard assemblies and wall protection material that is identical to that tested for the following physical properties, according to the test method indicated.
  - 1. Impact Strength:
    - a. Test Method: ASTM D 256.
    - b. Rating: 16 ft. lbs. per inch.
- D. Certification: Submit manufacturer's certificate stating that materials furnished comply with specified requirements. Include supporting certified laboratory testing data indicating that material meets specified test requirements.

### **1.5 DELIVERY, STORAGE AND HANDLING**

- A. Deliver materials to project site in original factory wrappings and containers, clearly labeled with identification of manufacturer, brand name, quality or grade, fire hazard classification, and lot number. Store materials in original undamaged packages and containers, inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, humidity; laid flat, blocked off ground to prevent sagging and warping.
- B. Comply with instructions and recommendations of manufacturer for special delivery, storage, and handling requirements.

### **1.6 SEQUENCING AND SCHEDULING**

- A. Sequence wall and corner guard and wall and door protection system installation with other work to minimize possibility of damage and soiling during remainder of construction period.

### **1.7 MAINTENANCE**

- A. Maintenance Instructions: Submit manufacturer's printed instructions for maintenance of installed work, including methods and frequency recommended for maintaining optimum condition under anticipated traffic and use conditions. Include precautions against materials and methods which may be detrimental to finishes and performance.
- B. Replacement Materials: After completion of work, deliver not less than 2 percent of each type, color, and pattern of wall and corner guard, and wall protection material exclusive of material required to properly complete installation. Furnish accessory components as required. Furnish replacement materials from same production run as materials installed. Package replacement materials with protective covering, identified with appropriate labels.

## **PART 2 - PRODUCTS**

### **2.1 ACCEPTABLE MANUFACTURERS**

- A. The notes and schedules on the Drawings establish manufacturer and model/design required for the Project. Provide the products listed unless Architect approves products of other manufacturer specifically for this Project.

## **2.2 ACCEPTABLE MANUFACTURERS**

- A. To establish standards of manufacture, operation, performance, and appearance, drawings and specifications are based on products of IPC Door and Wall Protection Systems. Provided compliance with requirements, products of the following manufacturers will also be acceptable:
  - 1. Inpro Corporation (IPC)
  - 2. Korogard
  - 3. Pawling Corporation
- B. Provide the following items at locations indicated or scheduled:
  - 1. Wallguards: IPC 700 Series; 0.060" thickness.
  - 2. Corner Guards: IPC 160, 168, Or 169 Series, 2" wing High Impact Corner Guard, 0.060" Thickness.
  - 3. Handrail: IPC 800 or 3110 Series, 0.060" thickness and HR910 wood.

## **2.3 MATERIALS**

- A. Provide all wall and corner guard items, in materials indicated, by the same manufacturer for each component. Fabricate units with tight seams and joints, with exposed edges rolled. Provide units with surfaces free or evidence of wrinkling, chipping, uneven coloration, dents and other imperfections.
  - 1. High Impact Vinyl/Acrylic Alloy: Minimum .078" thick, Class A Fire Rating, chemical and stain resistant. Provide material with ability to resist, without damage, a blow of 30 ft. lbs. per sq. in. at 60 degrees F.

## **2.4 FINISHES**

- A. Provide materials in colors as specified by Architect for custom color.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine areas and conditions in which wall and corner guards and wall protection systems will be installed. Do not proceed until unsatisfactory conditions have been corrected.

### **3.2 PREPARATION**

- A. Prior to installation of wall and corner guards, clean substrate to remove dust, debris, and loose particles.
- B. Ascertain that substrate is free of previous surface applied material. Prepare substrate surface to accept new material.
- C. Illuminate areas of installation using building's permanent lighting system; temporary lighting alone will not be acceptable.
- D. Verify that materials are those specified before installing.

### **3.3 INSTALLATION**

- A. Install surface mounted wall and corner guards and wall and door protection systems and accessories after other finishing operations, including painting, have been completed.
- B. Do not use material with chips, cracks, voids, stains, or other defects which might be visible in the finished work.
- C. Install material and assemblies to comply with drawings and final shop drawings in strict compliance with manufacturer's printed instructions. Adjust accessories for proper system alignment.

**3.4 FIELD QUALITY CONTROL**

- A. Remove and replace material which is broken, chipped, stained or otherwise damaged and which does not match adjoining work. Provide new matching units, installed as specified and in manner to eliminate evidence of replacement.

**3.5 CLEANING**

- A. Immediately upon completion of installation, clean installed material.
- B. Remove excess adhesive, using methods and materials recommended by manufacturer.
- C. Remove surplus materials, rubbish, and debris resulting from installation upon completion of work, and leave areas of installation in neat, clean condition.

**END OF SECTION 10 26 00**

## **SECTION 10 26 13 - PROTECTIVE COVERS**

### **PART 1 - GENERAL**

#### **1.01 RELATED DOCUMENTS**

Drawings, Technical Specifications, TSUS construction specifications Division 1, TSUS uniform general conditions for construction contract, safety requirements of OSHA and prevailing building codes & city, state and county.

#### **1.02 DESCRIPTION OF WORK**

- A. Structural and roof systems for covered walks as shown on plans.
- B. Flashing and caulking as required where covers abut existing building.
- C. Provide anchorage to new and existing walkways and/or pavement.

#### **1.03 MANUFACTURER**

- A. Texas Aluminum Industries, Inc.
- B. Avadek.
- c. Mapes Architectural Canopies.

#### **1.04 SUBMITTALS**

- A. Shop Drawings:
  - 1. Submit plans, elevation, and details for erection.
  - 2. Show connections, anchors, and accessory items.
- B. Samples: Submit samples for color and texture of exposed surfaces.

#### **1.05 ENGINEERING**

- A. Allowable loads and spans to be calculated by a registered professional engineer.
- B. Appropriate safety factors for stress and deflection shall be included in the design.
- C. All live, wind, seismic, foot traffic, and other loads to be in accordance with state and local building codes as well as sound engineering practices.
- D. Above calculation to be available upon request.

### **PART 2 - PRODUCTS**

#### **2.01 ROOF DECK**

- A. "W" roof panels.
- B. Roll formed from 29 KSI minimum yield 3005 H-28 sheet aluminum.
- C. Panels to have interlocking joints to provide structural continuity and self-flashing.

#### **2.02 FASCIA, COLUMNS, AND BEAMS**

- A. Extruded 6063-T6 aluminum.
- B. Fascia to serve as gutter for roof drainage.
- C. Columns to be square.
- D. Beams to be "I" shaped.

**2.03 MISCELLANEOUS**

- A. Hardware: Stainless steel.
- B. Finish: Aluminum to be 200-R1 etched and anodized per Aluminum Association's designation AA-C22-A21.
- C. Color: To be selected from standard manufacturers colors.

**PART 3 - EXECUTION**

**3.01 INSTALLATION**

- A. Completed structure shall conform to manufacturer's submitted shop drawings.
- B. All cuts and joints to be performed in a workmanlike manner.
- C. Replace any elements of the structure that were damaged in shipment.

**3.02 CLEANUP**

- A. Clean job site of any debris or clutter caused by the performance of work of this Section.
- B. Touchup finishes as required.
- C. Advise contractor of protection required to ensure work will be without damage at time of acceptance.

**END OF SECTION 10 26 13**

## **SECTION 10 28 13 - TOILET ACCESSORIES**

### **PART 1 - GENERAL**

#### **1.01 RELATED DOCUMENTS**

Drawings, Technical Specifications, TSUS construction specifications Division 1, TSUS uniform general conditions for construction contract, safety requirements of OSHA and prevailing building codes & city, state and county.

#### **1.02 DESCRIPTION OF WORK**

- A. Extent of each type of accessory as shown on drawings.
- B. Types of accessories required include and not limited to the following:
  - 1. Towel Dispenser
  - 2. Soap Dispenser
  - 3. Napkin Dispenser
  - 4. Mop Rack
  - 5. Grab Bars
  - 6. Waste Basket

#### **1.03 QUALITY ASSURANCE**

- A. Furnish inserts and anchoring devices and coordinate with other work to avoid delay.
- B. Coordinate accessory locations with other work to avoid interference and to assure proper operation of accessory units.
- C. Provide accessories required as manufactured by one of the following:
  - 1. Accessory Specialties, Inc.
  - 2. American Dispenser Co., Inc.
  - 3. Bobrick Washroom Equipment, Inc.
  - 4. Bradley Corp.

### **PART 2 - PRODUCTS**

#### **2.01 MATERIALS**

- A. Provide accessories as specified and as indicated on drawings.
- B. Locate units as required in accordance with manufacturer's instructions and as approved by the Engineer.
- C. Provide units fabricated from materials and with finishes as specified as follows:
  - 1. Stainless Steel: AISI Type 302/304, with polished No. 4 finish.
  - 2. Brass: Cast or forged quality alloy, complying with FS WW-P-541.
  - 3. Sheet Steel: Cold rolled commercial quality steel complying with ASTM A-366.
  - 4. Galvanized Steel Sheet: ASTM A527, 690.0.
  - 5. Chromium Plating Nickel and Chromium electro-deposited on Metal: Comply with ASTM B-456, Type SC2.
  - 6. Baked Enamel: Factory applied backed acrylic enamel coating.
  - 7. Steel Mounting Devices: Hot dipped galvanized after fabrication in accordance with ASTM A386.

#### **2.02 ITEMS AND LOCATIONS**



Furnish and install items as shown on drawings using one of the approved manufacturers.

### **PART 3 - EXECUTION**

#### **3.01 INSTALLATION**

- A. Use concealed fasteners wherever possible.
- B. Provide anchors, bolts, and other necessary fasteners and attach units securely to walls and partitions in locations as shown or directed.
- C. Install exposed mounting devices and fasteners finished to match the accessory being installed.
- D. Provide theft-resistant fasteners for all mounting devices.

**END OF SECTION 10 28 13**

## **SECTION 10 30 00 - LOUVERS AND VENTS**

### **PART 1 - GENERAL**

#### **1.01 RELATED DOCUMENTS**

Drawings, Technical Specifications, TSUS construction specifications Division 1, TSUS uniform general conditions for construction contract, safety requirements of OSHA and prevailing building codes & city, state and county.

#### **1.02 DESCRIPTION OF WORK**

- A. Extent and location of louvers is shown on architectural and or mechanical drawings.
- B. Types of louvers included are extruded aluminum.

#### **1.03 RELATED WORK OF OTHER SECTIONS**

- A. Sealants including installation are specified in Section 07 92 00.
- B. Air-handling louvers connected to ductwork are specified in Division 15.
- C. Door Louvers are specified in Division 8 Sections.

#### **1.04 QUALITY ASSURANCE**

- A. Verify size, location and placement of louvers prior to fabrication.
- B. Coordinate field measurements and shop drawings with fabrication and shop assembly.
- C. Preassemble units in shop and disassemble only as necessary for shipping and handling limitations.
- D. Clearly mark units for reassembly and installation.

#### **1.05 SUBMITTALS**

- A. Shop Drawings
  - 1. Submit drawings for fabrication, erection and accessories.
  - 2. Include plans, elevations, details of sections and connection to adjoining work
  - 3. Indicate materials, finishes, fasteners, joinery and other information to determine compliance with specified requirements.

### **PART 2 - PRODUCTS**

#### **2.01 MATERIALS**

- A. Aluminum Extrusions: ASTM B 221, Alloy 6063-T52.
- B. Fastenings:
  - 1. Use same material as item fastened.
  - 2. The exterior application use hot-dipped galvanized, stainless steel or aluminum.
  - 3. Provide types, gauges and lengths to suit unit installation conditions.
  - 4. Use Phillips flathead machine screws for exposed fasteners.

- C. Anchors and Inserts:
  - 1. Use nonferrous metal or hot-dip galvanized anchors and inserts for exterior installations.
  - 2. Use steel or lead expansion bolt devices for drilled-in-place anchors.
  - 3. Furnish inserts, as required, to be set into concrete or masonry work.

## **2.02 STATIONARY EXTRUDED ALUMINUM LOUVERS**

- A. As manufactured by Construction Specialties, Inc.
  - 1. Louver Model 4110 with storm blades.
  - 2. Sill style A.
  - 3. Head, jamb and sill sections to have integral caulking slot and retaining bead.
  - 4. Finish to be Duranodic No. 312 Medium Bronze.
  - 5. Louver Screen:
    - a) Provide removable screens with frames of the same metal and finish as louvers.
    - b) Provide rewireable frames of formed or extruded metal with a driven spline or insert for securing screen mesh.
    - c) Use 1/2" square mesh, 0.063" anodized aluminum wire.
    - d) Locate screen on inside face of louvers and secure with machine screws at each corner and at 12" o.c. between.

## **PART 3 - EXECUTION**

### **3.01 PREPARATION**

- A. Coordinate setting drawings, diagrams, templates, instructions and directions for the installation of anchorages.
- B. Coordinate the delivery of such items to the project site.

### **3.02 INSTALLATION**

- A. Locate and place louvers plumb, level and in proper alignment with adjacent work.
- B. Use concealed anchorages wherever possible.
- C. Provide brass or lead washers fitted to screws to protect metal surfaces and to make a weather-tight connection.
- D. Provide reveals and openings for sealants and joint fillers.
- E. Repair finishes damaged during installation or return items which cannot be satisfactorily refinishes.
- F. Protect galvanized and nonferrous metal surfaces from corrosion or galvanic action by application of a heavy coating of bituminous paint on surfaces which will be in contact with concrete, masonry or dissimilar metals.

## **END OF SECTION 10 30 00**

## **SECTION 10 44 13 - FIRE EXTINGUISHERS, CABINETS AND ACCESSORIES**

### **PART 1 - GENERAL**

#### **1.01 RELATED DOCUMENTS**

Drawings, Technical Specifications, TSUS construction specifications Division 1, TSUS uniform general conditions for construction contract, safety requirements of OSHA and prevailing building codes & city, state and county.

#### **1.02 DESCRIPTION OF WORK**

A. Furnish and install the required number of fire extinguishers as shown on drawings.

#### **1.03 QUALITY ASSURANCE**

- A. Furnish fire extinguishers which comply with applicable UL standard and are labeled by UL.
- B. Furnish fire extinguishers by one of the following:
1. J.L. Industries
  2. Larsen's Manufacturing Co.
- C. Furnish fire extinguisher cabinets by one of the following:
1. Accessory Specialties, Inc.
  2. J.L. Industries
  3. Larsen's Manufacturing Co.
  4. Watrous, Inc.

#### **1.04 SUBMITTALS**

- A. Product Data:
1. Submit manufacturer's technical data for fire extinguishers.
  2. For fire extinguisher cabinets submit the following information:
    - a) Rough-in dimensions and mounting methods for construction shown.
    - b) Cabinet type, style, hardware, materials, etc.

### **PART 2 - PRODUCTS**

#### **2.01 FIRE EXTINGUISHERS**

- A. General:
1. Provide fire extinguishers for each location as directed by Engineer.
  2. Furnish in colors and finishes as selected by Engineer from manufacturer's standard which comply with requirements of governing authorities.
- B. Multipurpose Dry Chemical Type (4A-60BC-FE):
1. UL-rated 4-A:60-B:C 5 lb. nominal capacity.
  2. Enameled steel container.
  3. For Class A, Class B and Class C fires.

## **2.02 FIRE EXTINGUISHER CABINETS**

- A. General:
  - 1. Provide fire extinguisher cabinets where indicated of suitable size to house fire extinguishers specified.
  - 2. Manufacturer's standard enameled steel box.
  - 3. Miter, weld and grind smooth all joints.
  
- B. Cabinet Type:
  - 1. Semi recessed cabinet box.
  - 2. One piece exposed combination trim and perimeter door frame overlapping wall surface all wall return at outer edge.
  - 3. Square edge flat trim with 1/4" to 5/16" backbend.
  - 4. Door:
    - a) Enameled steel frame.
    - b) DSA break glass panel with inside latch and lock.
  - 5. Hardware:
    - a) Provide either lever handle with cam action latch or door pull, exposed or concealed and friction latch.
    - b) Provide continuous type hinge permitting door to open 180 °
  - 6. Finish: Manufacturer's standard baked enamel coating.
  
- C. Identification: Identify fire extinguisher in cabinet with lettering spelling "FIRE EXTINGUISHER" painted on door by silk screen process.

**END OF SECTION 10 44 13**

## **SECTION 10 80 00 - MIRROR UNITS**

### **PART 1 - GENERAL**

#### **1.01 RELATED DOCUMENTS**

Drawings, Technical Specifications, TSUS construction specifications Division 1, TSUS uniform general conditions for construction contract, safety requirements of OSHA and prevailing building codes & city, state and county.

#### **1.02 DESCRIPTION OF WORK**

- A. Extent and location of mirror units is shown on the drawings.
- B. Type of units required is stainless steel framed mirrors with shelves.

#### **1.03 MANUFACTURERS**

- A. Accessory Specialties, Inc.
- B. Bradley Corp.
- C. Bobrick Washroom Equipment, Inc.
- D. The Charles Parker Co.

### **PART 2 - PRODUCTS**

#### **2.01 MATERIALS**

- A. Mirror Glass:
  - 1. 1/4" thick tempered.
  - 2. Silvering, copper coating and protective organic coating complying with FS DD-M-411.
- B. Stainless Steel:
  - 1. AISI Type 302/304.
  - 2. Polished No. 4 finish.
- C. Galvanized Steel Sheet: ASTM A527, G60.
- D. Galvanized Steel Mounting Devices: ASTM A386 hot-dip galvanized after fabrication.

#### **2.02 FABRICATION**

- A. General:
  - 1. Frames: Fabricate frames to accommodate wood, felt, plastic or other glass edge protection material.
  - 2. Backing: Provide mirror backing and support system which will permit rigid tamperproof glass installation and prevent moisture accumulation with either of the following:
    - a) Galvanized Steel Backing
      - 1) Not less than 22 gauge
      - 2) Full mirror size with non-absorptive filler material
    - b) Air Space Backing: Provide by use of resilient pads or grommets attached to hanger assembly.

3. Hangers: Provide system of mounting mirrors which will permit rigid, tamperproof and theft-proof installation with either of the following:
  - a) One-piece galvanized steel wall hanger device with spring action locking mechanism to hold mirror in position with no exposed screws or bolts.
  - b) Heavy-duty wall brackets of galvanized steel, equipped with concealed locking devices requiring special tool for removal.
- B. Stainless Steel Framed Mirror:
  1. Frames:
    - a) Fabricate to channel shape of 20 gauge stainless steel.
    - b) Carefully miter square corners to hairline joints and mechanically interlocked.
  2. Shelves:
    - a) Fabricate of same gauge and finish as frame.
    - b) Approximately 5" deep x width of frame.
    - c) Turn down and return edges for rigidity.
    - d) Attach rigidly to frame.

### **PART 3 - EXECUTION**

#### **3.01 INSTALLATION**

- A. Secure mirrors to walls in tamperproof manner with special hangers, toggles or screws.
- B. Set mirrors plumb, level and square at locations shown on plans.
- C. Set in accordance with manufacturer's instructions for type of substrate involved.
- D. Install one per restroom.

#### **3.02 CLEANING**

Clean surfaces of mirrors, frames and shelves in compliance with manufacturer's recommendations.

**END OF SECTION 10 80 00**

## **SECTION 14 20 00 – HYDRAULIC ELEVATORS**

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

Drawings, Technical Specifications, TSUS construction specifications Division 1, TSUS uniform general conditions for construction contract, safety requirements of OSHA and prevailing building codes & city, state and county.

#### 1.2 SUMMARY

- A. Section Includes: Hydraulic elevators as required by building criteria:
  - 1. Passenger Elevators, Car to match the size of existing opening & hoistway.
  
- B. Products Installed and Furnished Under This Section:
  - 1. Building announcement speakers
  - 2. Emergency Voice/Alarm Communication System Provisions
  - 3. In car CCTV camera provisions
  - 4. Elevator related security devices, control unit, mounting brackets, wiring materials, logic circuits, security system interface terminals, boxes and relays.
  - 5. Car interior finishes
  - 6. Car flooring
  - 7. Monitoring system interface
  
- C. Related Requirements:
  - 1. Demolition of existing and all required new structural system to install and operate new elevator, electrical & plumbing.
  
- D. Division 03 Section "Cast-in-Place Concrete" for setting sleeves, inserts, and anchoring devices in concrete.

#### 1.3 REFERENCES

- A. Definitions: Terms used are defined in the latest edition of the Safety Code for Elevators and Escalators, ASME A17.1.
  
- B. American National Standard Institute (ANSI):
  - 1. A117.1 - Accessible and Usable Buildings and Facilities
  
- C. American Society of Mechanical Engineers:
  - 1. ASME A17.1 - Safety Code for Elevators and Escalators.
  - 2. ASME A17.2, ASME A17.5, ASME A17.6, ASME A17.7 - Inspector's Manual for Electric Elevators.



- D. ASTM International:
  - 1. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
  - 2. ASTM A240
- E. National Fire Protection Association (NFPA)
  - 1. NFPA 101 – Life Safety Code
- F. US Department of Justice
  - 1. 2010 ADA Standards for Accessible Design.

#### 1.4 SUBMITTALS

- A. Product Data: Include capacities, sizes, performances, operation, control, signal systems operations, safety features, finishes, and similar information. Include product data for car enclosures and hoistway entrances. Include product data for signal fixtures, lights, graphics, Braille plates, and details of mounting provisions.
- B. Shop Drawings:
  - 1. Include plans, elevations, sections, and large-scale details indicating openings at each landing, machine room or equipment space layout, coordination with building structure, relationships with other construction, and locations of equipment.
  - 2. Include large-scale layout of car operating panel, pushbuttons, destination hall registration stations, signal fixtures, fire command center panel, and standby power operation control panel.
  - 3. Indicate maximum dynamic and static loads imposed on building structure at points of support, seismic loads, and maximum and average power demands.
  - 4. Power Confirmation Information: Include motor horsepower, code letter, starting current, full-load running current, and demand factor. Provide maximum and average power consumption.
- C. Samples for Initial Selection: For finishes involving surface treatment, paint or color selection.
- D. Samples for Verification: For exposed car, hoistway door and frame, and signal equipment finishes:
  - 1. Samples of sheet materials: 3" (75 mm) square.
  - 2. Running trim members: 4" (100 mm) lengths.

#### 1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data:
  - 1. For elevators to include in emergency, operation, and maintenance manuals.
  - 2. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include diagnostic and repair information available to manufacturer's and Installer's maintenance personnel.
- B. Inspection and Acceptance Certificates and Operating Permits: As required by authorities having jurisdiction for normal, unrestricted elevator use.

#### 1.6 QUALITY ASSURANCE

- A. Compliance with Regulatory Agencies: Comply with most stringent applicable provisions of following codes, laws, and/or authorities, including revisions and changes in effect:
  - 1. ASME A17.1
  - 2. ASME A17.2
  - 3. ASME A17.5
  - 4. NFPA 70
  - 5. Texas Accessibility Standards, TAS
  - 6. 2010 ADA Standards for Accessible Design, ANSI A117.1
  - 7. Local Fire Authority
  - 8. Requirements of most stringent provision of local authority having jurisdiction.
  - 9. NFPA101

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver material in Contractor's original unopened protective packaging.
- B. Store material in original protective packaging. Prevent soiling, physical damage, and moisture damage.
- C. Protect equipment and exposed finishes from damage and stains during transportation and construction.

#### 1.8 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair, restore, or replace elevator work that fails in materials or workmanship within specified warranty period.
- B. Failures include, but are not limited to: operation or control system failure including excessive malfunctions; performances below specified ratings; excessive wear; unusual deterioration or aging of materials or finishes; unsafe conditions; need for excessive maintenance; abnormal noise or vibration; similar unusual, unexpected, and unsatisfactory conditions.
- C. Warranty Period: One year from date of Substantial Completion.

#### 1.9 MAINTENANCE

- A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall provide twelve months full maintenance by skilled employees of elevator Installer. Include monthly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper elevator operation at rated speed and capacity. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
  - 1. Perform maintenance during normal working hours.
  - 2. Perform emergency callback service during normal working hours Include 24-hour-per-day, 7-day-per-week emergency callback service with response time of thirty minutes or less.
  - 3. Construction contract will include initial maintenance service beginning at Substantial Completion. Owner/General Contractor cannot deduct.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Approved Components:
  - 1. Hoistway Entrance: Columbia, H&B, Tyler, or other approved supplier.
  - 2. Fixtures vandal-resistant LED.
  - 3. 3rd Party control systems: MCE, or GAL.
- B. Environmental Conditions Hoistway Equipment
  - 1. Water-resistant NEMA 4 fixtures and wiring methods in any areas below 15' – 0" above sea level.

### 2.2 ELEVATORS

- A. Elevator System, General: Manufacturer's standard elevator systems. Unless otherwise indicated, manufacturer's standard components shall be used, as included in standard elevator systems and as required for complete system.
- B. Passenger Elevators Description:
  - Elevator Identification: Elevators  
TBD
  - 1. Capacity: As Required lbs.
  - 2. Class of Loading: Class A
  - 3. Contract Speed: As Required fpm
  - 4. Machine: Hydraulic Pump
  - 5. Machine Location: Adjacent at bottom landing
  - 6. Operational or Supervisory Control, Collective microprocessor-based: Selective collective, Duplex selective collective, or Group automatic control
  - 7. Stops: Front or Rear as required by Building needs
  - 8. Openings: Front or Rear as required by Building needs
  - 9. Minimum Clear Inside Car: as required by Building needs
  - 10. Minimum Clear to underside of canopy: as required by Building needs
  - 11. Entrance Size: as required by Building needs
  - 12. Entrance Type: as required by Building needs

### 2.3 MATERIALS

- A. Steel:
  - 1. Sheet Steel (Furniture Steel for Exposed Work): Stretcher-leveled, old-rolled, commercial quality carbon steel, complying with ASTM A366, matte finish.
  - 2. Sheet Steel (for Unexposed Work): Hot-rolled, commercial quality carbon steel, pickled and oiled, complying with ASTM A568/A568M-03.
  - 3. Structural Steel Shapes and Plates: ASTM A36.
- B. Stainless Steel: Type 316 or 430 complying with ASTM A240, with standard tempers and hardness required for fabrication, strength, and durability. Apply mechanical finish on fabricated work in the locations shown or specified, Federal Standard and NAAMM nomenclature, with texture and reflectivity required to match Architect's sample.

- C. Protect with adhesive paper covering.
    - 1. No. 4 Satin: Directional polish finish. Graining directions as shown or, if not shown, in vertical dimension.
    - 2. Textured: .050 inches mean pattern depth with bright directional polish (No. 4 satin finish).
      - a. 5WL as manufactured by Rigidized Metals.
      - b. Windsor pattern 5-SM as manufactured by Rimex Metals.
  - D. Aluminum: Extrusions per ASTM B221; sheet and plate per ASTM B209.
  - E. Plastic Laminate: ASTM E84 Class A and NEMA LD3.1, Fire-Rated Grade (GP-50), Type 7, 0.050" ±.005" thick, color and texture as follows:
    - 1. Exposed Surfaces: Color and texture selected by Architect.
    - 2. Concealed Surfaces: Contractor's standard color and finish.
  - F. Fire Retardant Veneer Plywood: Minimum 3/4" thick backup for natural finished wood and plastic laminate veneered panels, edged and faced as shown, provided with suitable anti-warp backing; meet ASTM E84 Class "I" rating with a flame-spread rating of 25 or less, registered with Local Authorities for elevator finish materials.
  - G. Natural Finish Wood Veneer: Standard thickness, 1/40" thoroughly dried conforming to ASME/HPMA HP-1983, Premium Grade. Place veneer, tapeless spliced with grain running in direction shown, belt, and polish sanded, book-matched. Species and finish designated and approved by Architect.
  - H. Paint: Clean exposed metal parts and assemblies of oil, grease, scale, and other foreign matter and factory paint one shop coat of standard rust-resistant primer. After erection, provide one finish coat of industrial enamel paint. Galvanized metal need not be painted.
  - I. Prime Finish: Clean all metal surfaces receiving a baked enamel paint finish of oil, grease, and scale. Apply one coat of rust-resistant primer followed by a filler coat over uneven surfaces. Sand smooth and apply final coat of primer.
  - J. Baked Enamel Finish: Prime finish per above. Unless specified "prime finish" only, apply and bake three additional coats of enamel in the selected solid color.
  - K. Ceramic: Refer to Section, Ceramic.
  - L. Carpet: Refer to Section, Carpet.
  - M. Vinyl tile: Refer to Section, Vinyl Composition Tile.
  - N. Glass: Laminated safety glass, minimum 9/16" thick, conforming to ANSI Z97.1 and CPSC 16 CFR Part 1201.
- 2.4 CAR AND GROUP PERFORMANCE
- A. Car Speed: ± 10% of contract speed under any loading condition.
  - B. Car Capacity: Safely lower, stop and hold 125% of rated load.

- C. Car Stopping Zone:  $\pm 1/4$ " under any loading condition.
- D. Door Times: Seconds from start to fully open or fully closed:
  - 1. Cars TBD: Door open: TBD seconds. Door close: TBD seconds. as required by Building needs
- E. Car Floor-to-Floor Performance Time: Seconds from start of doors closing until doors are 3/4 open (1/2 open for side opening doors) and car level and stopped at next successive floor under any loading condition or travel direction (TBD typical floor height):
  - 1. Cars TBD: TBD seconds. as required by Building needs
- F. Pressure: Fluid system components shall be designed and factory tested for 500 p.s.i. Maximum operating pressure shall be 400 p.s.i.
- G. Car Ride Quality:
  - 1. Acceleration and Deceleration: Smooth constant and not less than 1.5 feet/second<sup>2</sup> with an initial ramp between 0.5 and 0.75 second.
  - 2. Sustained Jerk: Not more than 6 feet/second<sup>3</sup>.
  - 3. Horizontal and vertical acceleration within car during all riding and door operating conditions. Not more than 15 mg peak to peak (adjacent peaks) in the 1-10 Hz range.
  - 4. Measurement Standards: Measure and evaluate ride quality consistent with ISO 18738, using low pass cutoff frequency of 10 Hz and A95 peak-to-peak average calculations.
- H. Noise and Vibration Control
  - 1. Airborne Noise: Measured noise level of elevator equipment and its operation shall not exceed 55 dBA inside car under any condition including door operation and car ventilation exhaust blower on its highest speed. Limit noise level in the machine room relating to elevator equipment and its operation to no more than 80 dBA. All dBA readings to be taken 3'-0" off the floor and 3'-0" from the equipment using the "A" weighted scale.
  - 2. Vibration Control: All elevator equipment provided under this contract, including power unit, controller, oil supply lines, and their support shall be mechanically isolated from the building structure and electrically isolated from the building power supply and to each other to minimize the possibility of objectionable noise and vibrations being transmitted to occupied areas of the building.

## 2.5 OPERATION

- A. Automatic Pushbutton Microprocessor-Based, Freight Only:
  - 1. Operate car without attendant from pushbuttons in car and at each landing. When car is idle, automatically start car and dispatch it to appropriate floor when call is registered by pressing car or hall pushbutton.
  - 2. Illuminate, "in use" lights in each hall pushbutton station when car is responding to registered car or hall call. Prevent registration of another call until trip is complete including time for passenger transfer and registration of car call if car is responding to a hall call. Extinguish "in use" light to indicate system is available to respond to next hall call.

- B. Collective Microprocessor-Based, Passenger and Service:
1. Operate car without attendant from pushbuttons in car and located at each floor. When car is available, automatically start car and dispatch it to floor corresponding to registered car or hall call. Once car starts, respond to registered calls in direction of travel and in the order the floors are reached.
  2. Do not reverse car direction until all car calls have been answered, or until all hall calls ahead of car and corresponding to the direction of car travel have been answered.
  3. Slow car and stop automatically at floors corresponding to registered calls, in the order in which they are approached in either direction of travel. As slowdown is initiated for a hall call, automatically cancel hall call. Cancel car calls in the same manner. Hold car at arrival floor an adjustable time interval to allow passenger transfer.
  4. Answer calls corresponding to direction in which car is traveling unless call in the opposite direction is highest (or lowest) call registered.
  5. Illuminate appropriate pushbutton to indicate call registration. Extinguish light when call is answered.
- C. Other Items:
1. Low Oil Control: In the event oil level is insufficient for travel to the top floor, provide controls to return elevator to the main level and park until oil is added.
  2. Load Weighing: Provide means for weighing car passenger load. Control system to provide dispatching at main floor in advance of normal intervals when car fills to capacity. Provide hall call by-pass when the car is filled to preset percentage of rated capacity and traveling in down direction. Field adjustment range: 10% to 100%.
  3. Anti-Nuisance Feature: If car loading relative to weight in car is not commensurate with number of registered car calls, or activation of door protection device is not commensurate with number of registered car calls, cancel car calls.
  4. Independent Service: Provide controls for operation of each car from its pushbuttons only. Close doors by constant pressure on desired destination floor button or door close button. Open doors automatically upon arrival at selected floor.
- D. Car-to-Lobby Feature: Provide the means in the main hall pushbutton station for automatic return to the Main floor. Return car nonstop after answering pre-registered car calls, and park with doors open for an adjustable time period of 60-90 seconds. Upon expiration of time period, car shall automatically revert to normal operation and close its doors until assigned as next car or until the car is placed on manual control via in-car attendant or out-of-service switch.
- E. Firefighters' Service: Provide equipment and operation in accordance with code requirements.
- F. Automatic Car Stopping Zone: Stop car within 1/4" above or below the landing sill. Maintain stopping zone regardless of load in car, direction of travel, distance between landings.
- G. Remote Monitoring and Information: Each controller and the group dispatch logic controller shall provide the following output information, including data logging, fault logs operational events, performance information including car speed, floor to floor times, and door times. The system shall be real time, capable of driving remote color

- H. LCD monitors that continually display the status of each car and call. Provide each group with a complete, interactive elevator monitoring system.
1. The system shall concurrently display all units in a group and separate units on one screen in a graphical format and record the following information for each monitored unit:
    - a. Group status:
      - 1) Group operational mode
      - 2) In/out of service
      - 3) Standby power
      - 4) Supervisory failure
      - 5) Location and direction of hall calls
      - 6) Phase I operation
      - 7) Hospital emergency service
    - b. Individual car status – expandable menus:
      - 1) Direction of travel
      - 2) Independent service
      - 3) Hall button failure
      - 4) Inspection service
      - 5) Firefighters' service
      - 6) Hospital emergency service
      - 7) Position of elevator
      - 8) Door status (open, opening, closing, closed)
      - 9) Door dwell time
      - 10) Load by-pass
      - 11) Standby power operation/sequence
      - 12) Power on/off
      - 13) Door detector
      - 14) Safety circuit
      - 15) Door zone
      - 16) Stop switch
      - 17) Alarm button
      - 18) Registered car calls
      - 19) Out of level
      - 20) Machine room space temperature exceeds 95 degrees
      - 21) Stop counter (number of starts)
      - 22) Car speed
      - 23) Door open times
      - 24) Door close time
      - 25) Start to stop motion time
      - 26) Emergency two-way communication device
      - 27) Air conditioner/heater
      - 28) Floor lockouts (car or hall)
      - 29) Lobby recall
      - 30) VIP service
      - 31) Firefighters' service
      - 32) Hospital emergency service
      - 33) Up/down peak
    - c. Service Driven Outages:
      - 1) Independent service
      - 2) Car out of service
      - 3) Lobby return, cleaning
    - d. Maintenance Activity "Indicators":
      - 1) Top of car inspection

- 2) Hoistway access
  - 3) Phase I and II
  - 4) Independent service
  - 5) Out of service
2. Faults monitored with visual and audible alarm, triggered by combinations of any of the above status points:
    - a. Safety circuit
    - b. Alarm bell
    - c. Stop switch
    - d. Emergency two-way communication device
    - e. Door reversal device
    - f. At least six user defined faults or events, i.e. water in pit, high machineroom space/ cab temperature
    - g. Transmit email when any monitored faults occur.
  3. If out of service 30 minutes, initiate email to designated address. If fault continues more than eight hours, send email hourly until car returned to service.
- I. Reporting Requirements: System shall provide reports in color graphical format both on-screen and in printed form capability to conveniently switch from one report type to another and from one bank to another using minimal mouse clicks and key strokes. Reports shall be displayed after minimal waiting time. Data for all reports shall be continuously recorded and stored. Reports shall be displayed by simply selecting a date and time range, bank of equipment, and report type. Date and time range selections shall carry forward from one report selection to the next. Reporting functions shall be sub-divided into the following categories:
1. Traffic Reports:
    - a. Number of hall calls per floor (hall call distribution on a per floor basis)
    - b. Number of hall calls per hour (24 hour time-line)
    - c. Hall call waiting times per floor (hall call waiting time distribution on a per floor basis)
    - d. Hall call waiting times per hour (24 hour time-line)
    - e. Distributed hall call response graph (24 hour time-line)
    - f. Detailed hall call response graph (% calls / n seconds)
    - g. Longest wait times including floor number, wait time, date, time, and direction
  2. Fault Reports:
    - a. Ten most recent faults (most recent faults listed per bank and per car)
    - b. Fault log – displays the entire fault log for a given time period
    - c. Faults per car (fault distribution on a per car basis)
    - d. Faults per floor (fault distribution on a per floor basis)
    - e. Faults per day/week/month (fault distribution on a per unit or group basis)
  3. Car Use Statistics:
    - a. Car use by hour (24 hour time-line of car calls, car starts, door cycles, delayed car, load by pass)
    - b. Car use statistics (same as above, shown for an entire bank)
  4. Group Service Log:
    - a. Cars in service (24 hour time-line with text log of group availability of each car)
    - b. Group functions (24 hour time-line with text log of actuation of group functions: Up peak, down peak, fire service, emergency power, etc.)
  5. Playback capability: Provide means to playback last fault events:
    - a. Provide means to store two years of data, prior to present.
    - b. Provide means to search data and display 50 faults in sequence of occurrence.
    - c. Provide means to transfer to permanent medium, CD, or approved equal.



- d. Provide means to print out playback data.
- J. Interface to Third Party Building Management Systems: The elevator system shall be capable of interfacing and exchanging data with the Owner's selected third party elevator management system and maintainable controls. Provide MCE control system delivered to site which is fully compatible with IDS LiftNet and LiftNet protocol.
- K. Motion Control: Microprocessor-based AC type with unit valve suitable for operation specified and capable of providing smooth, comfortable car acceleration and retardation. Limit the difference in car speed between full load and no load to not more than  $\pm 10\%$  of the contract speed in either direction of travel.
- L. Selective Leveling: Provide means to limit elevator car speed when traveling between adjacent floors.
- M. Passenger and Service, Door Operation: Automatically open doors when car arrives at main floor. At expiration of normal dwell time, close doors. Reopen doors when car is designated for loading. Provide front or rear selective door operation, if required.
- N. Freight, Power Door Operation: Open door and gate automatically when car arrives at a floor. Control door and gate closing by using constant-pressure buttons on car or at each floor. Provide passenger sequence operation. Provide reversing safety device for car gate. Provide automatic door and gate closing feature with warning buzzer.
- O. Standby Lighting and Alarm: Car mounted battery unit with solid-state charger to operate alarm bell and car emergency lighting. Battery to be rechargeable with minimum five-year life expectancy. Include required transformer. Provide constant pressure test button in service compartment of car operating panel. Provide lighting integral with portion of normal car lighting system.
- P. Battery Lowering Feature: Upon loss of normal power, provide controls to automatically lower the car to the nearest lower landing. Upon arrival at the lowest landing, the elevator doors shall open automatically and remain open until regular door time has expired. The elevator shall then become deactivated. The standby power source shall be provided via 12-volt D.C. battery units installed in machine room, including solid-state charger and testing means mounted in a common metal container. Battery to be rechargeable lead acid or nickel cadmium with a ten- year life expectancy. Upon restoration of normal power, the elevator shall automatically resume normal operation.
- Q. Card/Proximity Reader Security System: Provide provisions inside all cars for reader unit. Mount reader unit as directed by Architect and make cross connects to card reader terminal interface and relays in machine room or equipment space. Provide glass panel to match card proximity reader size. Elevator control systems shall provide output signal of selected floor to facilitate system tracking of floor access.
- R. Infant Abduction Operation, if applicable: Provide provisions in controller, on car, and in hall control station to interface with client's infant abduction prevention system. Configure control to hold car at floor with doors open, sound audible alarm on car, nurses station, and security control room, and prevent registration of car destination call if infant abduction monitor is activated.

- S. Hospital Emergency Service: Provide feature as specified for all Cars, Except Freight.
1. Feature shall be activated via a proximity card reader, mounted in hall call station at each landing. Activation of reader at any floor shall cause the following operation of selected elevators. An adjacent small blue light jewel to illuminate at that floor and all other floors with a priority service keyed switch to indicate cars "in use." Illuminate corresponding small blue light jewel in lobby control panel. Registered car calls for selected car shall be cancelled. A blue light with the engraved signage beneath "please exit car" at the top of the car operating panel shall pulsate indicating to riding passengers the car has been commandeered for priority service. Include audible annunciation verbiage as selected. A car traveling toward floor of activation shall express non-stop to that floor. A car traveling away from floor of activation shall stop at the next available floor, reverse without opening doors, and express non-stop to floor of activation.
  2. Upon arrival of car at floor of activation, car shall open its doors and "park" for an adjustable time period of 60-90 seconds. Provide second proximity card reader, mounted adjacent to blue light in car operating panel, for attendant operation of car under priority service feature. Upon activation, car "park time" shall be voided and car shall be under control of attendant. Registration of a destination floor, followed by the activation of the door close button, shall cause express non-stop travel to selected floor. Upon arrival at selected floor, car shall open its doors and remain at that floor until another floor is selected. Failure to activate car priority card reader or register a subsequent car call after activation of priority card reader within preset time constraints of 60-90 seconds shall cause car to be automatically restored to normal service.

## 2.6 MACHINE ROOM EQUIPMENT

- A. Arrange equipment in available spaces.
- B. Pump Unit: Assembled unit consisting of positive displacement pump, induction motor, master- type control valves combining safety features, holding, direction, bypass, stopping, manual lowering functions, shut off valve, oil reservoir with protected vent opening, oil level gauge, outlet strainer, drip pan, muffler, all mounted on isolating pads. Provide oil thermal unit, oil cooling unit, and oil temperature thermostat to maintain oil at operating temperature. Design unit for 120 up starts/hour.
- C. Landing System: Solid-state, magnetic, or optical type.
- D. Controller: UL/CSA labeled.
1. Compartment: Securely mount all assemblies, power supplies, chassis switches, relays, etc., on a substantial, self-supporting steel frame. Completely enclose equipment with covers. Provide means to prevent overheating.
  2. Relay Design: Magnet operated with contacts of design and material to insure maximum conductivity, long life, and reliable operation without overheating or excessive wear. Provide wiping action and means to prevent sticking due to fusion. Contacts carrying high inductive currents shall be provided with arc deflectors or suppressors.
  3. Microprocessor-Related Hardware:
    - a. Provide built-in noise suppression devices which provide a high level of noise immunity on all solid-state hardware and devices.
    - b. Provide power supplies with noise suppression devices.
    - c. Isolate inputs from external devices (such as pushbuttons) with opto-

- d. isolation modules.
  - e. Design control circuits with one leg of power supply grounded.
  - f. Safety circuits shall not be affected by accidental grounding of any part of the system.
  - g. System shall automatically restart when power is restored.
  - h. System memory shall be retained in the event of power failure or disturbance.
  - i. Equipment shall be provided with Electro Magnetic Interference (EMI) shielding within FCC guidelines.
- 4. Wiring: CSA labeled copper for factory wiring. Neatly route all wiring interconnections and securely attach wiring connections to studs or terminals.
  - 5. Permanently mark components (relays, fuses, PC boards, etc.) with symbols shown on wiring diagrams.
  - 6. Monitoring System Interface: Provide controller with serial data link through RJ45 Ethernet connection and install all devices necessary to monitor items outlined in Section 2.13. Elevator contractor responsible to connect monitoring system interface to machine room monitoring compartment and LAN. Wiring from the LAN to the machine room monitoring compartment by others.
  - 7. Provide controller or machine mounted auxiliary lockable "open" disconnect if mainline disconnect is not in sight of controller and/or machine.
- E. Muffler: Provide in discharge oil line near pump unit. Design shall dampen and absorb pulsation and noise in the flow of hydraulic fluid.
  - F. Piping and Oil: Provide piping, connections and oil for the system. Buried piping shall be secondarily contained with watertight Schedule 40 PVC sleeves between elevator machine room and pit. A minimum of two sound isolation couplings shall be provided between the pump unit and oil line and the oil line and jack unit. Provide isolated pipe stands or hangers as required.
  - G. Shut-Off Valve: manual valve on line adjacent to pump unit. Provide second valve in pit adjacent to jack unit.
  - H. If Cylinder Head is above Pumping Unit, Pressure Switch: Provide oil pressure sensitive switch in line to automatically close and prevent loss of oil in cylinder upon loss of pressure in oil supply line.

## 2.7 HOISTWAY EQUIPMENT

- A. Guide Rails: Planed steel T-sections for car of suitable size and weight for the application, including brackets for attachment to building structure. Provide rail backing to meet code requirements. Provide bracketing, at top and bottom of floor beams. No additional structural points of rail attachment, other than those shown on the Contract Documents, will be provided.
- B. Buffers: Spring type with blocking and support channels.
- C. Hydraulic Jack Assembly:
  - 1. Cylinders: Seamless steel pipe. Design head to receive unit-type packing and provide means to collect oil at cylinder head and return automatically to oil reservoir. Provide secondary containment/cylinder protection. Provide head assembly access ladders and platforms. Provide cylinder stabilizer bracketing between guide rails as required.

2. Plungers: Polished seamless steel tubing or pipe. If plunger length exceeds 24'-0", provide two or more sections not exceeding 16'-0" in length, or coordinate installation of longer unit at the jobsite. Join sections by internal threaded couplings. Multiple section jack units shall be factory polished while assembled and marked for proper future reassembly. Isolate plunger from car frames.
  3. Provide dual jack holeless application. A Required.
  4. Provide single, or dual-jack roped application. Mount sheaves to top of plungers. As Required
- D. Sheaves: Machined grooves and sealed bearings. Provide mounting means to top of plungers.

- E. Jack Support and Fluid Shut-Off Valves: Provide steel pit channels to support jack assembly and transmit loads to building structure. Provide intermediate stabilizers as required. Provide manual on/off valves in oil lines adjacent to pump unit and jack units in pit.
- F. Well Hole Casing, if Required:
  - 1. Well hole is to be provided by Elevator Contractor. No additional compensation will be allowed for unforeseen conditions of any kind or spoil removal.
  - 2. Install steel outer casing minimum 18" diameter. Install watertight sleeve over jack assembly for secondary containment prior to insertion into the outer casing. Extend PVC sleeve through pit floor slab to underside of jack support beams and seal with non-permeable membrane. Seal well opening at the pit floor with hydraulic quick setting cement. Provide PVC vision/access ports.
- G. Governor, if Required: Car driven, with pull-through jaws and bi-directional electrical shutdown switches. Provide required auxiliary supports for attachment to car guide rail or building structure.
- H. Governor Rope Tensioning Sheaves, if Required: Mount sheaves and support frame on pit floor or guide rail. Provide frame with guides or pivot point to enable free vertical movement and proper tension of rope.
- I. Suspension Means, if Required:
  - 1. 8 x 19 or 8 x 25 Seale construction, traction steel type. Fasten with staggered length, adjustable, spring isolated wedge type shackles.
  - 2. Approved governor rope.
- J. Overspeed Valves, if Required: Provide a pressure sensitive, mechanically-actuated seismic safety valve, conforming to ASME A17.1, Rule 3.19.4.7. Connect valve directly to jack assembly inlet.
- K. Terminal Stopping: Provide normal and final devices.
- L. Electrical Wiring and Wiring Connections:
  - 1. Conductors and Connections: Copper throughout with individual wires coded and connections on identified studs or terminal blocks. Use no splices or similar connections in wiring except at terminal blocks, control compartments, or junction boxes. Provide 10% spare conductors throughout. Run spare wires from car connection points to individual elevator controllers in the machine room.
  - 2. Conduit: Galvanized steel conduit, EMT, or duct. Flexible conduit length not to exceed 3'-0". Flexible heavy-duty service cord may be used between fixed car wiring and car door switches for door protective devices. Conduit from the closest hoistway of each elevator group or single elevator to the firefighters' control room.
  - 3. Traveling Cables: Flame and moisture-resistant outer cover. Prevent traveling cable from rubbing or chafing against hoistway or equipment within hoistway.
    - a. Provide five pair of shielded wires of minimum 18 gauge for card reader.
    - b. Provide for CCTV two pair of shielded 18 gauge wire within traveling cable from car controller to car top junction box, plus 3'-0" excess loop at both ends.
    - c. Provide two pair of 18 gauge wire for CCTV power.
    - d. Provide eight pair of spare shielded communication wires in addition

- e. to those required to connect specified items.
  - f. Tag spares in machine room. Provide cables from controller to car top.
4. Auxiliary Wiring: Provide conduit, wiring and connections for fire alarm initiating devices, emergency two-way communication system, firefighters' phone jack, paging speaker, CCTV, security system and card reader interface terminals and relays, and announcement speaker from the machine room junction box to each car controller in machine room.
- M. Passenger and Service Entrance Equipment:
- 1. Door Hangers: Two-point hanger roller with neoprene roller surface and suspension with eccentric upthrust roller adjustment.
  - 2. Door Tracks: Bar or formed, cold-drawn removable steel tracks with smooth roller contact surface.
  - 3. Door Interlocks: Operable without retiring cam. Paint interlock box flat black.
  - 4. Door Closers: Spirator, or jamb/strut mounted counterweight type. Design and adjust to insure smooth, quiet mechanical close of doors.
  - 5. Hoistway Door Unlocking Device: Provide unlocking device with escutcheon in door panel at all floors, with finish to match adjacent surface.
  - 6. Hoistway Access Switches: Mount in entrance frame side jamb at top and bottom floors. Provide switch without faceplate.
- N. Floor Numbers: Stencil paint 4" high floor designations in contrasting color on inside face of hoistway doors or hoistway fascia in location visible from within car.
- 2.8 HOISTWAY ENTRANCES
- A. Complete entrances bearing fire labels from a nationally recognized testing laboratory approved within the governing jurisdiction.
- B. Frames: 14 gauge hollow metal at all floors. Bolted and lapped head to jamb assembly at all floors. Provide Arabic floor designation/Braille plates, centered at 60" above finished floor, on both side jambs of all entrances. Provide plates at main egress landing with "Star" designation. For designated emergency car, provide "Star of Life" designation plates at height of 78"-84" above finished floor on both side jambs at all floors. Braille indications shall be below Arabic floor designation. Provide cast floor designation/Braille plates as manufactured by SCS Elevator Products, Inc. or Vision Mark.
- C. Transom Panels, if required: Sheet, offset labeled flush labeled projecting, or flush with frame. Same construction and finish as hoistway door panels at all floors.
- D. Door Panels: 16 gauge steel, sandwich construction without binder angles. Provide leading edges of center-opening doors with rubber astragals. Provide a minimum of two gibs per panel, one at leading and one at trailing edge with gibs in the sill groove entire length of door travel. Construct door panels with interlocking, stiffening ribs.
- E. Sight Guards: 14 gauge, same material and finish as hoistway entrance door panels. Construct without sharp edges.
- F. Sills: Extruded nickel silver.
- G. Sill Supports: Structural or formed steel designed to support door sill based upon

- H. carloading classification. Mount to eliminate need for grout under the sill.
- I. Fascia, Toe Guards and Hanger Covers: Delete fascia for Elevators and provide car door interlock to prevent opening of car doors outside the unlocking zone.
- J. Struts and Headers: Provide for vertical support of entrances and related material. Provide door open bumpers on entrances equipped with vertical struts.
- K. Finish of Frames and Doors: Satin finish stainless steel.
- L. Freight, Vertical Bi-Parting Freight Door Panels: 12 gauge formed steel plates welded into frame angles. Provide with safety astragals, vision panels, and truckable sills and load transfer angles. Provide telescoping upper section or pass-type doors as required.
- M. Hoistway Access:
  - 1. Hoistway Door Unlocking Device: Provide unlocking device with escutcheon in door panel at all floors, with finish to match adjacent surface.
  - 2. Hoistway Access Switches: Mount in entrance frame side jamb at top and bottom floors. Provide switch without faceplate.

## 2.9 CAR EQUIPMENT

- A. Frame: Welded or bolted, rolled or formed steel channel construction to meet load classification specified.
- B. Safety Device: Type "A," instantaneous, if required.
- C. Platform: Isolated type, constructed of steel, or steel and wood which is fireproofed on underside. Design and construct to accommodate load classification requirements. Provide Class "A" construction for passenger elevators, Class "C 1" construction for Service elevators, and Class C2 construction for freight elevator.
- D. Platform Apron: Minimum 14 gauge steel, reinforced and braced to car platform front and rear with Contractor's standard finish.
- E. Guide Shoes: Roller type with three or more spring dampened, sound-deadening rollers per shoe. Maximum roller rotation speed, 350 rpm.
  - 1. Freight Only: Solid type with renewable oilless inserts to accommodate freight loading classification.
- F. Finish Floor Covering: Furnished under other sections.
- G. Sills: One piece extrusion with extruded extension between car entrance columns to face of car front return. Extruded extension to match finish of sill.
  - 1. Elevators All Passenger and Service: Nickel silver.
- H. Door Panels: 16 gauge steel, sandwich construction without binder angles. Provide leading edges of center-opening doors with rubber astragals. Provide a minimum of two gibs per panel, one at leading and one at trailing edge with gibs in the sill groove entire length of door travel. Construct door panels with interlocking, stiffening ribs.

- I. Door Hangers: Two-point hanger roller with neoprene roller surface and suspension with eccentric upthrust roller adjustment.
- J. Door Track: Bar or formed, cold-drawn removable steel track with smooth roller contact surface.
- K. Door Header: Construct of minimum 12 gauge steel, shape to provide stiffening flanges.
- L. Door Electrical Contact: Prohibit car operation unless car door is closed. Provide car door interlock to prevent opening of car doors outside the unlocking zone.
- M. Door Clutch: Heavy-duty clutch, linkage arms, drive blocks and pickup rollers or cams to provide positive, smooth, quiet door operation. Design clutch so car doors can be closed, while hoistway doors remain open.
- N. Restricted Opening Device: Provide car-door interlock to prevent opening of car doors outside unlocking zone.
- O. Passenger and Service, Door Operator: High-speed, heavy-duty linear door operator capable of opening doors at no less than 2.5fps. Accomplish reversal in no more than 2½" of door movement. Provide solid-state door control with closed loop circuitry to constantly monitor and automatically adjust door operation based upon velocity, position, and motor current. Provide a minimum of four controller-activated motion profiles, per floor, per door, to maintain consistent, smooth, and quiet door operation at all floors, regardless of door weight or varying air pressure.
- P. Passenger and Service Door Control Device:
  - 1. Infrared Reopening Device:
    - a. Black, fully enclosed device with full screen infrared matrix or multiple beams extending vertically along leading edge of each door panel to minimum height of 7'-0" above finished floor. Provide extension of housing and lens full height of door panels. Device shall prevent doors from closing and reverse doors at normal opening speed if beams are obstructed while doors are closing, except during nudging operation. In event of device failure, provide for automatic shutdown of car at floor level with doors open:
  - 2. Nudging Operation: After beams of door control device are obstructed for a predetermined time interval (minimum 20.0-25.0 seconds), warning signal shall sound and doors shall attempt to close with a maximum of 2.5 foot pounds kinetic energy. Activation of the door open button shall override nudging operation and reopen doors.
  - 3. Interrupted Beam Time: When beams are interrupted



4. during initial door opening, hold door open a minimum of 3.0 seconds. When beams are interrupted after the initial 3.0 second hold open time, reduce time doors remain open to an adjustable time of approximately 1.0-1.5 seconds after beams are reestablished.
5. Differential Door Time: Provide separately adjustable timers to vary time that doors remain open after stopping in response to calls.
  - a. Car Call: Hold open time adjustable between 3.0 and 5.0 seconds.
  - b. Hall Call: Hold open time adjustable between 5.0 and 8.0 seconds. Use hall call time when car responds to coincidental calls.

Q. Car Operating Panel:

1. Passenger: Two car operating panels without faceplates consisting of a metal box containing the vandal resistant operating fixtures, mounted behind the car swing front return panels.
  - a. Provide manually operated stop switch within Firefighters' Phase II compartment
  - b. Provide "door open" button to stop and reopen doors or hold doors in open position.
  - c. Provide "door close" button to activate door close cycle. Cycle shall not begin until normal door dwell time for a car or hall call has expired, except firefighters' operation.
  - d. Locked panel including Phase II fire access switch and hidden floor buttons, call cancel button, door open, door close, switch, stop switch, light jewel, fire communication jack within locked panel, for fire officer use and use of car on independent service only.
2. Service: One vandal resistant car operating panel with faceplate consisting of a metal box containing operating fixtures, mounted behind the car stationary front return panel.
  - a. Provide manually operated stop switch within Firefighters' Phase II compartment.
  - b. Provide "door open" button to stop and reopen doors or hold doors in open position.
  - c. Provide "door close" button to activate door close cycle. Cycle shall not begin until normal door dwell time for a car or hall call has expired, except firefighters' operation.
  - d. Locked panel including Phase II fire access switch, call cancel button, door open, door close switch, stop switch, light jewel, fire communication jack within locked panel, for fire officer use and use of car on independent service only.
  - f. Provide "door open" button to stop and reopen doors or hold doors in open position.
  - g. Service Only, Extended Door Hold Open Button:

- h. Provide button to extend normal door hold open period up to 30 seconds. Cancel extended time by registration of car call or actuation of door close button.
  - i. Provide "door close" button to activate door close cycle. Close shall not begin until normal door dwell time for a car or hall call has expired, except firefighters' operation.
3. Suitably identify floor buttons, alarm button, door open button, door close button, and emergency push-to-call button with SCS Elevator Products, Inc. or equal cast tactile symbols recessed flush mounted with permanent rear mounted fastenings. Manufacturers standard tactile markings acceptable for service and freight cars. Configure plates per local building code accessibility standards including Braille. Locate top floor button at maximum height allowed above the car floor; no lower than 35" for emergency push-to-call button and alarm button.
  4. Provide minimum 3/4" diameter raised floor pushbuttons that illuminate to indicate call registration.
  5. Provide alarm button to ring bell located on car. Illuminate button when actuated.
  6. Provide Firefighters' devices and operation. Install firefighters' telephone jack with approved mounting bezel matching adjacent controls in firefighter's compartment.
  7. Provide lockable service compartment with recessed flush door. Door material and finish shall match car return panel or car operating panel faceplate. Include the following controls in lockable service cabinet with function and operating positions identified by permanent signage or engraved legend:
    - a. Inspection switch.
    - b. Light switch.
    - c. Exhaust blower switch.
    - d. Independent service switch.
    - e. Constant pressure test button for battery pack emergency lighting.
    - f. 120-volt, AC, GFCI protected electrical convenience duplex outlet.
    - g. Card reader override switch.
    - h. Switch to select either floor voice annunciation, floor passing tone, or chime.
    - i. Keyed stop switch.
  8. Provide black paint filled (except as noted), engraved, or approved etched signage as follows with approved size and font:
    - a. Phase II firefighters' operating instructions on inside face of firefighters' compartment door. Engrave filled red firefighters' operation on outside face of compartment door.
    - b. Building identification car number on main and auxiliary car operating panel.
    - c. Car capacity in pounds on main car operating panel service

- d. compartment door.
  - e. Loading classification and description on car operating panel service compartment door.
- R. Car Top Control Station: Mount to provide safe access and utilization while standing in an upright position on car top.
- S. Work Light and Duplex Plug Receptacle: GFCI protected outlet at top of car. Include on/off switch and lamp guard. Provide additional GFCI protected outlet on car top for installation of car CCTV.
- T. Communication System:
1. (Coordinate with Lamar State College Port Arthur to fit existing system)
  2. "Push to Call," two-way communication instrument in car integral to COP with automatic dialing, tracking, and recall features with shielded wiring to car controller in machine room. Provide dialer with automatic rollover capability with minimum two numbers.
    - a. "Push to Call" button or adjacent light jewel shall illuminate and flash when call is acknowledged. Button shall match car operating panel pushbutton design. Provide uppercase "PUSH TO CALL" "HELP ON THE WAY" engraved signage adjacent to button.
    - b. Provide "Push to Call" button tactile symbol, engraved signage, and Braille adjacent to button mounted integral with car front return panel.
  3. Firefighters' communication jack in car and firefighters' panel jack bezel shall match adjacent controls.
  4. Install remote speakers provided under Item 1.1. B.1 in car behind front return panel with drilled speaker pattern, with shielded wiring to machine room junction box.
  5. Provide two-way communication between car and machine room if required.

## 2.10 CAR ENCLOSURE

- A. Passenger Elevator: Provide complete as specified herein and detailed on architectural drawings.
1. Shell: Reinforced 14 gauge furniture steel formed panels with baked enamel interior finish as selected. Apply sound-deadening mastic to exterior. Provide concealed ventilation cutouts.
  2. Canopy: Reinforced 12 gauge furniture steel formed panels with lockable, contacted, hinged emergency exit. Interior finish white color reflective baked enamel.
  3. Front and Rear, if applicable, Return Panels and Integral Entrance Columns: Reinforced 14 gauge furniture steel clad with minimum 16 gauge satin finish stainless steel. Swing entire unit on substantial pivot points (minimum three) for service access to car operating panel(s). Locate pivot points to provide full swing of front return panel without interference

4. with side wall finish or handrail. Secure in closed position with concealed three-point latch. Provide firefighters' and service compartments with recessed flush cover and cutouts for operating switches, etc.
5. Transom: Reinforced 14 gauge furniture steel clad with minimum 16 gauge satin finish stainless steel full width of enclosure.
6. Car Door Panels: Reinforced minimum 16 gauge furniture steel clad with minimum 18 gauge satin finish stainless steel. Same construction as hoistway door panels.
7. Base: Satin finish stainless steel with concealed ventilation cutouts.
8. Interior Wall Finish: Removable panels, faced and edged, with color core plastic laminate, color and finish as selected.
9. Ventilation: Morrison Products, Inc. three-speed model SOE 06-01055 exhaust blower mounted to car canopy on isolated rubber grommets. Exhaust blower shall meet noise and vibration criteria.
10. Lighting: Provide LED fixtures with wiring and hookup. Coordinate with emergency lighting requirements
11. Suspended Ceiling: Six-section satin finish stainless steel panels with LED downlight fixture in each panel.
12. Handrails: Minimum 1¼" diameter stainless steel tubular grab bar with backing plates and captive nuts across rear wall. Bolt rails through car walls from back and mount on ½" deep solid round stainless steel standoff spacers no more than 18" O.C. Return handrail/guardrail ends to car walls.
13. Garage Elevators only, Cab Air Conditioner/Heater Unit: Provide self-contained cab air conditioner/heater on car top with concealed ducts, thermostat control, and evaporator. Isolate from car top to comply with noise and vibration requirements.

B. Service Elevators: Provide complete as specified herein.

1. Shell: Reinforced 14 gauge textured finish stainless steel formed panels no more than 18" wide with light-proof joints. Apply sound deadening mastic to exterior.
2. Canopy: Reinforced 12 gauge furniture steel formed panels with lockable, contacted, hinged emergency exit. Interior finish white reflective baked enamel.
3. Front and Rear Return Panels: Reinforced 14 gauge furniture steel clad with minimum 16 gauge textured finish stainless steel as specified in Item 2.02.
4. Entrance Columns and Transom: Reinforced 14 gauge furniture steel clad with minimum 16 gauge textured finish stainless steel.
5. Car Door Panels: Reinforced minimum 16 gauge satin finish stainless steel as specified in Item 2.02. Same construction as hoistway door panels. Cladding shall wrap leading and trailing edge of panel a minimum of ½" on rear side.
6. Ventilation: Morrison Products, Inc. three-speed model AA 06-01048 exhaust blower mounted to car canopy on

7. isolated rubber grommets. Exhaust blower shall meet noise and vibration criteria.
8. Lighting: LED fixture flush mounted in canopy with expanded metal protective diffuser and steel guard over fixtures on car top.
9. Handrails/Guardrails: Two lines. Top handrail line minimum 1½" diameter stainless steel grab bar with backing plates and captive nuts. Lower guardrail line 4" x 3/8" solid stainless steel flatstock bars mounted on both sides rear and side walls of the car. Locate bottom guardrail line at 8" above car floor and handrail line at 32" above the car floor. Bolt rails through car walls from back and mount on 1½" deep solid round stainless steel standoff spacers no more than 18" O.C. Return handrail/guardrail ends to car walls.

## 2.11 HALL CONTROL STATIONS

- A. Pushbuttons: Provide one riser or two risers, if required, with flush mounted faceplates. Include pushbuttons for each direction of travel that illuminate to indicate call registration. Include approved engraved message and pictorial representation prohibiting use of elevator during fire or other emergency as part of faceplate. Pushbutton design shall match car operating panel pushbuttons. Provide vandal resistant pushbutton and light assemblies. Provide LED illumination.
- B. Phase I Fire Service fixture, including key switch, engraved operating instructions and illuminating jewel. Provide illuminating jewel(s) indicating standby power status.
- C. Freight, Door Control Buttons: Include vandal resistant "door open," "door close," and "stop" buttons for control of power operated vertical bi-parting doors at each landing call button fixture. Provide buttons integral with hall control station. Pushbutton design shall match car operating panel pushbuttons.

## 2.12 SIGNALS

- A. Hall Lantern, Elevators, all except Freights:
  1. Provide at each entrance to indicate travel direction of arriving car. Locate as detailed on architectural drawings.
  2. Illuminate up or down LED lights and sound tone once for up and twice for down direction prior to car arrival at floor. Illuminate light until the car doors start to close.
  3. Sound level shall be adjustable from 20-80 dBA measured at 5'-0" in front of hall control station and 3'-0" off floor.
  4. Provide advanced predictive hall lantern notification to comply with ADA hall call notification time. Provide adjustable car door dwell time to comply with ADA requirements relative to hall call notification time.

5. Car direction lenses shall be arrow shaped with faceplates.
  6. Lenses shall be minimum 2½" in their smallest dimension.
  7. Provide vandal resistant lantern and light assemblies consisting of series of dots or lines for maximum visibility.
- B. Car Position Indicator: Alpha-numeric digital indicator containing floor designations and direction arrows a minimum of 1/2" high to indicate floor served and direction of car travel. Locate fixture in car front return panel above each car operating panel. When a car leaves or passes a floor, illuminate indication representing position of car in hoistway. Illuminate proper direction arrow to indicate direction of travel.
- C. Hall Position Indicator, Elevators all except Freights: Alpha-numeric digital indicator containing floor designations and direction arrows a minimum of 2½" high to indicate floor served and direction of car travel. Mount integral with hall lanterns at Main floor.
- D. Faceplate Material and Finish: Satin finish stainless steel, all fixtures. Tamper resistant fasteners for all fastenings exposed to the public.
- E. Floor Passing Tone: Provide an audible tone of no less than 20 decibels and frequency of no higher than 1500 Hz, to sound as the car passes or stops at a floor served.
- F. Voice Synthesizer: Provide electronic device with easily reprogrammable message and female voice to announce car direction, floor, emergency exiting instructions, etc.

#### 2.13 FIRE CONTROL PANEL (IF REQUIRED)

- A. Firefighters' Control Panel: Locate in building fire control room. Fixture faceplate, stainless steel satin finish, including the following features:
1. Car position and direction indicator (digital-readout or color SVGA display type). Identify each position indicator with car number and group identification.
  2. Indicator showing operating status of car.
  3. Manual car standby power selection switches and power status indicators.
  4. Two-position firefighters' emergency return switches and indicators with engraved instructions filled red.
  5. Firefighters' telephone jack.
  6. Fixtures and monitor shall be located as directed by Architect. Where applicable, identify all indicators and manual switches with appropriate engraving. Provide conduit and wiring to control panel. Coordinate size and location with Architect.
- B. Machine Room Display System with Battery Backup: Provide groups of elevators with a monitoring system in the machine room with color monitor. System shall be a Windows based operating

- C. system capable of outputting to external media. As a minimum, system shall display the following functions:
1. Operational Displays:
    - a. Car operating in normal/standby power.
    - b. Car position and direction of travel.
    - c. Car and Hall calls.
    - d. Operating mode.
    - e. Door status.
    - f. Delayed car.
    - g. Load weighing and by-pass.
    - h. Car to lobby feature.
    - i. Car in/out of service.
  2. System Performance Monitoring:
    - a. Hall call registration information: Provide memory capacity for at least the preceding five, 24-hour periods, in blocks of 5- or 15-minute segments, running hour to hour (i.e., 2:00 p.m. to 3:00 p.m.)
      - 1) Visual and printed summary of hall call registration events by floor, direction, and duration, totaled in 5- or 15-minute segments during any 60-minute block using an internal clock.
      - 2) Visual and printed summary of hall call registration duration averaged for 5- or 15-minute and hourly periods.
      - 3) Visual and printed summary of percentage of hall calls answered within 30 and 60 seconds in each 5- or 15-minute and hourly periods.
      - 4) Visual and printed summary of time periods during which individual cars are not in group operation (operating separately or out of service).
    - b. Accumulate system fault data including nature of fault, time, and day. Store and retrieval capabilities for minimum 30-day period.
  3. Provide printer to produce a hard copy of stored data. Provide directions and software to accomplish information retrieval.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Prior to beginning installation of equipment examine hoistway and machine room areas. Verify no irregularities exist which affect execution of work specified.
- B. Do not proceed with installation until work in place conforms to project requirements.

### 3.2 INSTALLATION

- A. Install all equipment in accordance with Contractor's

- B. instructions, referenced codes, specification, and approved submittals.
- C. Install machine room equipment with clearances in accordance with referenced codes and specification.
- D. Install all equipment so it may be easily removed for maintenance and repair.
- E. Install all equipment for ease of maintenance.
- F. Install all equipment to afford maximum accessibility, safety, and continuity of operation.
- G. Remove oil, grease, scale, and other foreign matter from the following equipment and apply one coat of field-applied machinery enamel.
  - 1. All exposed equipment and metal work installed as part of this work which does not have architectural finish.
  - 2. Machine room equipment, hoistway equipment including guide rails, guide rail brackets, and pit equipment.
  - 3. Neatly touch up damaged factory-painted surfaces with original paint color. Protect machine-finish surfaces against corrosion.
- H. Clean all architectural finishes and replace or restore any surfaces damaged during construction to like new condition.

### 3.3 FIELD QUALITY CONTROL

- A. Acceptance Testing: On completion of elevator installation and before permitting elevator use (either temporary or permanent), perform acceptance tests as required and recommended by ASME A17.1/CSA B44 and by governing regulations and agencies.
- B. Advise Owner, Architect, and authorities having jurisdiction in advance of dates and times that tests are to be performed on elevators.

### 3.4 ADJUSTING

- A. Install hydraulic jack assembly and guide rails plumb and align vertically with tolerance of 1/16" in 100'-0". Secure guide rail joints without gaps and file any irregularities to a smooth surface.
- B. Static balance car to equalize pressure of guide shoes on guide rails.
- C. Lubricate all equipment in accordance with Contractor's instructions.
- D. Adjust motors, valves, controllers, leveling switches, limit switches, stopping switches, door operators, interlocks, and



- E. safety devices to achieve required performance levels.

### 3.5 CLEANUP

- A. Keep work areas orderly and free from debris during progress of project. Remove packaging materials on a daily basis.
- B. Remove all loose materials and filings resulting from work.
- C. Clean machine room equipment and floor.
- D. Clean pit equipment and floor.
- E. Clean hoistways, car, car enclosure, entrances, operating, and signal fixtures.

### 3.6 TEST RESULTS:

- A. Under any load obtain specified contract speed, performance times, stopping accuracy without re-leveling, and ride quality to satisfaction of Consultant. Tests may be conducted under no load, balanced load, and full load conditions.
- B. Consultant may test temperature rise in motor windings limited to 50° Celsius above ambient. A full-capacity one hour running test, stopping at each floor for ten seconds in up and down directions, may be required.
- C. Engage a factory-authorized service representative to train Owner's maintenance personnel to operate, adjust, and maintain elevators.
- D. Check operation of each elevator with Owner's personnel present before date of Substantial Completion and again not more than one month before end of warranty period. Determine that operation systems and devices are functioning properly.

### 3.7 PROTECTION

- A. Temporary Use: Comply with the following requirements for each elevator used for construction purposes:
  - 1. Provide car with temporary enclosure, either within finished car or in place of finished car, to protect finishes from damage.
  - 2. Provide strippable protective film on entrance and car doors and frames.
  - 3. Provide padded wood bumpers on entrance door frames covering jambs and frame faces.
  - 4. Provide other protective coverings, barriers, devices, signs, and procedures as needed to protect elevator and elevator equipment.
  - 5. Do not load elevators beyond their rated weight capacity.
  - 6. Engage elevator Installer to provide full maintenance service. Include preventive maintenance, repair, or replacement of worn or defective components, lubrication, cleanup, and adjustment as necessary for proper elevator

7. operation at rated speed and capacity. Provide parts and supplies same as those used in the manufacture and installation of original equipment.
8. Engage Elevator Installer to restore damaged work, if any, so no evidence remains of correction. Return items which cannot be refinished in the field to the shop, make required repairs, and refinish entire unit, or provide new units as required.

END OF SECTION

## SECTION 21 00 00 – BASIC FIRE PROTECTION REQUIREMENTS

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Basic Fire Protection Requirements specifically applicable to Division 21 sections, in addition to Division 01 - General Requirements.

#### 1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including "Uniform General Conditions and Supplementary General Conditions For The State Of Texas Building Construction Contracts" and Division 01 Specification Sections, apply to the work of this Section.
  - 1. Where the term "Owner's Designated Representative" is used, it shall mean a member of the project's capital team as defined by UTMB.
- B. Basic and supplemental requirements common to Fire Protection.
- C. THE UNIFORM GENERAL CONDITIONS, SUPPLEMENTARY GENERAL CONDITIONS, and Division 01 of the specifications apply to the work specified in this section.
- D. All work covered by this section of these specifications shall be accomplished in accordance with all applicable provisions of the Contract Documents and any addenda or directives which may be issued herewith, or otherwise.

#### 1.3 GENERAL

- A. The Contractor shall design, size, provide and install all piping, valves and controls or any other incidentals required to insure that the proposed construction complies with NFPA 13.
- B. The Contractor shall execute all work herein after specified or indicated on accompanying drawings. Contractor shall provide all equipment necessary and usually furnished in connection with such work and systems whether or not mentioned specifically herein or on the drawings
- C. The Contractor shall be responsible for fitting his material and apparatus into the building and shall carefully lay out his work at the site to conform to the structural conditions, to avoid all obstructions, to conform to the details of the installation and thereby to provide an integrated satisfactory operating installation

- D. The Contractor shall prepare drawings diagrammatic in nature, shall show every connection in detail or every pipe in its exact location. These details are subject to the requirements of standards referenced elsewhere in these specifications, and structural and architectural conditions. The Contractor shall carefully investigate structural and finish conditions and shall coordinate the separate trades in order to avoid interference between the various phases of work. Work shall be organized and laid out so that it will be concealed in furred chases, above suspended ceilings, etc., in finished portions of the building, unless specifically noted to be exposed. Or where no ceilings exist. All exposed work shall be installed parallel or perpendicular to the lines of the building unless otherwise noted. All work shall be NFPA compliant and compliant with Insurance Underwriter requirements and guidelines.
- E. When the Fire Protection drawings do not give exact details as to the elevation of pipe the Contractor shall physically arrange the systems to fit in the space available at the elevations intended with proper grades for the functioning of the system involved. Piping is generally intended to be installed true and square to the building construction, The Contractor's drawings shall show all required offsets, control lines, pilot lines and other location details. Work shall be concealed in all finished areas, unless there is no ceiling.

#### 1.4 DEFINITIONS

- A. These definitions are included to clarify the direction and intention of these Specifications. The list given here is not by any means complete. For further clarification as required, contractor shall contact the designated Owner's representative.
1. Concealed / Exposed: Concealed areas are those that cannot be seen by the building occupants. Exposed areas are all areas that are exposed to view by the building occupants, including under counters, inside cabinets and closets, plus all mechanical rooms.
  2. General Requirements: The provisions of requirements of other Division 01 sections apply to entire work of contract and, where so indicated, to other elements that are included in project. Basic contract definitions are included in the General Conditions.
  3. Indicated: The term "indicated" is a cross reference to graphic representations, notes or schedules on drawings, to other paragraphs or schedules in the specifications, and to similar means of recording requirements on contract documents. Where terms such as "shown," "noted," "scheduled," and "specified" are used in lieu of "indicated," it is for the purpose of helping reader locate the cross reference, and no limitation of location is intended except as specifically noted.
  4. Directed, requested, etc.: Where not otherwise explained, terms such as "directed," "requested," "authorized," "selected," "approved," "required," "accepted," and "permitted" mean "directed by Architect/Engineer," "requested by Architect/Engineer" and similar phrases. However, no such implied meaning will be interpreted to extend Architect's/Engineer's responsibility into Contractor's area of construction supervision and job safety.
  5. Approve: Where used in conjunction with Architect's/Engineer's response to submittals, requests, applications, inquiries, reports and claims by Contractor, the meaning of term "approved" will be held to limitations to Architect's/Engineer's responsibilities and duties as specified in General and Supplementary Conditions. In no case will "approval" by Architect/Engineer be interpreted as a release of Contractor from responsibilities to fulfill requirements of contract documents or to extend Architect's/Engineer's responsibility into Contractor's area of construction supervision and job safety.

6. As required: Where "as required" is used in these specifications or on the drawings, it shall mean "that situations exist that are not necessarily described in detail or indicated that may cause the contractor certain complications in performing the work described or indicated. These complications entail the normal coordination activities expected of the Contractor where multiple trades are involved and new or existing construction causes deviations to otherwise simplistic approaches to the work to be performed. The term shall not be interpreted to permit an option on the part of the Contractor to achieve the end result."
7. Furnish: The term "furnish" is used to mean "supply and deliver to project site, ready for unloading, unpacking, assemble, installation, and similar operations. Where "furnish" applies to work for which the installation is not otherwise specified, "furnish" in such case shall mean "furnish and install."
8. Install: The term "install" is used to describe operations at Project Site including the actual "unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.
9. Provide: The term "provide" means "to furnish and install, complete and ready for the intended use.

#### 1.5 PERMITS, UTILITY CONNECTIONS AND INSPECTIONS

- A. General: Refer to Division 01 for construction phasing and time increments.
- B. Fees and Costs: If, during the course of the construction, a need arises to buy utilities, the Contractor shall pay all fees attendant thereto. If city or privately owned utility piping or electrical cable needs to be extended, relocated, or terminated, the Contractor will pay all permits and construction/inspection fees associated with that particular work.
- C. All work performed on this project is under the authority of the State of Texas, therefore no local construction fees or construction permits will be required except as may be required for new service taps, or new or modified connections to city controlled services. If inspections by city personnel are specifically required by this document, then the Contractor is responsible for any fees or permits in connection to those requirements.
- D. Compliance: The Contractor shall comply in every respect with all requirements of National Fire Protection Association, local Fire Department regulations and utility company requirements. In no case does this relieve the Contractor of the responsibility of complying with these specifications and drawings where specified conditions are of higher quality than the requirements of the above-specified authorities. Where requirements of the specifications and drawings are more lenient than the requirements of the above authorities having jurisdiction, the Contractor shall make installations in compliance with the requirements of the above authorities with no extra compensation.

#### 1.6 CONTRACT DRAWINGS

- A. All dimensional information related to new structures shall be taken from the appropriate drawings. All dimensional information related to existing facilities shall be taken from actual measurements made by the Contractor on the site.

- B. The interrelation of the specifications, the drawings, and the schedules are as follows: The specifications determine the nature and setting of the several materials, the drawings establish the quantities, dimensions and details, and the schedules give the performance characteristics. If the Contractor requires additional clarification, he shall request it in writing, following the contractually prescribed information flow requirements.
- C. Should the drawings or specifications conflict within themselves, or with each other, the better quality, or greater size or quantity of work or materials shall be performed or furnished.
- D. Coordinate related work and modify surrounding work as required.

#### 1.7 SUBMITTALS

- A. Refer to Division 1, UGC, and supplemental UGCs for specification requirements pertaining to timeliness of submission and review, quantity, and format. Each specification section describes the content of the submittals and any submittals which must be approved prior to submission of others.
- B. Proposed Products List: Include Products specified in the following sections:
  - 1. Section 22 05 29 – Plumbing Supports and Sleeves
  - 2. Section 21 05 53 – Fire Protection Piping and Equipment Identification
  - 3. Section 21 13 13 – Fire Protection Systems
- C. Submit shop drawings and product data grouped to include complete submittals of related systems, products, accessories and hydraulic calculations in a single submittal.
- D. Mark dimensions and values in units to match those specified.
- E. Submit fabrication drawings whenever (1) equipment proposed varies in physical size and arrangement from that indicated on the drawings, thus causing rearrangement of equipment space, (2) where tight spaces require extreme coordination between ductwork, piping, conduit, and other equipment, (3) where called for elsewhere in these specifications; and (4) where specifically requested by the Architect/Engineer. Fabrication drawings shall be made at no additional charge to the Owner or the Architect/Engineer.

#### 1.8 SUBSTITUTION OF MATERIALS AND EQUIPMENT

- A. Refer to General Conditions for substitution of materials and equipment.

- B. General: Within thirty days after the date of contract award or work order, whichever is later, and before purchasing or starting installation of materials or equipment, the Contractor shall submit for review, a complete list of suppliers, contractors and manufacturers for all materials and equipment that will be submitted for incorporation into the project. The list shall be arranged in accordance with the organization of the specifications. This initial list shall include the manufacturer's name and type or catalog number as required to identify the quality of material or equipment proposed. This list will be reviewed by the Engineer and the Owner and will be returned to the Contractor with comments as to which items are acceptable without further submittal data and which items will require detailed submittal data for further review and subsequent approval. The initial list shall be submitted as herein specified. Materials and equipment requiring detailed submittal data shall be submitted with sufficient data to indicate that all requirements of these specifications have been met and samples shall be furnished when requested. All manufacturers' data used as part of the submittal shall have all inapplicable features crossed out or deleted in a manner that will clearly indicate exactly what is to be furnished.
- C. It is not the intent of the drawings and/or specifications to limit products to any particular manufacturer nor to discriminate against an "APPROVED EQUAL" product as produced by another manufacturer. Some proprietary products are mentioned to set a definite standard for acceptance and to serve as a reference in comparison with other products. When a manufacturer's name appears in these specifications, it is not to be construed that the manufacturer is unconditionally acceptable as a provider of equipment for this project. The successful manufacturer or supplier shall meet all of the provisions of the appropriate specification(s).
- D. The specified products have been used in preparing the drawings and specifications and thus establish minimum qualities with which substitutes must at least equal to be considered acceptable. The burden of proof of equality rests with the Contractor. The decision of the designer is final.
- E. When requested by the Architect/Engineer, the Contractor shall provide a sample of the proposed substitute item. In some cases, samples of both the specified item and the proposed item shall be provided for comparison purposes.
- F. Timeliness: The burden of timeliness in the complete cycle of submittal data, shop drawings, and sample processing is on the Contractor. The Contractor shall allow a minimum of six (6) weeks time frame for review of each submission by the office of the design discipline involved after receipt of such submissions by that design discipline. The Contractor is responsible for allowing sufficient time in the construction schedule to cover the aforementioned cycles of data processing, including time for all resubmittal cycles on unacceptable materials, equipment, etc. covered by the data submitted. Construction delays and/or lack of timeliness in the above regard are the responsibility of the Contractor and will not be considered in any request for scheduled construction time extensions and/or additional costs to the Owner.
- G. All equipment installed on this project shall have local representation, local factory authorized service, and a local stock of repair parts.

- H. Acceptance of materials and equipment will be based on manufacturer's published data and will be tentative subject to the submission of complete shop drawings indicating compliance with the contract documents and that adequate and acceptable clearances for entry, servicing, and maintenance will exist. Acceptance of materials and equipment under this provision shall not be construed as authorizing any deviations from the specifications, unless the attention of the Architect/Engineer has been directed in writing to the specific deviations. Data submitted shall not contain unrelated information unless all pertinent information is properly identified.
- I. Certification: The Contractor shall carefully examine all data forwarded for approval and shall sign a certificate to the effect that the data has been carefully checked and found to be correct with respect to dimensions and available space and that the equipment complies with all requirements of the specifications.
- J. Physical Size of Equipment: Space is critical; therefore, equipment of larger sizes than shown, even though of specified manufacturer, will not be acceptable unless it can be demonstrated that ample space exists for proper installation, operation, and maintenance.
- K. Materials and Equipment Lists: Eight (8) copies of the list of materials and equipment, the name of manufacturer, trade name, type, and catalog number shall be submitted to the Architect/Engineer. The lists shall be accompanied by eight (8) sets of pictorial and descriptive data derived from the manufacturers' catalogs, sales literature, or incorporated in the shop drawings.
- L. Should a substitution be accepted, and should the substitute material prove defective, or otherwise unsatisfactory for the service intended within the guarantee period, this material or equipment shall be replaced with the material or equipment specified at Contractor's expense.

#### 1.9 MATERIALS AND WORKMANSHIP

- A. All materials, unless otherwise specified, shall be new, free from all defects, suitable for the intended use, and of the best quality of their respective kinds. Materials and equipment shall be installed in accordance with the manufacturer's recommendations and the best standard practice for the type of work involved. All work shall be executed by mechanics skilled in their respective trades, and the installations shall provide a neat, precise appearance. Materials and/or equipment damaged in shipment or otherwise damaged prior to installation shall not be repaired at the job site but shall be replaced with new materials and/or equipment.
- B. The responsibility for the furnishing of the proper equipment and/or material and seeing that it is installed as intended by the manufacturer, rests entirely upon the Contractor who shall request advice and supervisory assistance from the representative of specific manufacturers during the installation.



1.10 FLAME SPREAD PROPERTIES OF MATERIALS

- A. Materials and adhesives incorporated in this project shall conform to NFPA Standard 255, "Method of Test of Surface Burning Characteristics of Building Materials" and NFPA 90. The classification shall not exceed a flame spread rating of 25 for all materials, adhesives, finishes, etc., specified for each system, and shall not exceed a smoke developed rating of 50.

1.11 REGULATORY REQUIREMENTS

- A. The "Authority Having Jurisdiction" over the project described by these documents is the Owner, as an Agency of the State of Texas. As such, it is required that the installation shall meet the minimum standards prescribed in the latest editions of the following listed codes and standards, which are made a part of these specifications. All referenced codes and standards shall be those current at the date of issue of the design documents.
- B. National Fire Protection Association Standards (NFPA)
  - 1. NFPA No. 1, Fire Code
  - 2. NFPA No. 13, Sprinkler System, Installation
  - 3. NFPA No. 45, Fire Protection for Laboratories Using Chemicals
  - 4. NFPA No. 70, National Electrical Code
  - 5. NFPA No. 72D, Proprietary Signaling Systems
  - 6. NFPA No. 101, Life Safety Code
- C. American National Standards Institute (ANSI)
- D. American Society of Testing Materials (ASTM): All current editions of applicable manuals and standards
- E. American Water Works Association (AWWA): All current editions of applicable manuals and standards.
- F. National Electrical Manufacturers' Association (NEMA): All current editions of applicable manuals and standards.
- G. City of Port Arthur Texas, Fire Department as may be applicable to construction on this site.
- H. Texas Occupational Safety Act: All applicable safety standards.
- I. Occupational Safety and Health Act (OSHA).
- J. ADA and ANSI Standards: All work shall be in accord with all regulations and requirements of the Standards and Specifications for Handicapped and Disabled for the Construction of Public Buildings and Facilities in the State of Texas Usable by Physically Handicapped and Disabled persons, ANSI Standards and the requirements of the American Disabilities Act.
- K. Refer to specification sections hereinafter bound for additional Codes and Standards.

- L. All materials and workmanship shall comply with all applicable state and national codes, specifications, and industry standards. In all cases where Underwriters Laboratories, Inc. has established standards for a particular type material, such material shall comply with these standards. Evidence of compliance shall be the UL "label" or "listing" under Re-Examination Service.
- M. The Contract Documents are intended to comply with the aforementioned rules and regulations; however, some discrepancies may occur. Where such discrepancies occur, the Contractor shall immediately notify the Architect/Engineer in writing of said discrepancies and apply for an interpretation. Should the discovery and notification occur after the execution of a contract, any additional work required for compliance with said regulations shall be paid for as covered by Division 01 of these Contract Documents, providing no work of fabrication of materials has been accomplished in a manner of noncompliance. Should the Contractor fabricate and/or install materials and/or workmanship in such a manner that does not comply with the applicable codes, rules and regulations, the Contractor who performed such work shall bear all costs arising in correcting these deficiencies to comply with said rules and regulations

#### 1.12 GENERAL MATERIAL AND EQUIPMENT REQUIREMENTS

- A. Storage at Site: The Contractor shall not receive material or equipment at the job site until there is suitable space provided to properly protect equipment from rust, drip, humidity, and dust damage.
- B. Capacities shall be not less than those indicated but shall be such that no component or system becomes inoperative or is damaged because of startup or other overload conditions.
- C. Conformance with Agency Requirements: Where materials or equipment are specified to be approved, listed, tested, or labeled by the Underwriters Laboratories, Inc., or constructed and/or tested in accordance with the standards of the American Society of Mechanical Engineers or the Air Moving and Conditioning Association, the Contractor shall submit proof that the items furnished under this section of the specifications conform to such requirements. The label of the Underwriters Laboratories, Inc., applied to the item will be acceptable as sufficient evidence that the items conform to such requirements. The ASME stamp or the AMCA label will be acceptable as sufficient evidence that the items conform to the respective requirements.
- D. Nameplates: Each major component of equipment shall have the manufacturer's name, address, and catalog number on a plate securely attached to the item of equipment. All data on nameplates shall be legible at the time of Final Inspection.

- E. Prevention of Rust: Standard factory finish will be acceptable on equipment specified by model number; otherwise, surfaces of ferrous metal shall be given a rust inhibiting coating. The treatment shall withstand 200 hours in salt spray fog test, in accordance with Method 6061 of Federal Standard No. 141. Immediately after completion of the test, the specimen shall show no signs of wrinkling or cracking and no signs of rust creepage beyond 1/8" on either side of the scratch mark. Where rust inhibitor coating is specified hereinafter, any treatment that will pass the above test is acceptable unless a specific coating is specified except that coal tar or asphalt type coating will not be acceptable unless so stated for a specific item. Where steel is specified to be hot dip galvanized, mill galvanized sheet steel may be used provided all raw edges are painted with a zinc-pigmented paint conforming to Military Specification MIL-P-26915.
- F. Protection from Moving Parts: Belts, pulleys, chains, gears, couplings, projecting set screws, keys, and other rotating parts shall be fully enclosed or properly guarded for personnel protection.
- G. Verification of Dimensions: The Contractor shall be responsible for the coordination and proper relation of his work to the building structure and to the work of all trades. The Contractor shall visit the premises and become thoroughly familiar with all details of the work and working conditions, to verify all dimensions in the field, and to advise the Architect/Engineer of any discrepancy before performing any work. Adjustments to the work required in order to facilitate a coordinated installation shall be made at no additional cost to the Owner or the Architect/Engineer.

#### 1.13 PROJECT/SITE CONDITIONS

- A. Install Work in locations shown on drawings, unless prevented by Project conditions.
- B. Prepare drawings showing proposed rearrangement of Work to meet Project conditions, including changes to Work specified in other sections. Obtain permission of [Owner] [Architect/Engineer] before proceeding.

#### 1.14 MANUFACTURER'S RECOMMENDATIONS

- A. The manufacturer's published directions shall be followed in the delivery, storage, protection, installation, piping, and wiring of all equipment and material. The Contractor shall promptly notify the Architect/Engineer, in writing, of any conflict between the requirements of the Contract Documents and the manufacturer's directions, and shall obtain the Architect/Engineer's instructions before proceeding with the work. Should the Contractor perform any such work that does not comply with the manufacturer's directions or such instructions from the Architect/Engineer, he shall bear all costs arising in connection with the deficiencies.

#### 1.15 SPACE AND EQUIPMENT ARRANGEMENT

- A. The size of Fire Protection equipment indicated on the drawings is based on the dimensions of a particular manufacturer. While other manufacturers may be acceptable, it is the responsibility of the Contractor to determine if the equipment he proposes to furnish will fit in the space. Fabrication drawings shall be prepared when required by the Architect/Engineer or Owner to indicate a suitable arrangement.

- B. All equipment shall be installed in a manner to permit access to all surfaces. All valves, motors, drives, filters, and other accessory items shall be installed in a position to allow removal for service without disassembly of another part.

#### 1.16 LARGE APPARATUS

- A. Any large piece of apparatus that is to be installed in any space in the building, and that is too large to permit access through stairways, doorways, or shafts shall be brought to the job and placed in the space before the enclosing structure is completed. Following placement in the space, such apparatus shall be thoroughly, completely protected from damage as hereinafter specified.

#### 1.17 PROTECTION

- A. The Contractor shall at all times take such precautions as may be necessary to properly protect all materials and equipment from damage from the time of delivery until the completion of the work. This shall include the erection of all required temporary shelters and supports to adequately protect any items stored in the open on the site from the weather, the ground and surrounding work; the cribbing of any items above the floor of the construction; and the covering of items in the incomplete building with tarpaulins or other protective covering; the installation of electric heaters in electrical switchgear and similar equipment to prevent moisture damage. Failure on the part of the Contractor to comply with the above will be sufficient cause for the rejection of the items in question.
- B. Take particular care not to damage the building structure in performing work. All finished floors, step treads, and finished surfaces shall be covered to prevent any damage by workers or their tools and equipment during the construction of the building.
- C. Equipment and materials shall be protected from rust both before and after installation. Any equipment or materials found in a rusty condition at the time of final inspection must be cleaned of rust and repainted as specified elsewhere in these specifications.

#### 1.18 COOPERATION BETWEEN TRADES AND WITH OTHER CONTRACTORS

- A. Each trade, subcontractor, and/or Contractor must work in harmony with the various other trades, subcontractors and/or Contractors on the job as may be required to facilitate the progress to the best advantage of the job as a whole. Each trade, subcontractor, and/or Contractor must pursue its work promptly and carefully so as not to delay the general progress of the job. This Contractor shall work in harmony with Contractors working under other contracts on the premises.

#### 1.19 SUPERVISION

- A. Each Contractor and subcontractor shall keep a competent superintendent or foreman on the job at all times. (Refer to the Uniform General Conditions for additional information concerning supervision.)

- B. It shall be the responsibility of each superintendent to study all drawings and familiarize himself with the work to be done by other trades. He shall coordinate his work with other trades and before material is fabricated or installed, make sure that his work will not cause an interference with another trade. Where interferences are encountered, they shall be resolved at the job site by the superintendents involved. Where interferences cannot be resolved without major changes to the drawings, the matter shall be referred to the A/E for ruling.

#### 1.20 SITE OBSERVATION

- A. Site observation by the Architect/Engineer is for the express purpose of verifying compliance by the Contractor with the Contract Documents, and shall not be construed as construction supervision nor indication of approval of the manner or location in which the work is being performed as being a safe practice or place.

#### 1.21 PRECEDENCE OF MATERIALS

- A. The specifications determine the nature and setting of materials and equipment. The drawings establish quantities, dimensions and details.
- B. The installation precedence of materials shall be as follows. Note that if an interference is encountered, this shall guide the contractor in the determination of which trade shall be given the "Right-of-Way."

Building lines

Structural Members

Soil and Drain Piping

Condensate Drains

Vent Piping

Supply, Return, and Outside Air Ductwork

Exhaust Ductwork

HVAC Water Piping

Fire Protection Piping

Natural Gas Piping

Domestic Water (Cold and Hot)

Refrigerant Piping

Electrical Conduit

## 1.22 INSTALLATION METHODS

- A. Where to Conceal: All pipes shall be concealed in pipe chases, walls, furred spaces, or above the ceilings of the building unless otherwise indicated.
- B. Where to Expose: In mechanical rooms, janitor's closets tight against pan soffits in exposed "Tee" structures, or storage spaces, but only where necessary, piping may be run exposed. All exposed piping shall be run in the most aesthetic, inconspicuous manner, and parallel or perpendicular to the building lines.
- C. Support: All piping shall be adequately and properly supported from the building structure by means of hanger rods or clamps to walls as herein specified.
- D. Maintaining Clearance: Where limited space is available above the ceilings below concrete beams or other deep projections, pipe shall be sleeved through the projection where it crosses, rather than hung below them in a manner to provide maximum above floor clearance. Sleeves shall be as herein specified. Approval shall be obtained from the Architect/Engineer for each penetration.
- E. All pipe shall be cut accurately to measurements established at the building and shall be worked into place without springing or forcing. All pipes run exposed in machinery and equipment rooms shall be installed parallel to the building lines, except that piping shall be sloped to obtain the proper pitch. Piping run in furred ceilings, etc., shall be similarly installed, except as otherwise shown. All pipe openings shall be kept closed until the systems are closed with final connections.
  - 1. All piping not directly buried in the ground shall be considered as "interior piping."
  - 2. Prior to the installation of any ceiling material, gypsum, plaster, or acoustical board, the Contractor shall notify the construction inspector so that arrangement can be made for an inspection of the above ceiling area about to be "sealed" off. The Contractor shall give as much advance notice as possible no less than 10 working days.
  - 3. All above ceiling areas will be subject to a formal inspection before ceiling panels are installed, or installation is otherwise concealed from view. All mechanical and electrical work at and above the ceiling, including items supported by the ceiling grid, such as air inlets or outlets and lighting fixtures, shall be complete and installed in accordance with contract requirements, including power to lighting fixtures, fans, and other powered items. Adequate lighting shall be provided to permit thorough inspection of all above ceiling items. The inspection will include representatives of the following: General Contractor and each Subcontractor having work above the ceiling, Architect/Engineer, Physical Plant, Resident Construction Manager's Construction Inspector(s), the Resident Construction Manager, and Facilities Planning and Construction (FPC). Areas to be included time of inspection shall be coordinated with the Construction Inspector.
  - 4. The purpose of this inspection is to verify the completeness and quality of the installation of the air conditioning systems, the electrical systems, the plumbing systems, and any other special above ceiling systems such as pneumatic tube, vacuum systems, fire sprinkler piping and cable tray systems. The ceiling supports (tee bar or lath) shall be in place so that access panel and light fixture locations are identifiable and so that clearances and access provisions may be evaluated.
  - 5. No ceiling materials may be installed until the resulting deficiency list from this inspection is worked off and the Construction Inspector has given approval.

### 1.23 RECORDS FOR OWNER

#### A. Preparation:

1. Maintain at the job site a separate set of white prints of the contract drawings for the sole purpose of recording the "as-built" changes and diagrams of those portions of work in which actual construction is significantly at variance with the contract drawings.
2. Mark the drawings with a colored pencil.
3. Prepare, as the work progresses and upon completion of work, drawings clearly indicating locations of various lines, valves, ductwork, traps, equipment, and other pertinent items, as installed
4. Record underground and underslab piping installed, dimensioning exact location and elevation of such piping.
5. Coordinate requirements for Project Record Documents with Division 01.

#### B. Deliver: At conclusion of project, obtain without cost to Owner, reproducibles of original mechanical drawings and transfer as-built changes to these. Delivery of as-built prints and reproducibles is a condition of final acceptance.

#### C. In addition to the above, the Contractor shall accumulate during the progress of the job the following data, in duplicate, prepared in a neat brochure or packet folder and turn over to the Architect/Engineer for review, and subsequent delivery to the Owner.

1. All warranties and guarantees and manufacturers' directions on equipment and material covered by the Contract.
2. Valve tag charts and diagrams specified herein.
3. Copies of approved shop drawings.
4. Any and all other data and/or drawings required as submittals during construction.
5. Repair parts list of all major items and equipment including name, address and telephone number of local supplier or agent.

#### D. All of the above data shall be submitted to the Architect/Engineer for approval, and shall be corrected as instructed by the Architect/Engineer prior to submission of the final request for payment.

### 1.24 CUTTING AND PATCHING

#### A. General: Cut and patch walls, floors, etc., resulting from work in existing construction or by failure to provide proper openings or recesses in new construction.

#### B. Methods of cutting: Openings cut through concrete and masonry shall be made with masonry saws and/or core drills and at such locations acceptable to the Architect/Engineer. Impact type equipment shall not be used except where specifically acceptable to the Architect/Engineer. Openings in precast concrete slabs for pipes shall be core drilled to exact size.

#### C. Restoration: All openings shall be restored to "as new" condition under the appropriate specification section for the materials involved, and shall match remaining surrounding materials and/or finishes.

- D. Masonry: Where openings are cut through masonry walls, provide and install lintels or other structural supports to protect the remaining masonry. Adequate supports shall be provided during the cutting operation to prevent any damage to the masonry occasioned by the operation. All structural members, supports, etc., shall be of the proper size and shape, and shall be installed in a manner acceptable to the Architect/Engineer.
- E. Plaster: All mechanical work in areas containing plaster shall be completed prior to the application of the finish plaster coat. Cutting of finish plaster coat will not be permitted.
- F. Special Note: No cutting, boring, or excavating that will weaken the structure shall be undertaken.

#### 1.25 ROOF PENETRATIONS AND FLASHING

- A. Pipe, sleeves, pitch pockets, and flashings compatible with the roofing installation shall be provided and installed by a qualified contractor for all roof penetrations. This shall be the responsibility of the General Contractor.

#### 1.26 EXCAVATION, TRENCHING AND BACKFILL

- A. Excavation (See Divisions 00 and 01 for special requirements related to excavation and trenching.):
  1. The subcontractors shall perform all excavations of every description, for their particular installations and of whatever substances encountered, to the depths indicated on the drawings and/or required for the installation of piping. All exterior lines shall be installed with a minimum cover of 24," unless otherwise indicated. Generally, more cover shall be provided if grade will permit. All excavation materials not required for backfill or fill shall be removed and wasted as acceptable to the Construction Inspector. All excavations shall be made only by open cut. The banks of trenches shall be kept as nearly vertical as possible and where required, shall be properly sheeted and braced. Trenches shall be not less than 12" wider nor more than 16" wider than the outside edges of the pipe to be laid therein, and shall be excavated true to line so that a clear space not less than 6" nor more than 8" in width is provided on each side of the pipe. For sewers, the maximum width of trench specified applies to the width at and below the level of the pipe, and may be made as wide as necessary for sheeting and bracing and proper installation of the work.
  2. The bottom of trenches shall be accurately graded to provide proper fall and uniform bearing and support for each section of the pipe on undisturbed soil or 2" of sand fill at every point along its entire length, except for portions of the pipe sections where it is necessary to excavate for bell holes and for the proper sealing of pipe joints. Bell holes shall be dug after the trench bottom has been graded. Where inverts are not shown, grading shall be determined by the National Plumbing Code for the service intended and the size used. Bell holes for lead pipe joints shall be 12" in depth below the trench bottom and shall extend from a point 6" back of the face of the bell. Such bell holes shall be of sufficient width to provide ample room for caulking. Bell holes for sewer tile and water pipe shall be excavated only to an extent sufficient to permit accurate work in the making of the joints and to insure that the pipe, for a maximum of its length, will rest upon the prepared bottom of the trench. Depressions for joints other than bell-and-spigot shall be made in accordance with the recommendations of the joint manufacturer for the particular type of joint used. Special pipe beds shall be provided as specified hereinafter.



3. The lower 4" of the pipe trenches measuring from an overhead line set parallel to the grade line of the sewer shall be excavated only a few feet in advance to the pipe laying, by workers especially skilled in this type of work. Where damage is likely to result from withdrawing sheeting, the sheeting shall be left in place. Except at locations where excavation of rock from the bottom of trenches is required, care shall be taken not to excavate below the depths required. Where rock excavation is required, the rock shall be excavated to a minimum over depth of 6" below the trench depths specified. The over depth rock excavation and all excess trench excavation shall be backfilled with sand. Whenever wet or otherwise unstable soil is incapable of properly supporting the pipe is encountered in the trench bottom, such soil shall be removed to a depth and for the trench lengths required, and then backfilled to trench bottom grade, as hereinafter specified, with sand.
4. All grading in the vicinity of excavation shall be controlled to prevent surface ground water from flowing into the excavations. Any water accumulated in the excavations shall be removed by pumping or other acceptable method. During excavation, material suitable for backfilling shall be stacked in an orderly manner a sufficient distance back from edges of trenches to avoid overloading and prevent slides or cave-ins. Material unsuitable for backfilling shall be wasted and removed from the job site as directed by the Construction Inspector.
5. All shoring and sheeting required to perform and protect the excavations and to safeguard employees and/or adjacent structures shall be provided.
6. Excavate as required under the building in order that all piping, etc., shall clear the ground a minimum of 12" for a distance of 24" on either side. Edges of such excavations shall slope at an angle of not over 45 degrees with the horizontal unless otherwise approved by the Construction Inspector. The bottom of such excavation shall be graded to drain in a manner acceptable to the Construction Inspector.
7. All surplus materials removed in these trenching operations becomes the property of the contractor, and shall be disposed of at the expense of the contractor, at a legal disposal site, off of the campus.

#### B. Backfilling

1. Trenches shall not be backfilled until all required tests are performed and until the piping, utilities systems, etc., as installed are certified by the Owner's inspector to conform to the requirements specified hereinafter. The trenches shall be carefully backfilled with sand to a depth of 12 inches above the top of the pipe. The next layer and subsequent layers of backfill may be excavated materials approved for backfilling, consisting of earth, loam, sandy clay, sand and gravel, soft shale, or other approved materials free from large clods of earth or stones larger than 1 1/2" in diameter, flooded until the pipe has cover of not less than one foot. The remainder of the backfill material shall then be thrown into the trenches, moistened, and tamped or flooded in one-foot layers. Blasted rock, broken concrete or pavement, and large boulders shall not be used as backfill material. Any trenches improperly backfilled, or where settlement occurs, shall be reopened to the depth required for proper compaction, then refilled and mounded over, and smoothed off.
2. Backfill under concrete slabs-on-fill shall be as specified above, shall be gravel, or shall be other such materials more suitable for the application. Installation and compaction shall be as required for compatibility with adjacent materials.

- C. Opening and Re-closing Pavement and Lawns: Where excavation requires the opening of existing walks, streets, drives, other existing pavement, or lawns, such surfaces shall be cut as required to install new lines and to make new connections to existing lines. The sizes of the cut shall be held to a minimum, consistent with the work to be accomplished. After the installation of the new work is completed and the excavation has been backfilled and flooded, the area shall be patched, using materials to match those cut out. The patches shall thoroughly bond with the original surfaces and shall be level with them, and shall meet all the requirements established by the authorities having jurisdiction over such areas.
- D. Excavation in Vicinity of Trees: All trees including low hanging limbs within the immediate area of construction shall be adequately protected to a height of at least 5 ft. to prevent damage from the construction operations and/or equipment. All excavation within the outermost limb radius of all trees shall be accomplished with extreme care. All roots located within this outermost limb radius shall be brought to the attention of the Construction Inspector before they are cut or damaged in any way. The Construction Inspector will give immediate instructions for the disposition of it. All stumps and roots encountered in the excavation, which are not within the outermost limb radius of existing trees, shall be cut back to a distance of not less than 18" from the outside of any concrete structure or pipeline. No chips, parts of stumps, or loose rock shall be left in the excavation. Where stumps and roots have been cut out of the excavation, clean compacted dry bank sand shall be backfilled and tamped.

#### 1.27 OPERATION PRIOR TO COMPLETION

- A. When any piece of Fire Protection equipment is operable and it is to the advantage of the Contractor to operate the equipment, he may do so, providing that he properly supervises the operation, and has the Construction Inspector's written permission to do so. The warranty period shall, however, not commence until the equipment is operated for the beneficial use of the Owner, or date of substantial completion, whichever occurs first.
- B. Regardless of whether or not the equipment has or has not been operated, the Contractor shall properly clean the equipment, install clean filter media, properly adjust, and complete all deficiency list items before final acceptance by the Owner. The date of acceptance and performance certification will be the same date.

#### 1.28 EXISTING FACILITIES

- A. The Contractor shall be responsible for loss or damage to the existing facilities caused by him and his workers, and shall be responsible for repairing or replacing such loss or damage. The Contractor shall send proper notices, make necessary arrangements, and perform other services required for the care, protection and in service maintenance of all plumbing, heating, air conditioning, and ventilating services for the new and existing facilities. The Contractor shall erect temporary barricades, with necessary safety devices, as required to protect personnel from injury, removing all such temporary protection upon completion of the work.
- B. The Contractor shall provide temporary or new services to all existing facilities as required to maintain their proper operation when normal services are disrupted as a result of the work being accomplished under this project.

- C. Where existing construction is removed to provide working and extension access to existing utilities, Contractor shall remove doors, piping, conduit, outlet boxes, wiring, light fixtures, air conditioning ductwork and equipment, etc., to provide this access and shall reinstall them upon completion of work in the areas affected.
- D. Where partitions, walls, floors, or ceilings of existing construction are indicated to be removed, all Contractors shall remove and reinstall in locations approved by the Architect/Engineer all devices required for the operation of the various systems installed in the existing construction.
- E. Outages of services as required by the new installation will be permitted but only at a time approved by the Owner. The Contractor shall allow the Owner two weeks in order to schedule required outages. The time allowed for outages will not be during normal working hours unless otherwise approved by the Owner. All costs of outages, including overtime charges, shall be included in the contract amount.

#### 1.29 CHECKING AND TESTING MATERIALS AND/OR EQUIPMENT

- A. Before the work is accepted, an authorized representative of the manufacturer of the installed materials and/or equipment shall personally inspect the installation and operation of his materials and/or equipment to determine that it is properly installed and in proper operating order. The qualifications of the representative shall be appropriate to the technical requirements of the installation. The qualifications of the representative shall be submitted to the owner for approval. The decision of the owner concerning the appropriateness of the representative shall be final. Testing and checking shall be accomplished during the course of the work where required by work being concealed, and at the completion of the work otherwise. In addition, the Contractor shall submit to the Architect/Engineer a signed statement from each representative certifying as follows: "I certify that the materials and/or equipment listed below have been personally inspected by the undersigned authorized manufacturer's representative and is properly installed and operating in accordance with the manufacturer's recommendations."

#### 1.30 TESTS

- A. The Contractor shall make, at his own expense, any tests deemed necessary by the inspection departments having jurisdiction, and in the National Fire Protection Association, ASTM, etc. Standards listed. The Contractor shall provide all equipment, materials, and labor for making such tests.
- B. Additional tests specified hereinafter under the various specification sections shall be made.
- C. The Construction Inspector shall be notified in writing at least 10 working days prior to each test and other specification requirements requiring action on the part of the Construction Inspector. All equipment shall be placed in operation and tested for proper automatic control requirements before the balancing agency starts their work.
- D. Maintain Log of Tests as hereinafter specified.
- E. See specifications hereinafter for additional tests and requirements.

1.31 LOG OF TESTS

- A. All tests shall have pertinent data logged by the Contractor at the time of testing. Data shall include date, time, personnel, description, and extent of system tested, test conditions, test results, specified results, and other pertinent data. Data shall be delivered to the Architect/Engineer as specified under "Requirements for Final Acceptance." All Test Log entries shall be legibly signed by the Project Contractor or his authorized job superintendent.

1.32 COOPERATION AND CLEANUP

- A. It shall be the responsibility of each trade to cooperate fully with the other trades on the job to help keep the job site in a clean and safe condition. At the end of each day's work, each trade shall properly store all of his tools, equipment and materials and shall clean his debris from the job. Upon the completion of the job, each trade shall immediately remove all of his tools, equipment, any surplus materials and all debris caused by that portion of the work.

1.33 CLEANING AND PAINTING

- A. All equipment, piping and conduit, etc., furnished and installed in exposed areas under Division 21 of these specifications and as hereinafter specified shall be cleaned, prepared, and painted according to the following specification. In the event of a conflict between the specifications referenced, the provisions of this specification shall prevail only for Division 21 work.
- B. All purchased equipment shall be delivered to the job with a suitable factory protective finish with the colors hereinafter specified. The following materials shall not be painted: copper, galvanized metal, stainless steel, fiberglass, PVC, and PVDF.
- C. Before painting, materials and equipment surfaces shall be thoroughly cleaned of cement, plaster, and other foreign materials, and all oil and grease spots shall be removed. Such surfaces shall be carefully wiped and all cracks and corners scraped out. Exposed metalwork shall be carefully brushed down with the steel brushes to remove rust and other spots and left smooth and clean.
- D. Color of finish painting shall be painted in accordance with Lamar State College Standard Color Schedule for machinery spaces using Pratt and Lambert, Inc.'s "Effector" enamel, or approved equal. For painting purposes, the equipment and piping inside of built-up air handling units shall be painted the same as if they were within the walls of a Mechanical Room. Two coats shall be applied with a light tint first coat and deep color for final coat. Colors shall be as follows:

<u>ITEM</u>	<u>COLOR</u>	<u>"P and L" PAINT NUMBER</u>
Equipment Bases	Light Green	YG493M (Winter Pear)
Hanger Rods	Same as "Piping"	
Fire Protection Equipment and Piping	Safety Red	R131R (Vibrant Red)

- E. Jacketing on insulation shall not be painted.

- F. No nameplates on equipment shall be painted, and suitable protection shall be afforded to the plates to prevent their being rendered illegible due to the painting operation.
- G. Scope of painting for Division 21--work in areas other than those defined as "exposed" is as follows:
  - 1. All uncovered steel pipe, supports, exposed pipe and hanger rod threads, and hangers in underfloor spaces shall be cleaned and painted with two coats of Tropical Paint Co. No. 77-black asphaltic emulsion. Galvanized steel and copper lines in these spaces shall not be painted.
  - 2. All canvas finishes including those underfloor and in concealed spaces shall be painted with one sizing coat if not already sized, containing mildew resistant additive and Arabol adhesive prior to any other specified finish paint.
  - 3. All fire protection piping shall be painted whether concealed or exposed, in all areas of the project without exception. Fire protection piping shall be painted safety red. These "safety" colors shall be as defined by OSHA.
  - 4. If insulated, the piping shall be primed, only, prior to insulation, and the insulation jacketing shall be painted as specified for piping. The requirements of this paragraph are "primary" and have priority over any conflicting specification or instruction, should a conflict in the Construction Documents exist.

## PART 2 - PRODUCTS

### 2.1 GENERAL

- A. All materials shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.
- B. All equipment installed shall have local representation, local factory authorized service, and a local stock of repair parts.
- C. Responsibility for furnishing proper equipment and/or material and ensuring that equipment and/or material is installed as intended by the manufacturer, rests entirely upon the Contractor. Contractor shall request advice and supervisory assistance from the representative of specific manufacturers during the installation.
- D. All materials, unless otherwise specified, shall be new, free from all defects, suitable for the intended use and of the best quality of their respective kinds. Materials and equipment shall be installed in accordance with the manufacturer's recommendations and the best standard practice for the type of Work involved. All Work shall be executed by mechanics skilled in their respective trades, and the installations shall provide a neat, precise appearance. Materials and/or equipment damaged in shipment or otherwise damaged prior to installation shall not be repaired at the job Site but shall be replaced with new materials and/or equipment.
- E. Materials and equipment manufactured domestically are preferred when possible. Materials and equipment that are not available from a domestic manufacturer may be by a non-domestic manufacturer provided they fully comply with Contract Documents.
- F. Prevention of Rust: Standard factory finish will be acceptable on equipment specified by model number; otherwise, surfaces of ferrous metal shall be given a rust inhibiting coating.

## 2.2 NAMEPLATES

- A. Each major component of equipment shall have the manufacturer's name, address, and catalog number on a plate securely attached to the item of equipment. All data on nameplates shall be legible at the time of Final Inspection.
- B. Nameplates shall be black laminated rigid phenolic with white core. Nameplate minimum size shall be 1 inch high by 3 inches long with 3/16-inch-high engraved white letters.
- C. Nameplate Fasteners: Fasten nameplates to the front of equipment only by means of stainless steel self-tapping screws. Stick-ons or adhesives will not be allowed unless the NEMA enclosure rating is compromised, then only epoxy adhesive shall be used to attach nameplates.
- D. Nameplate Information: In general, the following information is to be provided for the types of electrical components or enclosures supplied with equipment.
  - 1. Individual Starters, Contactors, Disconnect Switches, and Similar Equipment: Identify the device, and voltage characteristics source and load served.

## 2.3 WALL, FLOOR AND CEILING PLATES (ESCUTCHEONS)

- A. Except as otherwise noted, provide stainless steel or chrome plated brass floor and ceiling plates around all pipes passing exposed through walls, floors or ceilings, in any spaces except underfloor and plenum spaces.
- B. Plates shall be sized to fit snugly against the outside of the pipe or against the insulation on lines that are insulated and positively secured to such pipe or insulation.
- C. For finished ceiling installation, secure escutcheons to ceiling with escutcheon fasteners.
- D. Plates will not be required for piping where pipe sleeves extend 3/4-inch or more above finished floor.

## 2.4 ROOF PENETRATIONS AND FLASHING

- A. Pipe sleeves, pitch pockets and flashings compatible with the roofing installation shall be provided and installed for all roof penetrations by a contractor qualified in such Work. Installation shall comply with the Contract Documents and with FM General Data Sheets 1-28, 1-29, 1-31 & 1-49 along with the FM approval guide.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Cooperate with trades of adjacent, related or affected materials or operations, and with trades performing continuations of this Work in order to effect timely and accurate placing of Work and to coordinate, in proper and correct sequence, the Work of such trades.

- B. The size of equipment indicated on the Drawings is based on the dimensions of a particular manufacturer. While other manufacturers may be acceptable, it is the responsibility of the Contractor to determine that the equipment proposed will fit in the space. Fabrication Drawings shall be prepared when required by the Architect/Engineer or Owner to indicate a suitable arrangement.
- C. All equipment shall be installed in a manner to permit access to all surfaces. All valves, filters, and other accessory items shall be installed in a position to allow removal for service without disassembly of another part.
- D. Space Requirements:
  - 1. Consider space limitations imposed by contiguous Work in location of equipment and material. Do not provide equipment or material which is not suitable in this respect.
  - 2. Make changes in material and equipment locations of up to five (5) feet, to allow for field conditions prior to actual installation, and as directed by the Architect/Engineer at no additional cost to the Owner.
- E. Contractor shall note that the electrical design and Drawings are based on the equipment scheduled and indicated on the Drawings. Should any equipment be provided requiring changes to the electrical design, the required electrical changes shall be made at no cost to the Owner.

### 3.2 INSTALLATION

- A. Installation shall meet or exceed all applicable federal, state and local requirements, referenced standards and conform to codes and ordinances of authorities having jurisdiction.
- B. All installation shall be in accordance with manufacturer's published recommendations.
- C. Piping may be run exposed in rooms typically without ceilings such as mechanical rooms, janitor's closets, tight against pan soffits in exposed "tee" structures, or storage spaces, but only where necessary. Shutoff and isolation valves shall be easily accessible.
- D. All pipe, conduits, etc., shall be cut accurately to measurements established at the building and shall be worked into place without springing or forcing. Piping and ducts run in furred ceilings, etc., shall be similarly installed, except as otherwise shown. All pipe openings shall be kept closed until the systems are closed with final connections.
- E. Prior to the installation of any ceiling material, gypsum, plaster or acoustical board, the Contractor shall notify Owner's Project Manager so that arrangement can be made for an inspection of the above-ceiling area about to be "sealed" off. The Contractor shall provide written notification to the Owner at least five (5) calendar days prior to the inspection.
- F. Precedence of Materials:
  - 1. The Specifications determine the nature and setting of materials and equipment. The Drawings establish quantities, dimensions and details.
  - 2. If interference is encountered, the following installation precedence of materials shall guide the Contractor to determine which trade shall be given the "Right of Way":
    - a. Building lines
    - b. Structural members
    - c. Structural support frames supporting ceiling equipment

- d. Soil and drain piping
  - e. Vent piping
  - f. Supply, return and outside air ductwork
  - g. Exhaust ductwork
  - h. HVAC water piping
  - i. Condensate piping
  - j. Fire protection piping
  - k. Natural gas piping
  - l. Medical/Laboratory gases
  - m. Domestic water (cold and hot, softened, treated)
  - n. Refrigerant piping
  - o. Electrical conduit
3. Coordinate fire protection system with other trade systems as required to maintain system right-of-ways.

### 3.3 TESTING

- A. When any piece of equipment is operable and it is to the advantage of the Contractor to operate the equipment, Contractor may do so, provided that Contractor properly supervises the operation, and has the Owner's written permission to do so. The warranty period shall, however, not commence until such time as the equipment is operated for the beneficial use of the Owner, or date of Substantial Completion, whichever occurs first.
- B. Regardless of whether or not the equipment has or has not been operated, the Contractor shall properly clean the equipment, install clean and properly adjust, and complete all deficiency list items before final acceptance by the Owner. The date of acceptance and performance certification will be the same date.
- C. Before the Work is accepted, an authorized representative of the manufacturer of the installed materials and/or equipment shall personally inspect the installation and operation of manufacturer's materials and/or equipment to determine that materials and/or equipment are properly installed and in proper operating order. The qualifications of the manufacturer's representative shall be appropriate to the technical requirements of the installation. The qualifications of the manufacturer's representative shall be submitted to the Owner for approval. The decision of the Owner concerning the appropriateness of the manufacturer's representative shall be final. Testing and checking shall be accomplished during the course of the Work where required by Work being concealed, and at the completion of the Work. In addition, the Contractor shall submit to the Architect/Engineer a signed statement from each manufacturer's representative certifying as follows: **"I certify that the materials and/or equipment listed below have been personally inspected by the undersigned authorized manufacturer's representative and is properly installed and operating in accordance with the manufacturer's recommendations."**
- D. The Contractor shall execute, at no additional cost to the Owner, any tests required by the Owner or the National Fire Protection Association, ASTM, etc. Standards listed. The Contractor shall provide all equipment, materials and labor for making such tests.
- E. Notify the Owner's Project Manager and the Architect/Engineer in writing at least seven (7) calendar days prior to each test and prior to other Specification requirements requiring Owner and Architect/Engineer to observe and/or approve tests.



- F. All tests shall have pertinent data logged by the Contractor at the time of testing. Data shall include date, time, personnel performing, observing and inspecting, description of the test and extent of system tested, test conditions, test results, specified results and other pertinent data. Data shall be delivered to the Architect/Engineer as specified under "Requirements for Final Acceptance." The Contractor or Contractor's authorized job superintendent shall legibly sign all Test Log entries.
- G. Refer to Commissioning Specification Sections for additional Start-up, prefunctional and operational checkout, and for functional performance test procedures.

#### 3.4 TRAINING

- A. Operating and Maintenance Manuals and instruction shall be provided as specified under the Division 01 Section entitled "Project Closeout Procedures."
- B. Specific training and operating instructions for individual equipment components shall be as specified in the individual Specification Sections.

END OF SECTION 21 00 00

## SECTION 21 05 53 – FIRE PROTECTION PIPING AND EQUIPMENT IDENTIFICATION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including "Uniform General Conditions and Supplementary General Conditions For The State Of Texas Building Construction Contracts" and Division 01 Specification Sections, apply to the work of this Section.
  - 1. Where the term "Owner's Designated Representative" is used, it shall mean a member of the project's capital team.

#### 1.2 THE FOLLOWING SECTIONS ARE TO BE INCLUDED AS IF WRITTEN HEREIN:

- A. Section 21 05 00 – Basic Fire Protection Requirements.
- B. Section 22 05 29 – Plumbing Supports and Sleeves.

#### 1.3 SECTION INCLUDES

- A. Nameplates
- B. Tags
- C. Stencils
- D. Pipe Markers

#### 1.4 RELATED SECTIONS

- A. Section 09 91 00 – Painting: Identification painting.

#### 1.5 REFERENCES

- A. ASME A13.1 – Scheme for the Identification of Piping Systems.

#### 1.6 SUBMITTALS

- A. Submit under provisions of Section 21 05 00.
- B. Submit list of wording, symbols, letter size, and color coding for mechanical identification.
- C. Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.
- D. Product Data: Provide manufacturers catalog literature for each product required.
- E. Samples: Submit two of each type of label, tag, etc., of the approximate size specified of implied in the specification.
- F. Manufacturer's Installation Instructions: Indicate special procedures, and installation.

## 1.7 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Section 21 05 00.
- B. Record actual locations of tagged valves.

## PART 2 - PRODUCTS

### 2.1 GENERAL

- A. All materials shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.

### 2.2 MANUFACTURERS

- A. Equipment Tags, Valve Tags, and Markers:
  - 1. Marking Systems, Inc.
  - 2. Seton Name Plate Company.
  - 3. W.H. Brady Company.
  - 4. Graphic Products, Inc.

### 2.3 EQUIPMENT

- A. Description: 3" x 4" vinyl label, 3.0 Mil self-adhesive vinyl similar to Dura Label Pro. Label color shall be black text on a white background.
- B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Section number and title where equipment is specified.
- C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.
- D. All scheduled equipment shall be identified with an Equipment Tag.

### 2.4 VALVE TAGS

- A. Valve tags shall conform to ANSI A13.1-1981 "Scheme for the Identification of Piping Systems"
- B. Provide valves with 1 1/2 inch diameter stainless steel or brass valve tag with stamped and black-filled numbers. Service designations shall be 1/4 inch letters, and valve numbers shall be 1/2 inch letters. Service designations shall be approved by Architect/Engineer. Secure tags to valves by use of brass "S" hooks and brass chain. Secure chain to valve by use of copper or monel meter seals.

- C. In addition to valve tags, valves at PRV stations, and other valves as specified shall be tagged with standardized color coded plastic tags. Each tag shall be attached to its valve with one tie strap. These tags shall be 2-½ inches wide by 1-½ inches high with these color codings:
1. Red = normally closed.
  2. Green = normally open.
  3. Blue = open in winter, closed in summer.
  4. Yellow = closed in winter, open in summer.

## 2.5 PIPE MARKERS

- A. Pipe Markers shall conform to ANSI A13.1-2007 "Scheme for the Identification of Piping Systems" as indicated below.

<b>Pipe Contents</b>	<b>Label Abbreviation</b>	<b>Label Colors (Background/Text)</b>
Fire Suppression Water	FIRE	Red/White
Wet Sprinklers	WET FIRE	Red/White

- B. Arrow markers must have same ANSI background colors as their companion pipe markers, or be incorporated into the pipe identification marker.
- C. Plastic Pipe Markers: Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.
- D. Plastic Tape Pipe Markers: Heat sealed or heat shrink, spring fasteners, clips or snap-on are acceptable.
- E. Underground Plastic Pipe markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.
- F. Pipe markers and arrow markers also shall be provided for all piping systems.
- G. Use Seton Setmark Type SNA or Brady snap-on type identification for all piping systems, up through 6 inch. For piping systems larger than 6 inches, use Seton or Brady strap-on markers or similar by Marking Services, Inc.

## 2.6 CEILING GRID TAG FOR EQUIPMENT LOCATED ABOVE LAY-IN CEILING

- A. Description: 3/4" x variable length" vinyl label, 3.0 Mil self-adhesive vinyl similar to Dura Label Pro. Label color shall be black text on a white background.
- B. All scheduled equipment above finish lay-in ceiling shall be identified with an Equipment Tag.

- C. All ceiling grid tags shall be installed prior to the ceiling cover inspection.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Installation shall meet or exceed all applicable federal, state and local requirements, referenced standards and conform to codes and ordinances of authorities having jurisdiction.
- B. All installation shall be in accordance with manufacturer's published recommendations.
- C. Install plastic tape, and pipe markers completely around pipe in accordance with manufacturer's instructions.
- D. Locate markers on the two (2) lower quarters of the pipe where view is unobstructed.

#### 3.2 VALVE TAGS

- A. Contractor(s) shall provide and install valve tags on all valves installed within this Project, except check valves. Tags with asset numbers shall be provided for valves.

#### 3.3 APPLICATION OF MARKERS AND STENCILS

- A. Piping runs throughout the Project including those above lift-out ceilings, under floor and those exposed to view when access doors or access panels are opened shall be identified by means of pipe markers and/or stencils. Concealed areas, for purposes of this identification section, are those areas that cannot be seen except by demolition of the building elements. In addition to pipe markers and/or stencils, arrow markers shall be used to indicate direction of flow.
- B. As a minimum, locate pipe markers and/or stencils as follows:
  - 1. Provide a pipe marker at each valve to indicate proper identification of pipe contents. Where several valves are on one (1) header, it is necessary to mark only the header.
  - 2. Every 20 feet in exposed and concealed areas on all piping systems. Provide at least one (1) pipe marker in each room on all piping systems.
  - 3. At each branch or riser take off on piping systems, excluding short takeoffs for fixtures and terminal units.
  - 4. Provide a pipe marker or stencil and an arrow marker at every point of pipe entry or exit where the pipe penetrates a wall, floor, service column or enclosure.
    - a. At access doors, manholes and similar access points that permit view of concealed piping.
    - b. Near major equipment items and other points of origination and termination.
- C. Provide an arrow marker with each pipe marker pointing away from the pipe marker to indicate direction of flow.
- D. Provide a double-ended arrow marker when flow can be in either or both directions.
- E. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.
- F. Identify control panels and major control components outside panels with plastic nameplates.

- G. Identify valves in main and branch piping with tags.
- H. Tag automatic controls, instruments and relays. Key to control schematic.
- I. Provide ceiling grid tags to locate valves or other concealed equipment above T-bar type panel ceilings. Locate in corner of grid closest to equipment.
- J. Identify right and left nipple and coupling union assemblies with the statement "Right/Left Nipple/Coupling".

END OF SECTION 21 05 53

## SECTION 21 13 13 - FIRE PROTECTION SYSTEMS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including "Uniform General Conditions and Supplementary General Conditions For The State Of Texas Building Construction Contracts" and Division 01 Specification Sections, apply to the work of this Section.
  - 1. Where the term "Owner's Designated Representative" is used, it shall mean a member of the project's capital team.

#### 1.2 THE FOLLOWING SECTIONS ARE TO BE INCLUDED AS IF WRITTEN HEREIN:

- A. Section 21 05 00 – Basic Fire Protection Requirements
- B. Section 22 05 29 – Plumbing Supports and Sleeves
- C. Section 21 05 53 – Fire Protection Piping and Equipment Identification

#### 1.3 SECTION INCLUDES

- A. Pipe, fittings, valves, and connections for sprinkler.

#### 1.4 RELATED SECTIONS

- A. Section 31 23 16.13 – Trenching
- B. Section 09 91 00 - Painting
- C. Section 22 05 48 – Vibration Isolation

#### 1.5 REFERENCES

- A. ANSI/ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250, and 800.
- B. ANSI/ASME B16.3 - Malleable Iron Threaded Fittings, Class 150 and 300.
- C. ANSI/ASME B16.4 - Cast Iron Threaded Fittings, Class 125 and 250.
- D. ANSI/ASME B16.5 - Pipe Flanges and Flanged Fittings.
- E. ANSI/ASME B16.9 - Factory-made Wrought Steel Buttwelding Fittings.
- F. ANSI/ASME B16.11 - Forged Steel Fittings, Socket-welding and Threaded.
- G. ANSI/ASME B16.18 - Cast Copper Alloy Solder-Joint Pressure Fittings.
- H. ANSI/ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.

- I. ANSI/ASME B16.25 - Buttwelding Ends.
- J. ANSI/ASME B36.10 - Welded and Seamless Wrought Steel Pipe.
- K. ANSI/ASME Sec 9 - Welding and Brazing Qualifications.
- L. ANSI/ASTM A135 - Electric-Resistance-Welded Steel Pipe.
- M. ANSI/ASTM A47 - Malleable Iron Castings.
- N. ANSI/ASTM B32 - Solder Metal.
- O. ANSI/AWS A5.8 - Brazing Filler Metal.
- P. ANSI/AWWA C110 - Ductile Iron and Gray Iron Fittings.
- Q. ANSI/AWWA C151 - Ductile Iron Pipe, Centrifugally Cast.
- R. ASTM A53 - Pipe, Steel, Black and Hot-Dipped, Zinc-coated Welded and Seamless.
- S. ASTM A120 - Pipe, Steel, Black and Hot-Dipped, Zinc-coated (Galvanized) Welded and Seamless, for Ordinary Uses.
- T. ASTM A234 - Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures.
- U. ASTM A795 - Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use.
- V. ASTM B75 - Seamless Copper Tube.
- W. ASTM B88 - Seamless Copper Water Tube.
- X. ASTM B251 - General Requirements for Wrought Seamless Copper and Copper-Alloy Tube.
- Y. ASTM F442 - Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe (SDR-PR).
- Z. AWS D10.9 - Specifications for Qualification of Welding Procedures and Welders for Piping and Tubing.
- AA. NFPA 13 - Installation of Sprinkler Systems.
- BB. NFPA 24 - Installation of Private Fire Service Mains and Their Appurtenances
- CC. UL - Fire Protection Equipment Directory.
- DD. City of Port Arthur, Texas, Fire Department Standards.
- EE. State of Texas, State Fire Marshal Rules.



- FF. All hose threads, coupling types, etc., utilized in the fire protection systems shall conform to the standards and requirements of the City of Port Arthur, Texas Fire Department.

#### 1.6 SUBMITTALS

- A. Submit under provisions of Section 21 05 00.
- B. Shop Drawings: Indicate pipe materials used, jointing methods, supports, floor and wall penetration seals. Indicate installation, layout, weights, mounting and support details, and piping connections.
  - 1. Shop Drawings: Shop Drawings shall be submitted prior to fabrication. The Shop Drawings shall include detail plans of sprinkler systems including piping sizes, sections and plot plan indicating the locations of underground supply connections, control valves, fire department connections, and other equipment to be used. The Shop Drawings shall become an integral part of these Specifications.
- C. Product Data: Provide data on sprinkler heads, valves, and specialties, including manufacturer's catalogue information. Submit performance ratings rough-in details, weights, support requirements, and piping connections.
- D. Manufacturer's Certificate: Certify that system has been tested and meets or exceeds requirements specified, and suggested by listed codes.
- E. Provide certificate of compliance from authority have jurisdiction indicating approval of field acceptance tests.

#### 1.7 OPERATION AND MAINTENANCE DATA

- A. Submit under provisions of Section 21 05 00.
- B. Maintenance Instructions: Include installation instructions, spare parts lists, procedures, and treatment programs.

#### 1.8 QUALITY ASSURANCE

- A. Sprinkler Systems: Perform work to NFPA 13.
- B. Standpipe and Hose Systems: Perform to NFPA 14.
- C. Welding Materials and Procedures: Perform to ASME Code.
- D. Equipment and Components: Bear FM label or marking. Provide manufacturer's name and pressure rating marked on valve body.
- E. Maintain one copy of each document on site.
- F. Design system under direct supervision of a Professional Engineer experienced in design of this work and licensed in the State of Texas. All design submittal documents and shop drawings shall bear the responsible engineers signed and dated seal.

- G. All parts of fire protection piping systems shall conform to all provisions of Underwriters' Laboratories requirements. All equipment shall bear the Underwriters' Laboratories label of approval.
- H. Determine volume and pressure of incoming water supply from residual pressure water flow test.
  - 1. Flow test shall be per the requirements of NFPA 291 (Recommended Practice for Fire Flow Testing and Marking of Hydrants).
  - 2. Flow test should be no less than 6 months old at the time shop drawings are submitted.
- I. Qualifications of the Installer: The system shall be installed by a firm regularly engaged in the design and installation of automatic sprinkler systems in accordance with requirements of the National Fire Protection Association and Fire Protection and Engineering Bureau of Texas, or by an authorized agent of such firm. Evidence to support the above requirements may be required and any proposed installer who cannot show suitable experience will be rejected.

#### 1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect, and handle products to site under provisions of Section 21 05 00.
- B. Deliver and store valves in shipping containers, with labeling in place.
- C. Provide temporary protective coating on cast iron and steel valves.
- D. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

#### PART 2 - PRODUCTS

##### 2.1 UNIONS:

- A. Provide and install unions at proper points to permit removal of pipe and various equipment and machinery items without injury to other parts of the system. No unions will be required in welded lines. Unions 2 inch and smaller shall be Class 300 AAR threaded malleable iron unions with iron to brass seats, and 2 ½ inch and larger shall be ground flange unions. Companion flanges on lines at various items for equipment machines and pieces of apparatus shall serve as unions to permit removal of the particular items.

## 2.2 FLANGES:

- A. All 150 lb. and 300 lb. ANSI flanges shall be weld neck and shall be domestically manufactured, forged carbon steel, conforming to ANSI B16.5 and ASTM A-181 Grade I or II or A-105-71 as made by Tube Turn or Dodson Global. Slip on flanges shall not be used. Each fitting shall be stamped as specified by ANSI B16.9 and, in addition, shall have the laboratory control number stenciled on each fitting for ready reference as to physical properties and chemical composition of the material. Complete test reports may be required for any fitting selected at random. Flanges which have been machined, remarked, painted or otherwise produced domestically from imported forges will not be acceptable. Flanges shall have the manufacturer's trademark permanently identified in accordance with MSS SP-25. Contractor shall submit data for firm certifying compliance with these Specifications. Bolts used shall be carbon steel bolts with semi-finished hexagon nuts of American Standard Heavy dimensions. Allthread rods will not be an acceptable for flange bolts. Steam system flange bolts shall have a tensile strength of 105,000 psi and an elastic limit of 81,000 psi and rated at least ANSI Grade V. Other bolts shall have a tensile strength of 80,000 psi and an elastic limit of 36,000 psi and rated at least ANSI Grade I.
- B. Flat faced flanges shall be furnished to match 125 lb cast iron flanges on pumps, check valves, strainers, etc. with full flange gaskets. Bolting of raised face flanges to flat faced flanges is not allowed.

## 2.3 FLANGE GASKETS

- A. Gaskets shall be placed between the flanges of all flanged joints.
- B. Gaskets shall be ring form gaskets fitting within the bolt circle of their respective flanges. Gaskets shall be 1/16" thick asbestos free material recommended for service by Anchor, Garlock, or John Crane. The inside diameter of such gaskets shall conform to the nominal pipe size and the outside diameter shall be such that the gasket extends outward to the studs or bolts employed in the flanged joint.
- C. Spares - Contractor shall provide ten spares for every flange size and rating.

## 2.4 WALL, FLOOR AND CEILING PLATES:

- A. See Section 21 00 00.

## 2.5 SLEEVES, INSERTS, AND FASTENINGS:

- A. General: All openings through all floors, walls, and roofs, etc., regardless of material for the passage of piping, etc., shall be sleeved. Refer to Specification Section 22 05 29.

## 2.6 MATERIALS:

### A. PIPING:

1. All pipe used for fire protection standpipe systems and fire sprinkler systems shall be Schedule 40 black steel pipe conforming to ASTM A-795 or ASTM A-53. All piping less than 2 1/2" shall be permitted to be threaded. All piping 2 1/2" and larger shall be welded, unless otherwise indicated herein.
2. Use of piping "roll" grooved type; cut grooved pipe is not permitted.

3. Scheduled 10 pipe is not permitted.

B. FITTINGS:

1. All welding type steel fittings employed in fabricating fire sprinkler systems shall conform to A.S.T.M. Specification A-234 and ANSI Standard B16.9-1964. All threaded fittings shall be Class 150 malleable iron fittings conforming to ASME B16.3. Pipe size changes shall be performed through the use of reducing tees or reducers designed for that purpose. The use of bushings is explicitly prohibited.
2. Unless otherwise shown or required, all fittings shall be welding type steel fittings. Refer to specification Section 22 05 26.
3. Threaded fittings shall be used when shown and shall be used from the point of connection of the pipe to the riser to each fire hose cabinet. Threaded fittings shall be Crane or Grinnell Company's Class 150 malleable iron fittings.
4. Grooved end couplings 2 ½" and larger shall be Victaulic Style 07 "Zero-Flex" Rigid Coupling, with EPDM gasket (minimum 700 psi working pressure) for use with roll grooved piping. Products by Gustin-Bacon, Gruvlok are acceptable, or Engineer-approved equal. Reducing type couplings, outlet couplings, "T" outlet fittings, cut-in style fittings, snap joint couplings, and flange adapter type fittings are not acceptable. Provide grooved fittings similar to standard weld fittings.
5. Extra heavy "Thread-o-lets" shall be used at each point of departure from the riser to the fire hose or valve cabinet. A "Thread-o-let" shall be installed below the level of the valve in the cabinet and a minimum of two (2) threaded ells shall be used to provide a swing joint connection from the riser to the valve in the cabinet.

2.7 VALVES:

- A. General – All shutoff valves shall be UL listed and FM approved for fire protection service.
- B. A sprinkler system control valve is required on every floor at the stair landing with inspector test assembly within 10 feet of the fire line drain riser. The fire line drain riser shall discharge indirectly to the sanitary system where indicated on the contract drawings.
- C. Shutoff valves for sizes 2 inch and smaller:
  1. Two piece bronze ball valve, bubble-tight shutoff, full port, blow-out proof stem, chrome plated brass ball and silicon bronze stem, threaded end connections, conforming to MSS SP-110.
  2. One piece, butterfly valve, full port, threaded ends, bronze housing and body, stainless steel disc. EPDM disc seal and slow closing.
  3. All valves shall be furnished with two factory mounted internal supervisory switches.
- D. Shut off valves for sizes over 2 inch:
  1. Butterfly valves lug type with EPDM molded in seat liner, ductile iron disc, stainless steel stem, manual gear operator, conforms to MSS SP-67 and MSS SP-25, with integral supervisory switch. Where a grooved piping system is allowed grooved end type butterfly valves may be used, consisting of ductile iron body and disc EPDM seats, stainless steel stem. Valves shall be equipped with internal supervisory switch.
  2. Gate valves – OS&Y (Outside Yoke and Stem) resilient wedge, epoxy coated interior and exterior, ASTM A 536 ductile iron valve body, bonnet and resilient wedge, ASTM B150 stem and flanged ends.

- E. Check valves for sizes 2 inch and smaller:
  - 1. Horizontal swing, bronze body, conforming to MSS Sp-80, threaded ends and rubber disc.
- F. Check valves for sizes over 2 inch:
  - 1. Iron body swing-check, bronze disc, seat ring and hinge pin, UL listed and FM approved, flanged ends, renewable seats and disc, tapped 3/4 inch for ball drip assembly.
- G. Standard of Quality for Fire Protection Valves:

<u>Size</u>	<u>Type</u>	<u>Class</u>	<u>Manufacturer</u>
<u>2" and Smaller</u>	<u>Ball</u>	<u>300</u>	<u>Nibco No. KT-505-W-8,</u> <u>Stockham No. T-255-FB-P-UL</u>
<u>2" and Smaller</u>	<u>Butterfly</u>	<u>175</u>	<u>Milwaukee No. BB-SC02</u>
<u>2 1/2" and</u> <u>Larger</u>	<u>Butterfly (lug)</u>	<u>250</u>	<u>Nibco No. LD3510-8</u>
<u>2 1/2" and</u> <u>Larger</u>	<u>Butterfly (grooved)</u>	<u>300</u>	<u>Nibco No. GD-4765-8N</u>
<u>2" and Smaller</u>	<u>Check</u>	<u>200</u>	<u>Nibco No. KT-403-W</u>
<u>2 1/2" and</u> <u>Larger</u>	<u>Check</u>	<u>175</u>	<u>Nibco No. F-908-W</u>
<u>2 1/2" and</u> <u>Larger</u>	<u>Check (grooved)</u>	<u>250</u>	<u>Nibco No. G-917 W</u>

2.8 BACKFLOW PREVENTERS:

- A. Provide double check valve assembly on fire water service entry inside building, unless local municipality requires a reduced pressure type backflow preventer. Double check valve assembly shall be UL listed, FM approved and ASSE 1015 listed, with flanged OS & Y resilient seated gate valves with type 304 schedule 40 stainless steel housing and sleeve with replaceable check disc rubber, manufactured by Watts No. 757OSY or approved equal by Wilkins or Apollo.

2.9 SPRINKLER SYSTEM

A. SYSTEM DESCRIPTION

- 1. System to provide coverage for entire building.
- 2. Provide system to minimum NFPA 13 ordinary hazard, Group 2 occupancy requirement unless indicated otherwise on the drawings or where a higher hazard classification is required by NFPA 13. Refer to "FP" drawings for locations of design densities of specific rooms and areas.
- 3. Interface system with building fire and smoke alarm system.

B. SUBMITTALS

- 1. Submit under provisions of Section 21 05 00.
- 2. Preliminary Shop Drawings: Prior to detailed submission, submit preliminary layout of finished ceiling areas indicating only head locations coordinated with ceiling installation.

3. Shop Drawings: Indicate hydraulic calculations, detailed pipe layout, hangers and supports, components and accessories. Indicate system controls.
  4. Submit shop drawings, product data, and hydraulic calculations to Factory Mutual for review. Submit copies of all information, and review comments to Architect/Engineer and Owner.
  5. Samples: Submit two of each style of sprinkler head specified.
- C. PROJECT RECORD DOCUMENTS
1. Submit under provisions of Section 21 05 00.
  2. Record actual locations of sprinkler heads and deviations of piping from drawings. Indicate drain and test locations.
- D. OPERATION AND MAINTENANCE DATA
1. Submit under provisions of Section 21 05 00.
  2. Maintenance Data: Include components of system, servicing requirements, Record Drawings, inspection data, replacement part numbers and availability, and location and numbers of service depot.
- E. QUALITY ASSURANCE
1. Perform Work in accordance with NFPA 13.
  2. Equipment and Components: Bear FM label or marking.
  3. Maintain one copy of all documents on site.
- F. EXTRA MATERIALS
1. Furnish under provisions of Section 21 05 00.
  2. Provide extra sprinkler heads as suggested under provisions of NFPA 13.
  3. Provide suitable wrenches for each head type.
  4. Provide metal storage cabinet in location designated.
- G. PRODUCTS
1. General: The Contractor shall provide all components required for the complete installation of automatic sprinkler systems as hereinafter specified and indicated on the Drawings.
  2. Materials and Equipment:
    - a. General: All materials and equipment used in the installation of the sprinkler system shall be listed as approved by the Underwriters' Laboratories, Inc., List of Inspected Fire Protection Equipment and Materials, or the Factory Mutual Testing Laboratories List of Approved Equipment, Fire Protection Devices and Devices Involving Fire Hazard, and shall be the latest design of the manufacturer. All piping, control valves, drain valves, fittings, etc. shall be as specified under this Section, Fire Protection System, & in Section 22 05 26 utilizing welded, flanged, and threaded fittings only. Where valves are not specified by Figure No. they shall be of specified manufacture, U.L. listed for service, and of same quality level as Figure Nos. specified. All pipe 2 1/2" and larger shall be welded, except as may be allowed herein. All pipe 2" and smaller shall be threaded using Class 150 pound malleable iron, A135 Schedule 40 black steel pipe and fittings. Note that if galvanized pipe or fittings are installed in other than dry systems, the contractor shall be responsible to remove the galvanized pipe or fittings and replace them with specified materials as soon as possible prior to further installation of the system.

3. Sprinklers:
  - a. Unless otherwise specified or indicated on the Drawings, sprinkler heads shall be quick response type spray heads of the upright or pendant ordinary degree temperature rating type except that sprinkler heads to be installed in the vicinity of heating equipment and lights shall be of the temperature rating required for such locations by National Fire Protection Association Standard No. 13. [Chrome plated bronze heads shall be installed in all locations.] [Ceiling sprinklers shall be Tyco No. Ty-FRB semi-recessed with white finish and polished chrome plated brass sprinkler head. Uprights shall be Tyco No. Ty-FRB.
  - b. The Contractor shall provide spare heads equal to one percent (1%) of the total number of heads installed under the Contract, but not less than ten (10). The heads shall be packed in a suitable wall mounted sprinkler cabinet and shall be representative of, and in proportion to, the number of each type and temperature rating heads installed. In addition to the spare heads, the Contractor shall provide not less than one special sprinkler head wrench for each type of head. The cabinet shall be located where directed by the Construction Inspector.
4. Note that the use of piping bushings for any purpose is explicitly prohibited.

H. Add locations and hazards as required by project conditions.

<u>Location</u>	<u>System Type/Hazard</u>
<u>Offices, Lobbies</u>	<u>Ordinary Hazard, Group 2</u>
<u>Warehouses</u>	<u>Ordinary Hazard, Group 2</u>
<u>Laboratories</u>	<u>Ordinary Hazard, Group 2</u>
<u>Mechanical Rooms</u>	<u>Ordinary Hazard, Group 2</u>
<u>Computer Rooms</u>	<u>Ordinary Hazard, Group 2, Pre-action</u>

#### 2.10 FIRE DEPARTMENT SIAMESE CONNECTIONS:

- A. At the points designated on the accompanying Drawings, install Siamese fittings required for fire protection purposes. From a point on the incoming water supply line, the Contractor shall extend water line for fire protection purposes to Siamese connections. Refer to NFPA 14 and the local fire department for restrictions on location of fire department connection.
- B. Provide [2 way] [3way] [4 way] [6 way] wall type Siamese connection equal to Potter Roemer No. \_\_\_\_ double clapper flush type Siamese connections with 2 ½ outlets having threads complying with the requirements of the Fire Department of the City of \_\_\_\_\*. They shall have proper caps with pin type lugs attached to the body of the Siamese connections with substantial chains. The plate fitting against the building shall have raised letters reading "AUTOMATIC SPRINKLER" or "STANDPIPE". All external surfaces shall be chromium plated polished surfaces or as directed by Architect.
- C. Provide [2 way] [3way] [4 way] [6 way] free standing type Siamese shall be equal to Potter-Romer No. \_\_\_\_ cast brass body with 2 ½" outlets and escutcheon. They shall have proper caps with pin type lugs attached to the body of connection with substantial chains. "STANDPIPE" or "AUTOMATIC SPRINKLER" is to be cast on head of connection. All external surfaces shall be chromium plated polished surfaces or as directed by Architect.

## PART 3 - EXECUTION

### 3.1 PREPARATION - ALL SYSTEMS:

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and foreign material, from inside and outside, before assembly.
- C. Prepare piping connections to equipment with flanges or unions.
- D. Flush entire system of foreign matter.

### 3.2 SYSTEM TESTS

- A. Hydrostatically test entire standpipe system in accordance with NFPA 14 and sprinkler system in accordance with NFPA 13, with a pressure of 200 psi maintaining that pressure with loss for 24 hours. Where portions of the system exceeds 150 psi working per the system shall be tested at a pressure of 50 psi in excess of the system working pressure for a 24 hour period.
- B. Test shall be witnessed by campus Fire Marshal.

### 3.3 INSTALLATION

#### A. SPRINKLERS

- 1. Install piping in accordance with NFPA 13 for sprinkler systems, NFPA 14 for standpipe and hose systems, and NFPA 24 for service mains. Note that the piping sizes indicated in the plans are the minimum acceptable. The Qualified Contractor shall provide proper sizes, materials and installation as required in the appropriate NFPA Standard.
- 2. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient. See Section 21 05 00 and 22 05 29.
- 3. Slope piping and arrange systems to drain at low points. Use eccentric reducers to maintain top of pipe level.
- 4. Provide drain valves at main shut-off valves, low points of piping and apparatus. Provide Fire Department test station, piped to drain.
- 5. Water Alarm: A water motor alarm shall be connected to each alarm valve and shall discharge to a brass alarm gong located on the exterior of the building as directed by the Architect. Alarm gong finish to be selected by the Architect. The alarm valves shall be Underwriters' Laboratories approved, wet type, connected to water supply and indicated on the Shop Drawings. Each alarm valve shall be provided with a circuit closer. Valves shall conform to the equipment of NFPA Standard No. 13, complete with retarding chamber and pressure switch.
  - a. Water Flow Alarm Switch: Provide, where indicated on the Drawings, McDonnell UL approved line size flow switches, or approved equal by other manufacturer. Flow switch shall be provided with delay, adjustable up to 90 seconds (60 to 90 seconds in Austin). See Division 26 for electrical signal connection by others to these flow switches.
- 6. Place pipe runs to minimize obstructions with other work.



7. Piping: Installation of piping, fittings and valves shall be as specified in Chapter 3, System Components, NFPA Standard No. 13, except where noted otherwise. Piping shall be concealed in all areas with finished ceilings. Piping shall be sterilized as specified in Section 22 05 26. The O.S.& Y. valves shall be provided as specified herein.
8. Heads shall be located in a symmetrical pattern related to ceiling features such as grid, beams, light fixtures, diffusers, etc., and where applicable, heads shall be located symmetrically with the ceiling grid, centered in two directions.
9. Apply paper cover to ensure concealed sprinkler head and cover plates do not receive field paint finish.
10. Install and connect fire pumps in accordance with Section 21 30 00 and NFPA 13.
11. Locate fire department connection with sufficient clearance from walls, obstructions, or adjacent Siamese connectors to allow full swing of fire department wrench handle.
12. System Layout: The fire sprinkler areas, piping, head locations, etc. as indicated is only for Contractor's reference as to areas to be protected and possible piping routes. If header or manifold sizes are given in the drawings, then the sizes given shall be the minimum sizes installed. Actual number, spacing and location of heads, size and routes of piping shall be provided in accordance with the applicable Specifications and acceptable Shop Drawings. All layouts, head spacing, coverage, etc., as may be required by the referenced authorities and/or Architectural and Structural conditions shall be made without increase in cost to the Owner or the Architect/Engineer. Modifications to head spacing, pipe routes, etc. shall be closely coordinated with the work of all other trades. The Fire Sprinkler Subcontractor shall be responsible for the design and installation of the fire sprinkler system as described herein and on the project drawings. The piping of the system shall be sized used the "hydraulic" method, as included in NFPA Standard No. 13. Piping sized using the "schedule" method is unacceptable, except where expanding an existing "scheduled" system.

END OF SECTION 21 13 13

## SECTION 22 05 26 - PIPE AND PIPE FITTINGS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including "Uniform General Conditions and Supplementary General Conditions For The State Of Texas Building Construction Contracts" and Division 01 Specification Sections, apply to the work of this Section.
  - 1. Where the term "Owner's Designated Representative" is used, it shall mean a member of the project's capital team.

#### 1.2 SUMMARY

- A. This Section includes requirements for pipe and pipe fittings for all piping systems. This Section applies to all Plumbing Sections of Division 22 which employ pipe and pipe fittings. Fabricate and erect all piping in accordance with ASME/ANSI B31.9 except as otherwise indicated.

#### 1.3 RELATED SECTIONS

- A. Division 07 – Thermal and moisture protection for firestopping requirements.
- B. Division 09 – Finishes for painting requirements.
- C. Section 22 05 00 – Common Work Results for Plumbing
- D. Section 22 05 53 - Identification for Plumbing Piping and Equipment.
- E. Section 22 05 48 - Vibration Isolation for Plumbing Piping and Equipment.
- F. Section 22 11 16 - Domestic Water Piping.
- G. Section 22 11 19 - Domestic Water Piping Specialties.
- H. Section 22 14 23.13 - Roof Drainage Piping Systems.

#### 1.4 SUBMITTALS

- A. Welding certificates.

#### 1.5 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX.
  - 1. Before any welding is performed, contractor shall submit a certificate certifying that welders comply with the following requirements:
    - a. Qualify welding processes and operators for piping according to ASME "Boiler and Pressure Vessel Code", Section IX, "Welding and Brazing Qualifications".
    - b. Comply with provisions of ASME B31 series "Code for Pressure Piping".

- c. Certify that each welder and welding operator has passed American Welding Society (AWS) qualification tests for the welding processes involved, and that certification is current.
- d. All welds shall be stamped according to the provisions of the American Welding Society.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. In other Part 2 paragraphs where titles below introduce lists or manufacturers, the following requirements apply to product selection:
  - 1. Acceptable Manufacturers: Subject to compliance with requirements, provide products by the manufacturer specified.

### 2.2 PIPE AND FITTINGS

- A. The particular type of pipe and fittings for each system is specified in the Section for that system. All piping and fittings shall be of U.S. Manufacturer. All pipe shall be shipped capped. Shipped and store on job site with ends capped from the factory.

### 2.3 JOINTS

- A. Screwed: Make screwed joints using machine-cut ANSI taper pipe threads. Apply a suitable joint compound, such as Teflon tape, to the male threads only. Ream the pipe to full inside diameter after cutting. All-thread nipples are not permitted.
- B. Dissimilar Metals: Make joints between copper and steel pipe and equipment along with steel pipe and ductile iron pipe using insulating unions such as Crane Company No. 1259; EPCO as manufactured by EPCO Sales, Inc.; or an approved equal.
- C. Solder Joints:
  - 1. Prior to making joints, cut pipe square and ream to full diameter. Clean exterior of pipe and socket. Apply a thin coat of suitable fluxing compound to both pipe and socket, and fit parts together immediately.
  - 2. Heat assembled joint only as required to cause the solder to flow. Run the joint full, slightly beaded on the outside, and wipe to remove excess solder.
  - 3. Utilize lead free solder. Use silver brazing alloy or Sil-Fos on refrigerant piping and on underground piping.
- D. Welded Joints:
  - 1. Make welded joints as recommended by the standards of the American Welding Society.
  - 2. Ensure complete penetration of deposited metal with base metal.
  - 3. Provide filler metal suitable for use with base metal.
  - 4. Keep inside of fittings free from globules of weld metal.
  - 5. Do not use mitered joints.
  - 6. Use standard weld elbow fittings for changes of direction or cut a standard elbow for odd angles.

- E. Flanged Joints:

1. Prior to installation of bolts, accurately center and align flanged joints to prevent mechanical prestressing of flanges, pipe and equipment. Align bolt holes to straddle the vertical, horizontal or north-south centerline. Do not exceed 3/64 inch per foot inclination of the flange face from true alignment.
2. Use flat-face companion flanges only with flat-faced fittings, valves or equipment. Otherwise, use raised-face flanges.
3. Install proper gaskets, suitable for intended service and factory cut to proper dimensions. Red rubber gaskets are not acceptable. Garlock gaskets or EPDM shall be used. Apply non-stick clean surface lubricant coating to both sides of gaskets.
4. Use ANSI nuts and bolts, galvanized or black to match flange material. Use Coreten or galvanized steel nuts and bolts underground. Tighten bolts progressively to prevent unbalanced stress. Draw bolts tight to ensure proper seating of gaskets. Use anti-seize compound on all bolts above and below grade. Bolt threads not to protrude more than 2 threads past nut.
5. Use carbon steel flanges conforming to ANSI B16.5 with materials conforming to ASTM A 105, Grade II or ASTM A 108, Grade II. Use welding neck type flanges at all fittings and on all pipe.
6. Flanges for ductile iron pipe are specified in Sections using that pipe.
7. Keep flange covers on equipment and shop-fabricated piping until ready to install in system.

F. No Hub: Install according to manufacturer's recommendations, using recommended tools.

G. Bell and Spigot: Use neoprene compression gaskets for sanitary and storm.

H. Push-on Joints (Ductile Iron Pipe): Restrained joints and gaskets for ductile iron pipe are specified in Sections using that pipe.

## 2.4 UNIONS

A. Use 150-pound standard (300-pound WOG) malleable iron, ground joint unions with bronze seat. Provide flanged union joints on piping larger than 2-1/2 inches.

## 2.5 BRANCH CONNECTIONS

A. For Pipe 2 inches and smaller, use threaded fittings for steel pipe. For threaded piping, use straight size of reducing tee.

B. For 2-1/2 Inches through 14 Inches: For welded piping, when branch size is the same as and one size smaller than header size, use welding tee. Use Weld-O-Let when branch is two or more sizes smaller than header. For threaded branch connections, use thread-o-let welded to header.

C. All changes in direction, branches, offsets etc., shall be made with standard pipe fittings. Holes in the main for branches shall be made with a hole cutting machine and a standard "Weld-O-Let" or "Thread-O-Let" fitting used. Burning holes in the system piping will cause that section of the piping to be cut out and replaced at the Contractor's expense

## 2.6 GASKETS

A. Provide gaskets between flanges of all flanged joints. Inside diameter of gaskets shall conform to nominal pipe size. Gaskets shall be ring type between raised face flanges and full face between flat face flanges with punched bolt holes and pipe opening.

- B. Gaskets shall be cut from 1/8 inch thick non-metallic, non-asbestos gasket material suitable for operating temperatures from -150°F to +750°F. Garlock or equal. For pipe smaller than 6 inches, use 1/16-inch-thick gasket.

## 2.7 FLOOR AND CEILING PLATES

- A. Provide chrome-plated floor and ceiling plates around pipes exposed to view and passing through walls, floors, partitions, or ceilings in finished areas. Size plates to fit pipe or insulation and securely lock in place.

## PART 3 - EXECUTION

### 3.1 PIPE FABRICATION AND INSTALLATION

- A. Make piping layout and installation in the most advantageous manner possible with respect to headroom, valve access, opening and equipment clearance, and clearance for other work.
- B. Give particular attention to piping in the vicinity of equipment. Preserve the maximum access to various equipment parts for maintenance. Install piping plumb and parallel with building walls.
- C. Do not cut or weaken any structural member.
- D. Cut all pipes accurately to measurement determined at the site. After cutting pipe, ream it to remove burrs.
- E. Install piping neatly, free from unnecessary traps and pockets. Work into place without springing or forcing. Use fittings to make all changes in direction. Field bending and mitering are prohibited. Make all connections to equipment using flanged joints or unions. Make reducing connections with reducing fittings only.
- F. All water piping installed above ground or below ground and in trenches, including preinsulated piping, must be installed by a licensed Mechanical Contractor at building rates. The wage rates for building trades apply only to the extent of work required to be installed by licensed Plumbing or Mechanical Contractors.

### 3.2 WELDING

- A. Weld and fabricate piping in accordance with ANSI Standard B31.9, latest edition, Code for Pressure Piping. Machine beveling in shop is preferred. Field beveling may be done by flame cutting to recognized standards.
- B. Align piping and equipment so that no part is offset more than 1/16 inch. Set all fittings and joints square and true, and preserve alignment during welding operation. Use of alignment rods inside pipe is prohibited.
- C. Do not permit any weld to project within the pipe so as to restrict it. Tack welds, if used, must be of the same material and made by the same procedure as the completed weld. Otherwise, remove tack welds during welding operation.
- D. Do not split, bend, flatten or otherwise damage piping before, during or after installation.

- E. Remove dirt, scale, and other foreign matter from inside piping before tying in sections, fittings, valves or equipment.

### 3.3 OFFSETS AND FITTINGS

- A. Because of the small scale of Drawings, the indication of all offsets and fittings is not possible. Carefully investigate the structural and finish conditions affecting the work and take such steps as may be required to meet such conditions.
- B. Install all piping close to walls, ceilings, and columns so piping will occupy the minimum space. Provide proper space for covering and removal of pipe, special clearances, and for offsets and fittings.

### 3.4 PIPE SLEEVES

- A. Fit with sleeves all pipes passing through gyp board, masonry, and concrete construction, refer to specification section 22 05 00 and the following:
  1. Provide 20 gauge wall sleeves for pipes passing through gyp board walls.
  2. Fabricate floor sleeves of schedule 40 weight galvanized steel pipe and masonry wall sleeves of 20 gauge galvanized steel.
  3. Size sleeve for minimum clearance between pipe or insulation and sleeve.
  4. All sleeves in wet lab areas to have a welded waterstop.
  5. All sleeves shall be hot dipped galvanized after fabrication.
- B. Extend each sleeve through the floor or wall. Cut the sleeve flush with each surface, except that in exposed locations, extend floor sleeves 2 inches above finished floor line.
- C. Seal all sleeves water and airtight. Seal annular space between pipes and sleeves with compound with flame and smoke spread rating of minimum 25/50 in accordance with ASTM E 84 test.
- D. Sleeves below grades in outside walls are detailed on drawings. Except as shown otherwise, provide Thunderline Link-Seal or approved equivalent with stainless steel nuts and bolts, with cast iron pressure plate.

### 3.5 ISOLATION VALVES

- A. Provide piping systems with line size shutoff valves located at the risers, at main branch connections at each floor and at branch takeoffs serving all equipment, and at other locations as indicated and required for isolation of piping or equipment.

### 3.6 DRAIN VALVES AND VENTS

- A. Install drain valves at all low points and at base of all risers of water piping systems so that these systems can be entirely drained. Install a 2 inch drain for 2-inch pipes and larger. Install a line size drain valve for pipes smaller than 2 inches. Provide hose adapter and cap on all drain lines.
- B. Provide automatic vents with isolation valves or manual vents at locations as indicated on drawings and all high points in piping systems.

### 3.7 CLEANING OF PIPING SYSTEMS

- A. Cleaning of piping system must be performed by an independent agency specializing in this type of work:
  - 1. The agency must have a minimum of 5 years experience with at least three projects of similar size.
  - 2. Submit project names for review.
  
- B. Minimum velocity of 10 feet per second must be maintained in the pipes during flushing period:
  - 1. Do not use building pumps for circulating water.
  - 2. Provide temporary pumps as required to achieve minimum velocities.
  - 3. Remove flow meters from building piping during flushing operation.
  - 4. Provide means (instrumentation) during flushing period to prove to the Owner that the minimum velocities are maintained in the pipes.
  
- C. Submit a detailed plan for the Engineer's and Owner's review and approval describing in full detail the individual steps associated with this process before any piping is installed:
  - 1. Plan must include a drawing indicating GPM's required to provide minimum velocity required in the piping, phasing of systems being cleaned, locations of drains or other temporary connections required for cleaning system, and cutsheet of temporary pump proposed.
  
- D. Clean piping systems thoroughly. Purge pipe of construction debris and contamination before placing the systems in service. Provide temporary connections and valves as required for cleaning, purging and circulating.
  
- E. Install temporary strainers in front of pumps, tanks, water still, solenoid valves, control valves, and other equipment where permanent strainers are not indicated. Keep these strainers in service until the equipment has been tested, then remove either entire strainer or straining element only. Fit strainers with a line size blowoff valve.
  
- F. Domestic Water Piping:
  - 1. All potable water piping and tanks shall, after successful pressure testing, be thoroughly flushed with clear water and then sterilized.
  - 2. Sterilization shall be with either liquid chlorine or chlorine gas of adequate volume to give a concentration of 50 ppm based upon the volume of the system being treated.
  - 3. The solution will be allowed to stand for a period of 24 hours.
  - 4. A minimum residual chlorine level of 5 ppm shall remain in each system for a minimum of 24 hours.
  - 5. After sterilization, all piping shall be thoroughly flushed.
  - 6. The above are minimum requirements and all sterilization procedures shall be in strict accordance with all local codes and authorities having jurisdiction.
  - 7. Under no circumstances shall the Contractor permit the use of any portion of the domestic water system until it has been properly sterilized and certified by the authorities having jurisdiction.
  
- G. Special requirements, if any, are specified in the Sections for each type of piping.
  
- H. After systems have been flushed, cleaned and sterilized; as required by specifications, provide written certification from the cleaning contractor that the systems are clean and ready for use.

### 3.8 LEAK TESTS

- A. All piping systems shall demonstrate leak tightness. This requirement shall be met by a water hydrostatic leak test or a pneumatic leak test, whichever is called for under specific piping Sections.
- B. Piping Systems:
  - 1. Test Preparation: Expansion joints shall be provided with temporary restraint, for the additional pressure load under test or shall be isolated from the test. Equipment and valves which are not rated for the pressure test shall be either disconnected from the piping or isolated by a blind flange or similar means.
  - 2. Test Pressure” The water hydrostatic test pressure shall be 1.5 times the design pressure. The pressure test shall be maintained for sufficient time to inspect all joints, with a minimum time of four hours.
  - 3. Special requirements, if any, for each system are specified in the Section for that system.

### 3.9 CONNECTIONS TO EQUIPMENT FURNISHED BY OTHERS

- A. Provide service connections to items of equipment furnished by others:
  - 1. Detailed shop drawings of equipment will be furnished indicating the exact number and location of rough-in points.
  - 2. Such final shop drawings may indicate adjustments in total number and exact location of rough-in points, and in equipment dimensions.
  - 3. Making adjustments to field conditions is considered a part of the work required.
- B. Roughing-In:
  - 1. When roughing-in, extend service piping to various items of equipment.
  - 2. Temporarily terminate at proper points as indicated on detailed equipment shop drawings or as directed.
  - 3. Do not use contract drawings accompanying these specifications for rough-in locations but only for pipe sizing and general routing.
- C. Stop Valves:
  - 1. Provide stop valves for each service at rough-in locations, except for drains.
  - 2. Stop valve locations are subject to approval, and in all cases must be accessible from the same room in which the furniture or equipment is located.

### 3.10 PAINTING

- A. Touch Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
  - 1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 22 05 26



## SECTION 22 05 53 - PLUMBING IDENTIFICATION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including "Uniform General Conditions and Supplementary General Conditions For The State Of Texas Building Construction Contracts" and Division 01 Specification Sections, apply to the work of this Section.
- 1. Where the term "Owner's Designated Representative" is used, it shall mean a member of the project's capital team.

#### 1.2 THE FOLLOWING SECTIONS ARE TO BE INCLUDED AS IF WRITTEN HEREIN:

- A. Section 22 05 00 – Common Work Results for Plumbing
- B. Section 22 05 29 – Plumbing Supports and Sleeves

#### 1.3 SECTION INCLUDES

- A. Nameplates
- B. Tags
- C. Stencils
- D. Pipe Markers

#### 1.4 RELATED SECTIONS

- A. Section 09 91 00 – Painting: Identification painting

#### 1.5 REFERENCES

- A. ASME A13.1 – Scheme for the Identification of Piping Systems

#### 1.6 SUBMITTALS

- A. Submit under provisions of Section 22 05 00.
- B. Submit list of wording, symbols, letter size, and color coding for mechanical identification.
- C. Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.
- D. Product Data: Provide manufacturers catalog literature for each product required.
- E. Samples: Submit two of each type of label, tag, etc., of the approximate size specified of implied in the specification.
- F. Manufacturer's Installation Instructions: Indicate special procedures, and installation.

## 1.7 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Section 22 05 00.
- B. Record actual locations of tagged valves.

## PART 2 - PRODUCTS

### 2.1 GENERAL

- A. The contractor shall make it possible for the personnel operating and maintaining the equipment and systems in this project to readily identify the various pieces of equipment, valves, piping, etc., by marking them. All items of equipment such as pumps, etc., shall be clearly marked using engraved nameplates as hereinafter specified. The item of equipment shall indicate the same number as shown on the drawings. For example, pumps will be identified as 3a, 3b, 3c, etc.
- B. Perform all Work required to provide and install Owner's equipment tags, valve tags, stencils, and pipe markers indicated by the Contract Documents with supplementary items necessary for proper installation.
- C. Contractor shall make it possible for Owner's operations and maintenance personnel to readily identify the various pieces of equipment, valves, piping, ductwork, etc., by marking them in accordance with this Specification.
- D. Clearly mark all items of equipment, including but not limited to valves, etc using equipment tags as specified in this Section.

### 2.2 NAMEPLATES

- A. Description: Laminated three-layer plastic with engraved [black] [ ] letters on light contrasting background color.
- B. Manufacturers:
  - 1. Seton Identification
  - 2. Brady Corporation
  - 3. Marking Services

### 2.3 TAGS

- A. Plastic Tags: Laminated three-layer plastic with engraved [black] [ ] letters on light contrasting background color. Tag size minimum 1-1/2 inch (40 mm) [diameter] [square] [ ].
- B. Metal Tags: [Brass] [Aluminum] [Stainless Steel] [ ] with stamped letters; tag size minimum 1-1/2 inch (40 mm) [diameter] [square] [ ] with smooth edges.
- C. Chart: Typewritten letter size list in anodized aluminum frame.
- D. Manufacturers:

1. Set on Identification Products

2. Brady Corporation

3. Marking Services

## 2.4 PIPE MARKERS

A. Color: Conform to ASME A13.1.

B. Plastic Pipe Markers: Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.

C. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

D. Underground Plastic Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches (150 mm) wide by 4 mil (0.10 mm) thick, manufactured for direct burial service.

E. Manufacturers

1. Seton Identification Products

2. Brady Corporation

3. Marking Services

## 2.5 CEILING GRID LABELS

A. Ceiling grid labels are to be created by means of P-Touch. The label shall have the equipment tag number information according to equipment/valve number.

B. Coordinate with owner property services for color coding or additional project specific requirements of P-Touch labels.

## 2.6 PLUMBING EQUIPMENT

A. Equipment shall be identified by the attachment of engraved nameplates constructed from laminated phenolic plastic, at least 1/16" thick, 3-ply, with black surfaces and white core. Engraving shall be condensed gothic, at least 1/2" high, appropriately spaced. Nomenclature on the label shall include the name of the item, its mark number, area, space, or equipment served, and other pertinent information. Equipment to be labeled shall water heaters, valves and etc.

## 2.7 VALVE TAGS:

- A. The Contractor shall provide and install identification tags lettered and numbered to correspond to the information shown on the charts described above. These tags are to be affixed to all valves except simple service and drain valves located within 10' and within sight of the device or equipment served. For example, it would not be expected that valves at a pressure reducing station in a machine room would be tagged. These tags shall be 1/8" thick brass discs, 1 1/2" in diameter. Each tag shall be attached to its valve with copper clad annealed iron wire or other approved material.
- B. Valves at water headers PRV stations, valves associated with gas, water meters, and other valves as specified shall also be tagged with standardized color coded plastic tags. These tags shall be 2 1/2" wide by 1 1/2" high with these color codings: Red = normally closed; Green = normally open; Tags should be engraved on both sides.
- C. In addition, pipe runs throughout the building including those above lift out ceilings, under floor, and those exposed to view when access doors or access panels are opened shall be identified by means of Seton Setmark or Brady Mechanical Pipe Markers. Concealed areas, for purposes of this identification section, are those areas which cannot be seen except by demolition of the building elements. In addition to the pipe markers, arrow markers shall be used to indicate direction of flow. The following specific instructions shall apply to the application of these markers:
  - D. Provide a pipe marker at each valve to indicate proper identification of pipe contents. Where several valves exist on one header, it is necessary to mark only the header.
  - E. Provide an arrow marker with each pipe marker pointing away from the pipe marker to indicate direction of flow.
  - F. Provide a double ended arrow marker when flow can be in either or both directions.
  - G. Provide a pipe marker and an arrow marker at every point of pipe entry or exit where line goes through a wall or service column.
  - H. Provide pipe markers and arrow markers at intervals not exceeding 50 feet.
  - I. Markers shall be located on the two lower quarters of the pipe where view is unobstructed.
- J. Use snap-on type identification for all piping systems, 3/4" thru 6". For piping systems larger than 6", use strap on markers.
- K. Pipe Markers shall conform to ANSI A 13.1-1981 "Scheme for the Identification of Piping Systems." Arrow markers must have same ANSI background colors as their companion pipe markers, or be incorporated into the pipe identification marker.
- L. Locate markers to be visible from floor.

## 2.8 SPECIALS:

- A. Refer to special requirements noted in the various sections hereinafter bound.

### PART 3 - EXECUTION

#### 3.1 PREPARATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.
- B. Prepare surfaces in accordance with Division 9 for stencil painting.

#### 3.2 INSTALLATION

- A. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.
- B. Install tags with corrosion resistant chain.
- C. Apply stencil painting in accordance with Division 9.
- D. Install plastic pipe markers in accordance with manufacturer's instructions.
- E. Identify control panels and major control components outside panels with plastic nameplates.
- F. Identify valves in main and branch piping with tags.
- G. Tag automatic controls, instruments, and relays. Key to control schematic.
- H. Provide ceiling tacks to locate valves or other concealed equipment above T-bar type panel ceilings. Locate in corner of panel closest to equipment.

END OF SECTION 22 05 53

## SECTION 22 05 84 – PLUMBING SPECIALTIES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including "Uniform General Conditions and Supplementary General Conditions For The State Of Texas Building Construction Contracts" and Division 01 Specification Sections, apply to the work of this Section.
  - 1. Where the term "Owner's Designated Representative" is used, it shall mean a member of the project's capital team.

#### 1.2 SECTION INCLUDES

- A. Roof, overflow, floor and deck drains.
- B. Floor sinks.
- C. Cleanouts.
- D. Hose bibbs.
- E. Hydrants.
- F. Water hammer arrestors.
- G. Manholes.
- H. Catch basins.

#### 1.3 RELATED SECTIONS

- A. Division 03 – Cast-in-Place Concrete.
- B. Division 07 – Built-up Roofing and Roof Accessories.
- C. Division 08 – Access Doors.
- D. Division 09 – Painting.
- E. Section 22 13 16 – Plumbing Piping.
- F. Section 22 05 00 – Common Work Results for Plumbing.
- G. Section 22 05 53 – Plumbing Identification.
- H. Section 23 07 19 – Piping Insulation.
- I. Division 31 – Dewatering, Excavation, Backfilling, Trenching and Trench Safety Systems.

#### 1.4 REFERENCES

- A. ANSI/ASSE 1013 - Backflow Preventers, Reduced Pressure Principle.

- B. ANSI A112.26.1M - Water Hammer Arrestors.
- C. PDI WH-201 - Water Hammer Arrestors.
- D. AWWA C506 - Backflow Prevention Devices - Reduced Pressure Principle.

#### 1.5 SUBMITTALS

- A. Submit under provisions of Division 01.
- B. Shop Drawings: Indicate dimensions, weights, and placement of openings and holes.
- C. Product Data: Provide component sizes, rough-in requirements, service sizes, and finishes.
- D. Manufacturer's Installation Instructions: Indicate assembly and support requirements.

#### 1.6 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Division 01.
- B. Record actual locations of equipment.

#### 1.7 OPERATION AND MAINTENANCE DATA

- A. Submit under provisions of Division 01.
- B. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

#### 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect and handle products to/at site under provisions of Division 01.
- B. Accept specialties on site in original factory packaging. Inspect for damage.

### PART 2 - PRODUCTS

#### 2.1 PLUMBING FIXTURE SCHEDULE

- A. See plumbing schedule shown on drawings for fixtures not specified in these specifications.

#### 2.2 AUTOMATIC TRAP PRIMERS

- A. Automatic Type: Automatic trap priming valve equal to Josam 88250 series.
- B. Provide ASSE 1072 compliant Rectorseal Floor Drain Trap Sealer (Sure Seal) in all floor drains and floor sinks where electronic trap primers are not indicated on the drawings.

#### 2.3 WATER HAMMER ARRESTORS

- A. Manufacturers: Products manufactured by Precision Plumbing Products, Inc., are specified. Equal products manufactured by Sioux Chief Manufacturing Company, Inc. will be acceptable.

- B. Water Hammer Arrestor (WHA-1):
  - 1. Precision Plumbing Products, Inc. Model Series SC, ANSI A112.26.1M and PDI WH-201, piston actuated, factory sealed, seamless hard drawn copper barrel with threaded end.

### PART 3 - EXECUTION

#### 3.1 PREPARATION

- A. Coordinate cutting and forming of roof and floor construction to receive drains to required elevations.

#### 3.2 GENERAL INSTALLATION REQUIREMENTS

- A. Install in accordance with manufacturer's instructions.
- B. Extend cleanouts to finished floor or just behind finished wall surface. Install wall cleanouts at an elevation above the flood level rim of the highest fixture served. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.
- C. Encase exterior cleanouts in 18" x 18" x 6" thick reinforced concrete pads. Set top of pad 2" above proposed finished grade elevation at cleanout location.
- D. Provide cleanouts at the bottom of each stack, at each change of direction and at intervals not exceeding 90 feet in horizontal runs.
- E. Install an accessible cleanout plug, with wall access panel, in the vertical vent line above the fixture flood level rim whenever a sanitary cross fitting is used.
- F. Pipe relief from backflow preventers to nearest drain.
- G. Install water hammer arrestors on every hot and cold water connection to each plumbing fixture and piece of equipment requiring water service. Multiple fixtures may be served utilizing single shock absorbers if installed in accordance with the manufacturer's recommendations. Conceal shock absorbers inside walls and above ceilings. Supply access door where shock absorbers are installed inside walls.
- H. Provide sheet lead flashing at each roof drain, overflow drain and at floor drains and cleanouts located in floors with waterproof membranes. Refer to Section 23 05 29 for requirements.
- I. Ensure all Floor Drains, Floor Sinks with exception of F.S.-C are set ½" Min. below finished floor and concrete is sloped to top of drain so as any liquid around will migrate into the drain.

END OF SECTION 22 05 84



## SECTION 22 07 19 – PLUMBING INSULATION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including "Uniform General Conditions and Supplementary General Conditions For The State Of Texas Building Construction Contracts" and Division 01 Specification Sections, apply to the work of this Section.
  - 1. Where the term "Owner's Designated Representative" is used, it shall mean a member of the project's capital team.

#### 1.2 THE FOLLOWING SECTIONS ARE TO BE INCLUDED AS IF WRITTEN HEREIN:

- A. 22 05 00 -- Common Work Results for Plumbing
- B. 22 05 29 – Plumbing Supports and Sleeves
- C. 22 05 53 – Plumbing Identification

#### 1.3 SECTION INCLUDES

- A. Piping insulation
- B. Jackets and accessories

#### 1.4 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

- A. Section 22 13 16- Plumbing Piping: Placement of hangers and hanger inserts.

#### 1.5 RELATED SECTIONS

- A. Division 9 - Painting

#### 1.6 REFERENCES

- A. ASTM B209 Aluminum and Aluminum Alloy Sheet and Plate.
- B. ASTM C177 Steady State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded Hot Plate Apparatus.
- C. ASTM C195 Mineral Fiber Thermal Insulation Cement.
- D. ASTM C335 Steady State Heat Transfer Properties of Horizontal Pipe Insulation.
- E. ASTM C449 Mineral Fiber Hydraulic setting Thermal
- F. ASTM C518 Steady State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
- G. ASTM C533 Calcium Silicate Block and Pipe Thermal Insulation.

- H. ASTM C534 Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
  - I. ASTM C547 Mineral Fiber Preformed Pipe Insulation.
  - J. ASTM C552 Cellular Glass Block and Pipe Thermal Insulation.
  - K. ASTM C578 Preformed, Block Type Cellular Polystyrene Thermal Insulation.
  - L. ASTM C585 Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS System).
  - M. ASTM C921 Properties of Jacketing Materials for Thermal Insulation.
  - N. ASTM D1056 Flexible Cellular Materials Sponge or Expanded Rubber.
  - O. ASTM D2842 Water Absorption of Rigid Cellular Plastics.
  - P. ASTM E84 Surface Burning Characteristics of Building Materials.
  - Q. ASTM E96 Water Vapor Transmission of Materials.
  - R. NFPA 255 Surface Burning Characteristics of Building Materials.
  - S. UL 723 Surface Burning Characteristics of Building Materials.
  - T. ASHRAE 90.1 – Energy Standard for Buildings Except Low Rise Residential Buildings
- 1.7 SUBMITTALS
- A. Submit under provisions of Section 22 05 00.
  - B. Product Data: Provide product description, list of materials 'k' value, 'R' value, mean temperature rating, and thickness for each service, and locations.
  - C. Samples: When requested, submit two samples of any representative size illustrating each insulation type.
  - D. Manufacturer's Installation Instructions: Indicate procedures which ensure acceptable workmanship and installation standards will be achieved.

## 1.8 QUALITY ASSURANCE

- A. All insulation, jacket, adhesives, mastics, sealers, etc., utilized in the fabrication of these systems shall meet NFPA for fire resistant ratings (maximum of 25 flame spread and 50 smoke developed ratings) and shall be approved by the insulation manufacturer for guaranteed performances when incorporated into their insulation system, unless a specific product is specified for a specific application, and is stated as an exception to this requirement. Certificates to this effect shall be submitted along with Contractor's submittal data for this section of the Specifications. No material may be used that, when tested by the ASTM E84 89 test method, is found to melt, drip or delaminate to such a degree that the continuity of the flame front is destroyed, thereby resulting in an artificially low flame spread rating.
- B. All surfaces to be insulated shall be clean and dry before applying the insulation. All sections of molded pipe covering shall be firmly butted together. Where an insulation covering is applied, it shall lap the adjoining section of insulation by at least three inches (3"). Where insulation terminates, it shall be neatly beveled and finished. No insulation shall be applied until the pipe, duct, etc., have been pressure tested and found tight. Piping, flexible connections, flanges, valves, strainers, and unions shall be covered unless specifically noted otherwise. Flexible connections on duct shall not be covered. All materials used shall be fire retardant or nonflammable. Refer to Section 22 05 00.
- C. All piping shall be insulated as indicated on the Drawings, as specified herein, and as required for a complete system. In each case, the insulation shall be equal to that specified and materials applied and finished as described in these Specifications.
- D. To be considered, alternate materials shall have equivalent thermal and moisture resistance of the specified materials.
- E. Jackets for piping insulation shall conform to requirements of ASTM C921, Type II for piping with temperatures above ambient.

## 1.9 QUALIFICATIONS

- A. All insulation shall be applied by mechanics skilled in this particular work and regularly engaged in such occupation.
- B. All insulation shall be applied in strict accordance with these Specifications and with factory printed recommendations on items not herein mentioned. Unsightly, inadequate, or sloppy work will not be acceptable, and all such work shall be removed and replaced as many times as necessary to achieve an acceptable installation. The company performing the work of this section shall have a minimum of three years' experience specializing in the trade.

## 1.10 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect, and handle products to site under provisions of Section 22 05 00.
- B. Deliver materials to site in original factory packaging, labeled with manufacturer's identification, including product thermal ratings and thickness.
- C. Store insulation in original wrapping and protect from weather and construction traffic. Protect insulation against dirt, water, chemical, and mechanical damage.

## 1.11 ENVIRONMENTAL REQUIREMENTS

- A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.
- B. Maintain temperature during and after installation for minimum period of 24 hours.
- C. All insulation materials to be asbestos free.

## PART 2 - PRODUCTS

### 2.1 DOMESTIC HOT AND COLD WATER

- A. All domestic hot and cold water lines in buildings, including valves, strainers, unions, flanges, etc., except where specifically noted to the contrary, shall be insulated.
- B. All domestic cold water lines shall be insulated as scheduled with preformed fiberglass insulation with a factory applied All Service Jacket, vapor sealing all joints, and factory performed fittings with vapor seal, or a flexible, "25-50" rated, closed cell elastomeric thermal insulation such as "Self Seal Armaflex 2000". Elastomeric products shall be supplied in a pre-slit tubular form with a pressure sensitive adhesive system for closure and vapor sealing of the longitudinal joint. All elastomeric insulating products shall be guaranteed not to react with copper piping. Valves shall be insulated with mitered pipe covering with voids filled with glass fiber blanket insulation. Valves and fittings shall be vapor sealed with a water base asphaltic emulsion. Fittings on concealed insulation shall be built up to the thickness of adjacent insulation with glass fiber fitting wrap and shall be finished with Glasfab tape embedded in vapor barrier emulsion. Exposed fitting insulation shall be built up to same thickness as adjoining pipe insulation with one coat cement and after drying shall be finished with a white vapor seal and canvas jacket secured with "Arabol" adhesive and be suitable for painting. Seams in jacket shall be placed in the least noticeable locations. Where seams, joint or fittings are rough they shall be covered with an application of insulating cement troweled on smoothly before the canvas is applied with Arabol adhesive. The canvas must be free of wrinkles and have a smooth, neat appearance.
- C. All domestic hot water piping systems shall be insulated as specified above for cold water except the vapor barrier may be deleted and the lap and butt joints secured with staples and a field applied adhesive (self sealing lap and butt joints alone are not acceptable). The insulation thickness shall be as scheduled. Where service temperature exceeds 250°F, insulation shall contain high temp binders.

### 2.2 ROOF DRAIN AND OVERFLOW DRAIN PIPING

- A. All horizontal runs of roof drain piping in the building, and the bottom of all roof drains shall be insulated and sealed to the roof. Insulation shall be as specified for domestic cold water. Vertical roof drain piping inside the building shall not be insulated.

### 2.3 TYPE A: FIBERGLASS

- A. Owens Corning or equal glass fiber insulation piping insulation with a "K" factor of 0.23 BTU-In/Hr.-degree F at 75°F and 0.32 BTU-In/Hr.-degree F at 250°
  - 1. Rated maximum service temperature of 850°F.
  - 2. Maximum density of 3.5-5.5 lbs/ft<sup>3</sup>

3. Compressive strength of 28.5 psi minimum when tested in accordance with ASTM C165.
4. Rated as 25 flame spread and 50 smoke developed when tested in accordance with ASTM E84, UL 723, CAN/ULC-S102-M88 or NFPA 255.
5. Certified to meet the requirements of ASTM C795 for use over stainless steel.
6. Rated as noncombustible when tested in accordance with ASTM E136.
7. Insulation treated with water resistant resin on the surface and within each layer of the insulation

#### 2.4 TYPE B: CLOSED CELL ELASTOMERIC

- A. Closed cell elastomeric piping insulation with a "K" factor of 0.25 BTU-In/Hr.-degree F at as manufactured by Armacell or equal.
  1. Rated maximum service temperature of 220°F.
  2. Rated as 25 flame spread and 50 smoke developed when tested in accordance with ASTM E84, UL 723, CAN/ULC-S102-M88 or NFPA 255.
  3. Certified to meet the requirements of ASTM C795 for use over stainless steel.
  4. Rated as noncombustible when tested in accordance with ASTM E136.

#### 2.5 PROTECTIVE JACKETING

- A. Aluminum Jacketing and fitting covers: 0.016 aluminum smooth as manufactured by Premetco or Childers. The jacket shall be pre-cut, pre-rolled, and lapped a minimum of two inches (2") in all directions to shed water. The metal shall be secured at each joint with a minimum of one each (1 ea.) 3/4" wide .020 aluminum or stainless steel band and seal. The metal jacketing and fitting covers shall be fabricated of 0.016" aluminum or stainless steel with a smooth finish.
- B. PVC Jacketing: Proto Corp. LoSmoke PVC jacketing and fitting covers Material shall have 25/50 rating and shall be limited to piping systems operating at 140 degrees or below.

### PART 3 - INSTALLATION

#### 3.1 EXAMINATION

- A. Verify that piping has been tested before applying insulation materials.
- B. Verify that surfaces are clean, foreign material removed, and dry.

#### 3.2 INSTALLATION

- A. Install materials in accordance with manufacturer's instructions in the absence of specific instruction herein.
- B. On exposed piping, locate insulation and cover seams in least visible locations, but not higher than at the side of the pipe at the "90°" position, with the seam lapped such that the lap is directed down.
- C. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations.
- D. For insulated pipes conveying fluids above ambient temperature:
  1. Provide standard jackets, with or without vapor barrier, factory applied or field applied.

2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe.

E. For hot piping conveying fluids 140 degrees F or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.

### 3.3 INSERTS, SUPPORTS AND SHIELDS

A. Application: Piping 3/4 inch diameter or larger for all systems.

B. Shields: Install between pipe hangers or pipe hanger rolls and inserts. Hangers shall be on the outside of the insulation and shall not be in contact with the pipe. Curved metal shields shall be used between the hangers or support points and the bottom of the insulated pipe for insulated pipes 3/4" and larger. Curved metal shields shall be designed to limit the bearing stress on the insulation to 35 psi and shall be curved to fit up to mid-perimeter of the insulated pipe. Shields shall be made of galvanized iron, or black iron painted on both sides with two coats of aluminum paint. Required metal shield sizes are as follows:

Nominal IPS	Metal Thickness of Shield	Lengths
up thru 2"	14 gauge	12"
thru 6"	12 gauge	16"
and above	10 gauge	20"

C. Insert Location: Between support shield and piping and under the finish jacket.

D. Insert Configuration: Minimum 2" inches longer than length of shield, of same thickness and contour as adjoining insulation; may be factory fabricated.

E. Insert Material: Heavy density insulating material suitable for the planned temperature range, and the weight of the pipe.

F. The shields at support points shall be secured with 1/2" x 0.016" stainless steel bands and seals.

G. Finish insulation at supports, protrusions, and interruptions.

H. In lieu of the above the following system of support may be used:

1. At the pipe support positions, the insulation and vapor barrier shall be continuous and shall not be punctured by the support. The insulation at the support shall be the full circumference of 5lbs/ft<sup>3</sup> INSUL-PHEN Foam material to withstand the bearing loads transmitted from the pipe to the support, it shall extend for at least 1" on either side of the support to allow sealing of the joints with the pipe insulation jacket.

2. The load bearing insulation at the support shall be capable of withstanding the maximum static compressive loads generated by pipe supported at the centers shown in Table Variations: Pipe loads greater than those generated at the support centers shown in Table 1 shall be referred to the manufacturer to establish the length and density of the insulated support block. The support centers are based on the weight of Sch 80 pipe filled with water and covered with 1" thickness of 2.2 lbs/ft<sup>3</sup> standard insulation including FSK/ASJ vapor barrier.

I. Table 1 K Block Support Centers

Nominal Pipe Size	3/4	1	1 1/4	2	2 1/2	3	4	6	8	10	12	14	16	18	20	24
Max support centers (feet)																
Sch 80 pipe filled with water covered with 1" of Standard Insulation	6.5	6.5	6.5	10	10	10	10	10	14	14	14	20	20	20	20	20
Metal Saddle Gauge (Galvanized Steel)	22	22	22	20	20	20	16	14	14	14	14	14	14	14	14	14
Length of K Block (inches)	6	6	6	6	6	6	6	9	9	9	9	9	9	12	12	12

1. The Insulation at supports shall be a Kooltherm K Block. K Blocks shall be faced with factory applied FSK/ASJ vapor barrier and fitted with a galvanized steel 1800 saddle bonded to the bottom section of the K Block, for all pipe sizes 1 1/2" and larger.
2. The vapor barrier shall be completed by the use of a FSK/ASJ overlap and factory applied self-seal lap tape and sealed with vapor barrier adhesive.
3. At all support positions, other than those where the insulated pipe support block is surrounded by a clip or saddle in direct contact with the block, a block designed to accept the loads generated by the pipe shall be presented to the engineer for approval. e.g. Of the type Kooltherm products K Block. Ref:-Kooltherm sketch 106/2c for use with Roller or flat beam support.
4. In all cases where roller supports are used the length of the insulation and the wearing plate where fitted shall extend beyond the limits of the pipe movement.

J. For purpose of definition in this Specification: "concealed" areas are those areas which cannot be seen by the building occupants, and "exposed" areas are all areas which are exposed to view by the building occupants, including under counter and inside cabinet areas, plus all mechanical rooms.

K. Self-Sealing Lap and butt joints will not be acceptable as the only seal on piping insulation joints. Self Sealing Lap and butt joints may be utilized only if the joints are additionally secured with field applied vapor barrier adhesive (on piping Systems requiring vapor barriers) or staples and field applied adhesive (on piping system which do not require a vapor barrier jacket). Mechanical fasteners shall be used whenever possible to assure permanent installation.

L. Insulation minimum thickness shall be as scheduled; however, additional thickness shall be provided to prevent condensation on the cold surfaces and to provide a maximum exterior insulation surface of 140 degrees F on the hot surfaces.

M. All insulated piping in the mechanical rooms within 8'-0" of the floor shall be encased in an aluminum protective jacket, and where applicable, finish at top with nickel-plated brass flange plate with set screws or end joint sealing butt strips.

N. All piping with crawl space, outside building and in tunnels shall be protected with an aluminum jacket.

### 3.4 PAINTING

A. All exposed insulation shall be prepared to receive painting specified under Section 09 91 00.

3.5 INSULATION APPLICATION SCHEDULE

A. Where minimum scheduled thickness exceeds the thickness required to meet the minimum R-Value, provide the minimum scheduled thickness.

<u>Service</u>	<u>Pipe Diameter Inches</u>	<u>Location</u>	<u>Fluid Temp Degrees F</u>	<u>Min. R-Value</u>	<u>Insulation Type and Thickness in Inches</u>	
Domestic Cold Water And Makeup Water	All Sizes	Interior	Ambient	4.2	<u>Type A</u> 1	<u>Type B</u> 1
Domestic Cold Water and Domestic Hot Water	All Sizes	Interior, Serving Single Fixtures	Ambient	2.1	<u>Type A</u> 1/2	<u>Type B</u> 1/2
Domestic Hot Water Supply & Return	1 to 1-1/4	Interior	105-140	4.2	<u>Type A</u> 1	<u>Type B</u> 1
Domestic Hot Water Supply & Return	1-1/2 and up	Interior	105-140	6.4	<u>Type A</u> 1-1/2	<u>Type B</u> 1-1/2

1. All insulation R-Values shall be the greater of what is scheduled above or required to meet ASHRAE 90.1-2010.
2. Minimum 'R' does not consider water vapor transmission and condensation. Additional insulation and/or vapor retarders may be required to limit water vapor transmission and condensation under extreme conditions.
3. Refer to floor plans for any additional locations for insulating piping due to acoustical concerns.

END OF SECTION 22 07 19



## SECTION 22 11 16 - DOMESTIC WATER PIPING SYSTEMS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including "Uniform General Conditions and Supplementary General Conditions For The State Of Texas Building Construction Contracts" and Division 01 Specification Sections, apply to the work of this Section.
  - 1. Where the term "Owner's Designated Representative" is used, it shall mean a member of the project's capital team.

#### 1.2 SUMMARY

- A. This Section includes requirements for furnishing and installing domestic hot and cold water piping, including hot water return, makeup water and irrigation water within the building.

#### 1.3 RELATED SECTIONS

- A. Section 22 05 53 - Identification for Plumbing Piping and Equipment.
- B. Section 22 05 00 - Common Work Results For Plumbing.
- C. Section 22 07 19 - Plumbing Piping Insulation.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Field quality-control reports.

#### 1.5 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 14 for plastic, potable domestic water piping and components.
- C. Comply with UL classified in accordance with ANSI/NSF 61 for hot and cold potable water service and shall be certified to the low lead requirements of NSF-372 for potable domestic water piping and components. Manufacturer must provide written documentation of compliance.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with requirements provide indicated products by manufacturers listed.
  - 1. Valves:
    - a. Apollo.
    - b. Crane.

- c. Nibco.
- d. Keystone.
- e. Watts.
- f. Milwaukee.
- g. Hammond.
2. Vacuum Breakers and Backflow Preventers:
  - a. Watts.
  - b. Wilkins.
  - c. Apollo
3. Expansion Tanks:
  - a. Amtrol.
  - b. Watts.
  - c. Taco.

## 2.2 PIPING AND FITTINGS

- A. Underground Piping:
  1. Underground Piping: Type K soft copper shall be used for underground piping.
- B. Aboveground: Provide seamless, Type L copper water tube with ANSI B16.22 wrought copper fittings with socket ends. Lead-free solder for all solder joints.
- C. Fittings:
  1. All fittings shall be Streamline Solder Fittings manufactured by Streamline Pipe and Fittings Division, Mueller Brass Company, or approved equal. These wrought copper fittings shall be rigid and strong with openings machined to accurate capillary fit for the pipe.
  2. Joints are to be soldered and/or brazed. Joints in piping 2" and smaller are to be made with either 95/5 (95% tin/5% antimony) or 96/4 (96% tin/4% silver). Piping joints 2-1/2" and larger are to be made utilizing Sil-Fos 15 (15% silver/80% copper/5% phosphorus). Joints that are to be soldered, shall be made with a water soluble flux and lead free solder.
- D. Unions: ANSI B16.22 Class 150, 300-pound water-oil-gas service wrought solder joint fitting such as NIBCO 633/733 union C x C, or approved equal.
  1. Flange joints larger than 2 inches shall be brass.
  2. Provide dielectric isolating unions or connections between metallic piping of dissimilar metal.
  3. Dielectric waterway fittings with grooved and/or threaded ends, as manufactured by Victaulic Company, Series 647, for sizes 1/2" through 8".

## 2.3 VALVES

- A. Comply with requirements in Section 22 11 19, Domestic Water Piping Specialties, for balancing valves, drain valves, backflow preventers, and vacuum breakers.
- B. Ball Valves (pipe sizes through 2 inches): 600 psi WOG, cast silicone bronze body, ASTM B584 Alloy C87600, two piece reinforced Teflon seats, full port, blowout proof stem, quarter turn handle with stainless steel ball and stem with threaded ends, manufactured by NIBCO No. T-585-66-LF or approved equal.
- C. Check Valves:

1. 2 inches and smaller: Class 125, horizontal swing silicone bronze disc, with bodies and caps conforming to ASTM B 584 Alloy 87850 cast silicone bronze material, threaded ends, manufactured by NIBCO No. T-413-Y-LF or approved equal.
  2. 2-1/2 inches and larger: Class 125, iron body, globe style, renewable seat and disc, spring actuated, lead free, conforming to NSF/ANSI 61 & 372, MSS SP-125, FM approved. For flanged systems - Nibco Model F-910-B-LF, or approved equal. For grooved piping systems - Nibco Model G-920-W-LF, or approved equal.
- D. Domestic Hot Water Circulation Loop Circuit Setter (Balancing Valve): Self-contained fully automatic, constructed of type 303 stainless steel, rated for 200 psig maximum working pressure, thermal actuated, self-cleaning, spring loaded, designed for hot water system set to close at 140 degrees F (fully open at 130 degrees F), ANSI/NSF 61 certified, complete with check valve and lead free ball valve on inlet and outlet side of valve, manufactured by ThermOmegaTech "CircuitSolver" No. CSUA-3/4-XXX-CV-03, or approved equal. Refer to floor plan for flow rate (gpm) setting. Contractor shall balance the new domestic hot water return installation to insure the flow rate is correct within the design.
- E. Water Pressure Reducing Valves:
1. Manufacturers: Other acceptable domestic manufacturers offering equivalent products will be considered. Valves must be NSF-61 compliant.
  2. 1 Inch and Smaller: Watts Model No. LF223SB; bronze body with integral bronze strainer, built-in by-pass feature, direct acting design, renewable stainless steel seat, threaded ends, rated for 300 psig inlet pressure, outlet pressure adjustable from 25 to 75 psig.
  3. 1 1/4 Inch and Larger: Cla-Val Model No. 90G-01ACJ; pilot-operated, screwed ends for sizes 2 inch and smaller and Class 150 flanged ends for sizes 2 1/2 inch and larger, 15 to 75 psig adjustment range, stainless steel trim, cast iron body, FDA approved epoxy coated inside, strainer on pilot operating control line, closing speed control and flow stabilizer. Install dielectric flange isolation kits where valves are installed in copper piping systems.
- F. Relief Valves:
1. Combination Temperature and Pressure Relief Valves: Watts, or approved equal, domestic manufacturer, bronze body, reseating type, test lever, capacities ASME rated and design certified by AGA, certification label attached to valve, temperature sensing element length as required for immersion in the water within the top 6 inches of the tank.
  2. Pressure Relief Valves: Kunkle Model No. 20M, or approved equal, domestic manufacturer, bronze body, stainless steel seat and disc.
- ## 2.4 STRAINERS
- A. Y type, for pipe sizes 2 inch and less, class 125 rated for working pressure through 200 psig at 200°F, threaded ends, threaded cap, ASTM B62 cast bronze body and cap, 20 mesh stainless steel screen, openings not larger than 1/32 inch, tapped blowout outlet with minimum size of 1/4 inch, similar to NIBCO No. T-413-Y-LF, or approved equal.
- B. Y type, for pipe sizes over 2 inch, Class 125, iron body, globe style, renewable seat and disc, spring actuated, lead free, conforming to NSF/ANSI 61 & 372, MSS SP-125, FM approved. For flanged systems - Nibco Model F-910-B-LF, or approved equal. For grooved piping systems - Nibco Model G-920-W-LF, or approved equal.

## 2.5 VACUUM BREAKERS AND BACKFLOW PREVENTERS

- A. Atmospheric Vacuum Breakers: Full line size, manufactured of brass or bronze with full size orifice, dry guide out of the liquid pressure area and disc float closing vent with minimum flow. Manufactured by Watts Regulator, No. 288A Series, or approved equal by Wilkens or Apollo.
- B. Pressure Type Vacuum Breaker: Full line size, with full size orifices, manufactured of brass or bronze with double poppit (check valve) stainless steel screen and vent. Manufactured by Watts Regulator, No. LF800M4QT, or approved equal by Wilkens or Apollo.
- C. Reduced Pressure Backflow Preventer: Size as indicated on Drawings, manufactured of bronze, rated for 175 psi, and shall include strainer, gate or ball valves based on size, pressure differential relief valve, check valves, test cocks, and relief vent and funnel drain.
  - 1. Unit shall meet the requirements of ASSE 1013, and AWWA, University of Southern California tested and approved.
  - 2. Backflow preventers shall be installed where they are easily accessible. Provide a minimum 36" clearance in front of device for testing/maintenance. Backflow preventers shall not be concealed or installed above ceilings.
  - 3. Sizes 2" and Smaller: : Watts Series LF909 reduced pressure type, or Zurn-Wilkins Model 975XL reduced pressure type with NSF-61 compliant bronze body construction, stainless steel check modules (including seats); stainless steel relief valve seats, shafts and flange bolts; integral body unions for sizes 3/4" and 1", flanged adapter ends for sizes 1 1/4", 1 1/2" and 2"; 1/4 turn, full port, resilient seated, bronze ball valve shut-off valves on inlet and outlet of backflow preventer; bronze strainer on inlet. Install approved air gap connection piped to drain.
- D. Vacuum Relief Valve: 3/4 inch bronze with high temperature resisting disc, and disc guide located out of water.
  - 1. Tested up to 200 psi and 250°F and shall be open on a vacuum of not more than 1/2 inch of mercury.
  - 2. Manufactured by Watts Regulator No. N36g, or approved equal by Wilkens or Apollo.

## 2.6 AIR RELIEF VENTS

- A. Float operated, constructed of cast iron with stainless steel float and trim and isolating valve:
  - 1. 1/2 inch, rated at 300 psi at 150°F.
  - 2. Vents shall be designed to eliminate air from the system automatically without permitting the passage of water.
  - 3. Minimum 3/4 inch system connection (inlet), minimum 1/2 inch drain connection (outlet), 1/4 inch drilled, tapped and plugged test connection.
  - 4. Manufactured by Clark-Reliance, Model No. 6-V, or approved equal.
- B. For sizes under 2" (Point of Use at Equipment Connections): Automatic in operation, adjustable, renewable stainless steel seat, bronze body, adjustable from 25-75 psi outlet pressure, with stainless steel strainer screen, with gauge tappings, manufactured by Watts No. U5B, or approved equal.

## 2.7 EXPANSION TANK

- A. ET-1: ASME coded pre-charged hydropneumatic steel expansion tank, constructed with a maximum working pressure of 150 psig. Internal wetted parts in compliance with FDA regulations and approvals. Internal butyl diaphragm, isolating air from water. Refer to plumbing drawings/schedules for volume and dimensions. Manufactured by Amtrol Therm-X-Trol or approved equal by Watts or Taco.

## 2.8 GROUT

- A. Standard: ASTM C 1107, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- B. Characteristics: Nonshrink; recommended for interior and exterior applications.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

## PART 3 - EXECUTION

### 3.1 EARTHWORK

- A. Comply with requirements in Division 31 Section, Earth Moving, for excavating, trenching, and backfilling.

### 3.2 CONNECTION

- A. Install unions downstream of all threaded valves and in all locations that supply serviceable equipment.
- B. Screwed Joints: Make joint with clean, full cut standard pipe threads. Ream after cutting and threading. Use heavy duty Teflon sealing compound or Teflon tape as threaded seal. Sealing compound shall be AGA and NSF certified, non-toxic, non-drying, anti-seize, and classified by UL.
- C. Use anti-seize compound on all bolts for flanges.
- D. Press type pipe joints shall be made in accordance with manufacturer's installation instructions. The tubing shall be fully inserted into the fitting and the tubing marked at the shoulder of the fitting. The fittings alignment shall be checked against the mark on the tubing to assure the tubing is fully engaged (inserted) in the fitting. The joints shall be pressed using the manufacturer's approved tool.

### 3.3 INSTALLATION

- A. Encase all underground cast iron or ductile iron pipe and fittings in black 8-mil thick, polyethylene plastic sheet.

- B. If water service building entry occurs through an exterior building wall, insert Schedule 40 galvanized steel pipe sleeve in the forms of the building wall through which the water service enters the building. The interior diameter of such sleeve is to be four inches (4") greater than the exterior diameter of the water service. Position the water service in this sleeve concentrically and seal the annular space with a Link-Seal. Provide stainless steel escutcheon at wall penetration.
- C. Provide a protective wrapping of "Tape Coat" SP, warmed with hand torch, to protect all underground copper piping. Spirally wrap pipe with a minimum half tape width overlap. Prior to installing tape, clean and prime pipe as recommended by the tape manufacturer. With owner approval in writing, Armaflex pipe insulation may be used for underground copper piping in lieu of wrapping the piping with tape, provided that all insulation joints are sealed and taped.
- D. Arrange groups of fixtures to have their group valves in one location. Provide access to all concealed valves by means of access doors. Coordinate the location of valves with the architectural features of the building in order that the access doors will be located symmetrically with other features and will be suitable for the finished construction materials.
- E. Securely anchor hot and cold water piping inside wall and chase construction to uni-strut by means of strut-clamps or other ridged approved material to be secured between wall studs to prevent movement of plumbing fixture trim and piping. Secure copper piping to uni-strut by means of uni-strut crush-clamps, isolation tape is prohibited.
- F. Use reducing fittings for reducing or increasing where any change in the pipe sizes occurs. No bushing of any nature will be allowed in piping.
- G. Assemble all exposed chrome plated, polished or enameled connections from fixtures with special care, showing no tool marks or threads at fittings, and supported by neat racks or hangers with round head screws of same material and finish.
- H. Provide manufactured shock arrestors in each hot and cold water supply to every plumbing fixture and piece of equipment requiring water connections. Contractor fabricated pipe type air chambers are not allowed. Refer to Section 22 05 84 for shock arrestor specifications.
- I. Testing And Sterilization:
  - 1. Test all water piping systems to assure their being absolutely tight. In the case of pipes which are to be insulated, these tests are to be completed and the piping system proven to be absolutely tight before any insulation is applied. Wherever pipes are placed so that they will ultimately be concealed, conduct these tests and demonstrate the absolute tightness of each piping system before the piping is concealed.
  - 2. Subject all new piping to a hydrostatic pressure test of 150 pounds per square inch gauge for a period of no less than twenty-four hours. During this test period, carefully inspect all pipe, fittings and accessories in the particular piping system which is being tested. If leaks are detected, repair leaks and repeat the hydrostatic test. Repeat this procedure until, for an entire twenty-four hour period, no leaks can be found while the system being tested is subjected to the pressure mentioned above. With owner approval in writing, piping located in occupied or sensitive areas may be tested pneumatically at 150 psi for 24 hours in lieu of the hydrostatic test.

3. Following hydrostatic testing, subject all new piping to its normal operating pressure and temperature for a period of no less than five (5) days. During that period, carefully observe all portions of the new piping for leaks. The piping systems must demonstrate the propriety of their installation by remaining absolutely tight during this period. Even though the completion of these tests is satisfactory, there is a continuing responsibility for the ultimate, proper, and satisfactory operation of such piping systems and their accessories.
  4. After completion of the testing, the new cold and hot water piping, with attached equipment, must be thoroughly sterilize new piping with a solution containing not less than 50 parts per million of available chlorine. Utilize liquid chlorine conforming to U. S. Army Specification No. 4-1 or calcium hypochlorite or chlorinated lime conforming to the requirements of Federal Specification O-C-114. Allow the sterilizing solution to remain in the system for a period of eight (8) hours during which time all valves and faucets are to be opened and closed several times. After sterilization, flush the solution from the system with clean water until the residual chlorine content is not greater than 0.2 parts per million.
  5. Conduct the sterilization process as required by the owner Specifications, and upon completion of the process, the contractor is to use an NELAP Approved Laboratory to test and certify the cleanliness of the water piping system. Pay all costs and charges incidental to this test and certification. Provide certificate from Laboratory to Owner.
  6. The Owner's Representative will supervise and witness the sterilization process.
  7. At the Owner's discretion, the sterilization process may be waved.
- J. Once water is introduced into the piping system, the contractor will be responsible for flushing the system weekly until the system has been turned over to the Owner for use. A written flushing plan is required to be approved by the Owner prior to the start of construction.
- K. The system shall not have any dead legs longer than 2 times the pipe diameter.
- L. Any piping to be used for domestic water is to be sealed on both ends while stored on site until use.
- 3.4 DRAINAGE
- A. Install water piping systems with uniform horizontal grade of 1/8 inch per 10 feet, minimum, to low points to provide complete drainage of the system. Where constant pitch cannot be maintained for long runs, establish intermediate low points and rise to new level. Grade branches to drain to mains or risers. Unless otherwise indicated, terminate low points of risers with drain valve piped to nearest hub or floor drain.
- 3.5 IDENTIFICATION
- A. Identify system components. Comply with requirements in Section 22 05 53.4, Identification for Plumbing Piping and Equipment, for identification materials and installation.
- B. Label pressure piping with system operating pressure.
- 3.6 FIELD QUALITY CONTROL
- A. Perform tests and inspections.
- B. Piping Inspections:

1. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
2. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
  - a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
  - b. Final Inspection: Arrange final inspection for authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
3. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

C. Piping Tests:

1. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
2. Test for leaks and defects in piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
3. Leave domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
4. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
5. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
6. Prepare reports for tests and for corrective action required.

D. Domestic water piping will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

### 3.7 CLEANING

A. Clean and disinfect potable domestic water piping as follows:

1. Purge new piping before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:
  - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
  - b. Fill and isolate system according to either of the following:
    - 1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
    - 2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.
  - c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
  - d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.



- B. Prepare and submit reports of purging and disinfecting activities.
- C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

END OF SECTION 22 11 16

## SECTION 22 11 17 - GAS PIPING AND APPURTENANCES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including "Uniform General Conditions and Supplementary General Conditions For The State Of Texas Building Construction Contracts" and Division 01 Specification Sections, apply to the work of this Section.
  - 1. Where the term "Owner's Designated Representative" is used, it shall mean a member of the project's capital team.

#### 1.2 SUMMARY

- A. This Section provides requirements for furnishing and installing gas piping inside and outside of building, including the supply line from the gas meter, service lines to gas equipment and appliances, termination of the service line with a valve, and final connection to equipment and appliances. Also included shall be the gas vent piping. Contractor is responsible for all fees required by the natural gas utility company to furnish the gas meter assembly with main pressure regulator and installation of natural gas piping system extending to the meter from utility company gas main located on the campus. Refer to civil drawings for general routing to meter. All work shall be compliant with the city of Port Arthur Building Codes (as applicable), NFPA 54 and the International Fuel Gas Code. NFPA 54 shall apply to gas systems operating at a pressure of 125 psi or less.

#### 1.3 RELATED WORK

- A. Section 22 05 00, Painting.
- B. Section 22 05 00, Common Work Results for Plumbing.
- C. Section 22 05 26, Pipe and Pipe Fittings.
- D. Section 22 05 53, Identification for Plumbing Piping and Equipment.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For facility natural gas piping layout. Include plans, piping layout and elevations, sections, and details for fabrication of pipe anchors, hangers, supports for multiple pipes, alignment guides, expansion joints and loops, and attachments of the same to building structure. Detail location of anchors, alignment guides, and expansion joints and loops.
- C. Delegated-Design Submittal: For gas piping and equipment indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
  - 1. Detail fabrication and assembly of anchors and seismic restraints.
  - 2. Design Calculations: Calculate requirements for selecting seismic restraints.

3. Detail fabrication and assembly of pipe anchors, hangers, supports for multiple pipes, and attachments of the same to building structure.

- D. Brazing certificates.
- E. Welding certificates.
- F. Field quality-control reports.
- G. Operation and maintenance data.
- H. Warranty: Sample of special warranty.

## 1.5 QUALITY ASSURANCE

- A. Brazing: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX.
- B. Steel Support Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- C. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- E. Comply with ASME B31.9, "Building Services Piping," for fuel-oil piping materials, installation, testing, and inspecting.
- F. Comply with requirements of the EPA and of state and local authorities having jurisdiction. Include recording of fuel-oil storage tanks and monitoring of tanks and piping.

## PART 2 - PRODUCTS

### 2.1 GENERAL

- A. Ball Valves: Subject to compliance with requirements, provide products by one of the following:
  1. Watts.
  2. Stockham.
  3. Nibco.
  4. Apollo
- B. Lubricated Plug Valves: Subject to compliance with requirements, provide products by one of the following:
  1. Fisher.
  2. Nordstrom.
  3. Milliken.

## 2.2 PIPE AND FITTINGS

### A. Piping:

1. Above Ground: Pipe shall be Schedule 40, ASTM A 53, black steel. Fittings for pipe sizes 2" and smaller at equipment connections shall be with black 150-pound malleable iron screwed fittings, conforming to ANSI B16.3. Fittings for 2 inch and smaller in all locations, upstream of equipment connections, shall be socket weld carbon steel fittings conforming to ANSI B16.11. Pipe larger than 2 inches in all locations: Provide Schedule 40, ASTM A53, black steel pipe with long radius butt weld fittings. All pipe joints located in crawl space shall be welded fittings, without exception. Valves and fittings at equipment connections shall be threaded or flanged. Outdoor aboveground pipe and fittings 2 inch and less shall have socket welded joints, and pipe and fittings over 2 inch shall have butt welded joints. Where gas piping is installed in a crawl space that does not have sufficient ventilation, the piping shall be encased in a Schedule 20 welded steel sleeve and vented to atmosphere exterior of the building.
2. Below Ground: Polyethylene resin conforming to ASTM D 1248, Type II, Grade 3, and with pipe properties conforming to ASTM D 2513. Piping with minimum wall thickness as required by SDR-11. Socket fittings through 2 inches, butt-fused fittings for 3 inches and larger. DuPont "Aldyl A" or approved equal.

B. Unions: Use 150-pound standard (300-pound water, oil or gas) malleable iron, ground joint unions, with bronze seat. Provide flange joints for pipe 3 inches and larger in diameter.

C. Flanges: Furnish Class 125 ANSI cast iron flanges.

D. At equipment connections flexible connectors may be used. The flexible connectors shall be corrugated stainless steel, ASTM A240 with U/V resistant polyethylene jacket, ASTM E84 compliant index for flame and smoke, manufactured by Gastite.

## 2.3 UNDERGROUND WARNING TAPE

A. Minimum 3 inch wide polyethylene detectable type marking tape. The tape shall be resistant to alkalis, acids and other destructive agents found in soil and impregnated with metal so that it can be readily recognized after burial by standard locating equipment.

1. Lamination bond of one (1) layer of Minimum 0.35 mils thick aluminum foil between two (2) layers of minimum 4.3 mils thick inert plastic film.
2. Minimum tensile strength: 63 LBS per 3 IN width.
3. Minimum elongation: 500 percent.
4. Provide continuous yellow with black letter printed message repeated every 16 to 36 inches warning of pipe buried below (e.g.: "CAUTION GAS LINE BURIED BELOW").
5. Manufactured by Reef Industries "Terra Tape" or approved equal.

## 2.4 VALVES

A. Ball Valves: Two piece, 600 psi WOG, cast brass body, replaceable reinforced Teflon seats, full port, blowout-proof stem, chrome-plated brass ball, threaded ends, carbon steel handle, quarter turn, MSS-SP-110 compliant, UL listed and CSA approved for natural gas service stamped directly on valve body (125G), manufactured by Nibco Model T-585-70-UL, or approved other.

- B. Plug Valves: Lubricated type, suitable for bi-directional dead end service, bubble tight shut-off, Port area at least 80% of the pipe area, self-cleaning plug sealing surfaces, cast iron ASTM A126 Class B body, threaded connection for sizes through 2 inch downstream of emergency shut-off valves, and flanged for all sizes upstream of emergency shut-off valves. Bolted bonnet, permanently lubricated with baked TFE or thermosetting epoxy boded to plug, ball checks, cast iron shaft with wrench operator for sizes smaller than 4 inch, position indicator, memory stop, specifically designed for natural gas service, CGA approved, GSA approval stamped on valve as fuel gas rated, manufactured by Nordstrom Figure 142, 143 or Walworth Figure 2720 and 2721.

## 2.5 GAS REGULATOR

- A. All pressure regulators shall be designed, manufactured and approved for natural gas service.
- B. Pressure regulators for individual service lines shall be capable of reducing distribution line pressure to pressures required for users. Pressure relief shall be set at a lower pressure than would cause unsafe operation of any connected user. Regulator shall have a single port with orifice diameter no greater than that recommended by manufacturer for the maximum gas pressure at the regulator inlet. Regulator vent valve shall be of resilient materials designed to withstand flow conditions when pressed against valve port. Regulator shall be capable of limiting build-up of pressure under no-flow conditions to 50 percent or less of the discharge pressure maintained under flow conditions. Commercial grade diaphragm type with internal relief valve, vent valve, cast iron body, Buna-N diaphragm. Manufactured by Sensus or Fisher.

## 2.6 GAS METERS

- A. Main meter for the entire Building (Complex): Provided and installed by the Natural Gas Utility Company.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. The serving utility company will provide connection to an existing gas main and service to the Complex Natural Gas meter assembly. Give proper notice and pay all fees and other costs for complete gas service.

### 3.2 INSTALLATION

- A. Installation Standards: The installation of the entire natural gas system shall be in accordance with NFPA 54. Provide warning tape for underground gas piping per NFPA 54.
- B. Drip Legs: Install a capped drip leg 6 inches long at the base of each vertical riser and at each equipment connection.
- C. Where natural gas piping is installed vertically, not grouped with other piping, secure to wall with hanger similar to B-Line Figure BL1400. Hanger shall be primed and painted to match wall. Hanger shall be on 4'-0" o.c. spacing.
- D. Sleeves:

1. Encase gas piping running in or through solid partitions and in spaces within the building in which gas might collect or from which gas might be introduced into supply or return air systems. Sleeving is only required where indicated on the plumbing drawings or where required by NFPA 54.
2. For encasement or sleeving, use Schedule 10, black steel pipe and fittings conforming to ASTM A 120, with welded joints.
3. Sleeve piping and fittings must be two pipe sizes, but not less than 1 inch larger than encased gas piping.
4. Vent sleeve to outside, or to nearest ventilated space discharging to outside.

E. Connections:

1. Make threaded joints with square, clean, full cut, standard taper pipe threads.
2. Ream after cutting and threading. Use heavy duty teflon sealing compound or teflon tape as threading seal.
3. Sealing compound shall be non-toxic, non-drying, anti-seize, UL classified, and AGA approved.

- F. All aboveground natural gas piping shall be primed and painted.

### 3.3 CLEANING AND PURGING

- A. Follow guidelines set forth in NFPA 54, and as specified.
- B. Pipe, tubing, fittings, valves and equipment shall be visibly clean of foreign material before being installed into the system. Pipe shall be cleaned by hammering, shaking or swabbing, or combination of methods.
- C. The system shall be purged with dry oil-free compressed air after erection. Oil free air is defined as containing less than 5 ppm oil with a 36°F or lower dewpoint. Use 80 to 90 psi pressure to purge system, unless otherwise indicated.
- D. Purge system at 12000 fpm velocity before installing any valves or control device. During the progress of construction, the open ends of pipe, fittings, and valves shall be properly protected to prevent the admission of foreign matter.
- E. Immediately after installation, valve outlets shall be closed with a threaded plug or cap and left closed until gas equipment is connected.

### 3.4 PRESSURE TESTING SYSTEM

- A. General: As a minimum pressure test system per NFPA 54. Test pressure shall be measured with a manometer or pressure measuring device designed and calibrated to read a pressure loss due to leakage during the pressure test period. Testing shall be conducted by a licensed plumber.
- B. For systems on which the normal operating pressure is 0.5 psig, the test pressure shall be 5.0 psig and the time interval shall be 30 minutes.
- C. For systems on which the normal operating pressure is 0.5 psig to 4.9 psig, the test pressure shall be 1.5 times the normal operating pressure or 5.0 psig, whichever is greater, and the time interval shall be 30 minutes.

- D. A pressure test using normal operating pressure shall be utilized only on systems operating at 5.0 psig or greater, and the time interval shall be one hour.
- E. Any interior piping failing the pressure test shall be repaired and retested or the piping shall be disconnected from the gas supply.

END OF SECTION 22 11 17

## SECTION 22 11 19 - DOMESTIC WATER PIPING SPECIALTIES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including "Uniform General Conditions and Supplementary General Conditions For The State Of Texas Building Construction Contracts" and Division 01 Specification Sections, apply to the work of this Section.
  - 1. Where the term "Owner's Designated Representative" is used, it shall mean a member of the project's capital team.

#### 1.2 SUMMARY

- A. This Section includes requirements for furnishing and installation of plumbing specialties including the following:
  - 1. Pressure and temperature taps.
  - 2. Automatic air vents.
  - 3. Pressure gauges.
  - 4. Thermometers.
- B. Section 22 11 16 - Domestic Water Piping Systems.

#### 1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Field quality-control test reports.
- C. Operation and maintenance data.

#### 1.4 QUALITY ASSURANCE

- A. NSF Compliance:
  - 1. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9."

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Pressure and Temperature Tap: Subject to compliance with requirements, provide products by Peterson Engineering Company, or Sisco.
- B. Automatic Air Vents: Subject to compliance with requirements provide cast iron body with stainless steel seat and float as manufactured by one of the following:
  - 1. Apco.
  - 2. Armstrong.
  - 3. Clark.
  - 4. ITT Bell & Gosset.
  - 5. Taco.



## 2.2 PRESSURE AND TEMPERATURE TAPS

- A. Location: Provide pressure and temperature taps where indicated on plumbing drawings and details.
- B. Taps: Provide ½ inch solid brass fittings which will receive either a pressure or temperature probe with valve core of Nordel and fitted with a color coded cap and gasket. Furnish "pete's Plug" as manufactured by Peterson Engineering Company, or "Sisco P/T Plug" as manufactured by Sisco, No. 710, rated at 275°F and 1000 psig. Provide long stem type for insulated pipe.
- C. Instruments: Provide two No. 500 "Pete's Plug" pressure gauge adapters with four gauges and probes, and four 5 inch stem pocket thermometers. Two thermometers for domestic hot water systems when applicable. "Pete's plugs" to match insulation thickness.

## 2.3 WATER SYSTEM AIR VENTS

- A. Furnish and install cast iron body fixed pivot ball automatic float-type air vents at high points of all hydronic systems and where shown on Drawings.
  - 1. Cast iron vent body with stainless steel float, and stainless steel seat, valve and lever.
  - 2. Rate vent for a minimum 125 psi, 400°F.
- B. Extend 1/2-inch copper discharge drain to nearest floor or hub drain.
- C. Ball Valve: Place between air vent and piping system.
  - 1. 600 pound w.o.g., full port two-piece ball valve with stainless steel ball, reinforced seat, blowout proof stainless steel stem and lever handle, similar to Nibco T-585-70-66LF.

## 2.4 GAUGES AND THERMOMETERS:

- A. General. Provide gauges and thermometers for monitoring plumbing systems as shown on the drawings and specified herein.
- B. Gauges. Gauges shall be Ashcroft, Terice, Weksler, Moeller, or U.S. with 4-1/2" dial face, phenol case, stainless steel movement with Grade A phosphor bronze bourdon tube and micrometer-type calibration adjustment screw. Accuracy shall be 1/2 of 1% of full scale. Provide a Crane No. 222H or needle valve with snubbers at the pumps. Provide liquid filled gauges at pumps. Gradation shall be one pound or less.
- C. Thermometers. Thermometers shall be Weksler, Marshall Town or Ashcroft with 5" dial, all stainless steel construction bi-metal type with accuracy of +/- 1% of scale range. Minimum of 2-1/2" straight or angle form stem as best suited for reading. Stem length shall be sized to provide most accurate reading for pipe diameter.
- D. Thermometer Wells. Thermometer wells shall be brass or stainless steel with pressure and temperature ratings suitable for their application. Wells for insulated piping shall have a 2-1/2" lagging protrusion. Locate thermometer wells so the sensing bulb will give a true and correct reading. Install thermometer so as not to cause undue restriction in small piping. Where wells are located in pipelines 1-1/2" and smaller, provide a section of pipe of such diameter that the net area of the pipeline will not be reduced by the thermometer well. All wells shall be filled with silicon and complete with caps and chains.

- E. Range and Gradations. Gauges and thermometers shall be selected to give range and gradations best suited for quantities to be measured. Generally, gauges and thermometers shall be selected so that normal operating pressures and temperatures are not more than 2/3 nor less than 1/2 of the range; scale division shall be 1°F. Typical ranges for domestic cold water shall be 0° to 100°F and for domestic hot water shall be 30°F to 240°F.
- F. Gauge Locations. Provide pressure gauges at the following locations:
  - 1. Suction side of each pump (except sump pumps and sewage ejectors).
  - 2. Discharge side of each pump (except sump pumps and sewage ejectors).
  - 3. At the main domestic service entry.
  - 4. At the top of the main domestic water risers.
- G. Thermometer Locations. Provide thermometers and thermometer wells at the following locations:
  - 1. On each hot water circulating loop return line from the building (locate near circulating pump).
  - 2. On each incoming cold water supply to each domestic water heater.
  - 3. On the outlet hot water from the domestic water heater.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Refer to Section 22 05 00, Common Work Results for Plumbing, for piping joining materials, joint construction, and basic installation requirements.
- B. Install hydronic specialty items as shown on Drawings and in accordance with manufacturer's installation requirements.
- C. Provide automatic air vents at all high points in systems. For air vents above ceilings and concealed areas, provide copper vent tubing to nearest hub or floor drain.
- D. For strainers, provide valve connection piped to floor drain at all pumps. On strainers that are not piped to drain, provide valved connection with hose adapter and cap.
- E. Provide valved manual air vent where indicated on Drawings. Install pipe plug in valve.

END OF SECTION 22 11 19

## SECTION 22 13 16 - SANITARY WASTE AND VENT PIPING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including "Uniform General Conditions and Supplementary General Conditions For The State Of Texas Building Construction Contracts" and Division 01 Specification Sections, apply to the work of this Section.
  - 1. Where the term "Owner's Designated Representative" is used, it shall mean a member of the project's capital team.

#### 1.2 SUMMARY

- A. This Section includes requirements for furnishing and installing sanitary waste, soil and grease waste system piping and associated vent piping within buildings and underground laterals within 5 feet of building.

#### 1.3 RELATED WORK

- A. Section 22 05 53 - Identification for Plumbing Piping and Equipment.
- B. Section 22 05 29 - Hangers and Supports for Plumbing and Equipment.

#### 1.4 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum working pressure, unless otherwise indicated:
  - 1. Soil, Waste, and Vent Piping: 10-foot head of water.

#### 1.5 SUBMITTALS

- A. Field quality-control inspection and test reports.

#### 1.6 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping; and "NSF-drain" for plastic drain piping.

### PART 2 - PRODUCTS

#### 2.1 PIPING MATERIALS

- 1. Pipe shall be manufactured from virgin rigid PVC (polyvinyl chloride) vinyl compounds with a cell class of 12454 as identified in ASTM D 1784. PVC Schedule 40 pipe shall be Iron Pipe Size (IPS) conforming to ASTM D 1785 and ASTM D 2665. Injection molded PVC DWV fittings shall conform to ASTM D 2665. Fabricated PVC DWV fittings shall conform to ASTM F 1866.

- B. Pressure Piping (Sump Pump Discharge): Piping shall include all piping from pump discharge to a point where piping begins to slope at a normal positive slope (1/8 inch per foot). For aboveground locations provide Schedule 40, ASTM A 53, galvanized steel pipe. Fittings shall be with galvanized Class 150, malleable iron threaded fittings, ANSI B16.3, for pipe sizes 2 inches and less, and rolled groove type couplings and fittings for pipe sizes over 2 inches. Grooved couplings shall be UL listed, ASTM A536 ductile iron, with type 316 stainless steel bolts and nuts, and EPDM gaskets, rated for a minimum working pressure of 300 psi, manufactured by Victaulic Style 07 Zero-Flex, or approved equal by Gruvlok. Fittings shall be UL listed, ductile iron construction for IPS carbon steel pipe system. For underground locations provide Type 1 Schedule 40 PVC pipe with DWV pattern, fittings with solvent cement joints conforming to ASTM D2665.
- C. Piping through Wall Sleeves: Provide section of ductile iron piping, as detailed, in wall penetrations.
- D. The p-trap for the floor drains receiving condensate shall be schedule 40 PVC with solvent cement joints, the remaining portion of the condensate drainage system shall be as specified in paragraph 2.01B & C herein.

## 2.2 VENT PIPE AND FITTINGS

- A. Vent pipe, fittings, joints and couplings shall be same as specified for the gravity sanitary sewer system as specified herein.

## PART 3 - EXECUTION

### 3.1 PIPING INSTALLATION

- A. Basic piping installation requirements are specified in Section 22 05 00, Common Work Results for Plumbing.
- B. Run all piping in the most direct manner, parallel and perpendicular to building lines. Horizontal pipes 3" and smaller shall have a grade of one-quarter inch (1/4") per foot. Horizontal pipes 4" and larger shall slope one-eighth inch (1/8") per foot, unless otherwise noted on Drawings.
- C. Make all joints tight as recommended by the manufacturer. Brace all elbows, tees, wyes and combination wye and eighth bend fittings against thrust loads which might result in joint separation due to dynamic forces caused by sudden, heavy flow surges.
- D. Test sanitary drainage and vent piping by plugging all openings, filling the systems with water so that all parts of the piping system are subjected to a minimum 15 ft. of water head pressure. Inspect all joints, repair leaks found and retest until piping is demonstrated to be free from leaks for a period of 24 hours. Do not backfill trenches or close in pipes with construction until successful test results are achieved. All tests are to be observed by the Owner's Representative and documented by the Contractor.
  - 1. With written owner approval, the sanitary piping system may be tested pneumatically in lieu of hydrostatic pressure tests in occupied buildings or over sensitive areas. Measurement to be done with a diaphragm gauge in lieu of a spring gauge. Length of test to be determined in order to prevent the tested piping from being left unattended.

- E. Install promptly all sewer, drains and piping after excavating, chasing or cutting for same has been done so as to keep the openings for such piping open as short a time as possible. No piping is to be permanently closed up, furred in or covered before the examination of same by Owner's Representative.
- F. Size waste pipes to conform to the sizes indicated on the Drawings. Under no circumstances is any drain or vent line to be smaller than two inches. The waste pipes from water closets to be four inches. Vent stacks are to be 4" minimum size.
- G. Wastes must be brought up directly in back of each fixture.
- H. Make all waste connections of heavy brass threaded nipples connecting to sanitary tee. All fixtures used in connection with the conveying of any waste substance to the sanitary sewer is to be connected by means of a trap, waste and overflow. Slip joints will be permitted only on the house side of the trap, waste and overflow, or appliance which have such slip joints embodied in their original manufacture. Fixtures which have waste opening connected to the soil or waste lines by the use of bolts or screws must have such connections made by the use of the exact number of bolts or screws as provided for in their original manufacture.
- I. Where waste and vents are exposed at fixtures, pipes are to be chrome plated and are to include chrome plated escutcheons where they pass through floors, walls, or ceilings.
- J. No P-traps are to be installed concealed in walls or chases unless approved by the Owner's Representative.
- K. Use of Double Combination fittings in the vertical position within the Water Closet sequence on the sanitary sewer portion is prohibited. Contractor shall install a Figure Five Fitting.
- L. Provide cleanout at every toilet sequence (turned out into the men's stall if possible) above flood-rim of Water Closet.

### 3.2 UNDERGROUND PIPING INSTALLATION

- A. General: Install as indicated herein for buried pipe. For piping to be installed under slabs with carton forms refer to paragraph J, herein.
- B. Pipe Grading: Lay and maintain all pipes at required lines and grades during the course of work to comply with Drawings.
- C. Trench:
  - 1. Excavate trench to depth required.
  - 2. Properly brace and dewater trench and keep it free of water during installation, testing of pipe, and backfilling.
  - 3. Do not discharge water onto a street or freeway without prior approval from Owner's Representative.
- D. Excavation:
  - 1. Trench shall be at least 18 inches wider than the maximum diameter of the pipe or largest bell and laid in the center of the trench.
  - 2. Excavate trench to a minimum depth of 12" below the bottom of the final elevation of the pipe.

3. Increase trench width as required and piling left in place until sufficient compacted backfill is in place.
4. Properly sheet and brace all open trenches to render them secure and remove all such sheeting and bracing before completing the backfill.
5. Comply with local regulations or, in the absence thereof, with the "Manual of Accident Prevention in Construction" of the Associated General Contractors of America, Inc.
6. The quantity of excavation required to install sheeting and the installation and removal of sheetings and bracings will not be regarded as Extra Work. All costs incurred for this excavation and the installation of sheeting shall be included in the Contract Price.
7. Refer to Structural and Civil drawings for trench details.

E. Grading:

1. Upon Completion of excavation and prior to the laying of the pipe, the trench bottom shall be brought up to the required elevation with a pipe cushion as per Division 31, except where the cushion has been eliminated by the Engineer.
2. Pipe cushions shall be select material deposited in the trench and shall be compacted, leveled off, and shaped to obtain a smooth compacted bed along the laying length of the pipe. Pipe cushion shall be as follows:
  - a. Stable, Firm Semidry Trench: Piping shall be laid on bedding of washed sand with minimum 3 inches thick all around pipe and covering pipe.
  - b. Undisturbed earth, in a constant uniformly sloped trench shall be under the sand bed.
  - c. Laying space for hubs or mechanical joints shall be hand cut to 6 inches either side of the joint and stabilized sand poured and wet in to even with the natural earth trench bottom.
  - d. The leakproof integrity test of the piping system shall be inspected by the Owner's Representative prior to covering the piping.
  - e. Failure to notify the Owner's Representative for inspection prior to covering the piping will result in the piping being uncovered and the test being performed again.
  - f. Where the slope of the trench is found to belly down along the line of piping, before joining, the pipe shall be removed from the trench and the belly converted to uniform slope by adding stabilized bank sand, wet down and slightly mounded to the center of the trench. The section of piping will then be "rolled" into place so with support uniform along its entire length.
  - g. Where the slope of the trench is found to arch up along the line of piping, before joining, the pipe shall be removed from the trench and the arch converted to uniform slope by cutting the arch out. The section of piping will then be reset into place with support uniform along its entire length.
3. Wet Clay (Black Gumbo): Lay piping in a constant, uniformly sloped trench. After shaping, the trench shall receive 6 inch minimum clean bedding sand, which shall be uniformly distributed on the trench bottom.
  - a. Hand remove laying space for the hubs or mechanical joints and place the piping on the setting bed with the weight of the piping distributed evenly on the setting bed over its entire length.
  - b. The leak proof integrity test of the piping system shall be inspected by the Owner's Representative prior to covering the piping by the Engineer's agent. Failure to notify the Owner's Representative for inspection prior to covering the piping will result in the piping being uncovered and the test performed again.

4. Rock: Where rock is encountered, the excavate trench to a minimum of 6 inches below the pipe elevation and backfill with bedding sand to provide a uniform layer for pipe support. Backfill shall be as indicated for Wet Clay- Black Gumbo.
- F. Special Considerations: Where there are expansive soil conditions on the site, special precautions shall be taken to prevent pushing and breakage of underground piping. Precautions shall be in accordance with local installation techniques and may include carton forms or special pipe bedding.
- G. Backfill: Backfill trenches only after piping has been inspected, tested, and approved by the Owner Representative.
1. Place backfill material in the trench either by hand or approved mechanical methods. The compaction of backfill material shall be accompanied by tamping with hand tools or approved pneumatic tampers, by using vibratory compactors, by puddling, or by any combination of the three
  2. The method of compaction shall be approved and all compaction shall be done to the satisfaction of the Architect.
  3. Backfill completely around pipe, including 18 inches above the pipe, with suitable bank sand, tamped in 4 inch layers under, around, and over pipe. Water down backfill as required.
  4. The remainder of the backfill for pipes shall be select backfill material tamped at intervals of no more than 12 inch depths, to attain a 95 percent Proctor Compaction Density:
    - a. All materials to be used as select material backfill shall be approved by the Architect.
    - b. If, in the opinion of the Architect, the excavated material does not meet the requirements of select material, the Contractor shall be required to screen the material prior to use as select material backfill.
    - c. Material used in the upper portion of the backfill or subgrade shall not contain stone, rock, or other material larger than 6 inches in longest dimension. No wood, vegetable matter, or other material, which in the opinion of the Architect is unsuitable, shall be included in the backfill.
    - d. The upper 24 inches of backfill may be water jetted, if desired. Bring backfill up to finish grade identified on the Architectural Drawings, including additional backfill required to offset settlement during consolidation. When removal of unsuitable, excavated material creates a shortage of backfill material, the Contractor shall, at no change in Contract amount, furnish material as specified in this Section in the amount required to complete the backfill.
- H. Existing Surfaces: Restore existing streets, driveways and sidewalks damaged during the excavation work to acceptable condition, subject to approval by the Architect.
- I. Safety: Provide street and sidewalk excavations with approved barricades, warning lights, and cover plates as required by the City. Refer Division 1 for additional requirements.
- J. Underground Piping under Slabs with Carton Forms
1. Upon completion of excavation the carton forms shall be provided in trench for pipe to rest on with a minimum clearance of 12" from bottom of pipe to bottom of trench.
  2. Clevis hangers shall be installed to support pipe with continuous threaded rods from concrete slab as detailed on Plumbing drawings and Structural drawings.
  3. Clevis hanger support shall be installed at end pipe joint and change of direction.
  4. Follow pipe void systems manufacturer's recommendations and guidelines.

### 3.3 JOINT CONSTRUCTION

- A. PVC Non-pressure Piping Joints: Join piping according to ASTM D 2665.

### 3.4 HANGER AND SUPPORT INSTALLATION

- A. Support vertical piping and tubing at base and at each floor.
- B. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch minimum rods.
- C. Install supports for vertical steel piping every 15 feet.
- D. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.
- E. Support PVC piping with maximum hanger spacing per manufacturer's recommendations

### 3.5 CONNECTIONS

- A. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

### 3.6 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
  - 1. Test pipe before backfilling and connecting to sewers by maintaining not less than 10 feet of hydrostatic head for 4 hours without a leak.
  - 2. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
  - 3. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction.
  - 1. After all sections of soil, waste, and vent piping are installed, but before fixtures are connected, test system by plugging all outlets and filling vertical sections with water to maintain not less than 10 feet of hydrostatic head for 4 hours without any drop in water level for all sections of piping. Provide wyes as required to facilitate plugging.
  - 2. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
  - 3. Prepare reports for tests and required corrective action.

### 3.7 CLEANING

- A. Clean interior of piping. Remove dirt and debris as work progresses.



- B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.
- D. Vacuum out floor drain, floor sink, mop sink, shower stall p-traps as part of the final completion inspection, to insure that the p-trap is free of debris.

END OF SECTION 22 13 16

## SECTION 23 00 00 - MECHANICAL GENERAL PROVISIONS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including "Uniform General Conditions and Supplementary General Conditions For The State Of Texas Building Construction Contracts" and Division 01 Specification Sections, apply to the work of this Section.
  - 1. Where the term "Owner's Designated Representative" is used, it shall mean a member of the project's capital team.

#### 1.2 SUMMARY

- A. Except as modified in this Section, General Conditions, Special Conditions, applicable provisions of Division 01, General Requirements, and other provisions and requirements of the contract documents apply to work of Division 23.
- B. Applicable provisions of this Section apply to all Sections of Division 23 HVAC.
- C. Contract drawings are diagrammatic only and do not give fully dimensioned locations of various elements of work. Determine exact locations from field measurements and provide coordination drawings.
- D. All work in these Sections shall be installed by craftsmen skilled in their trade.
- E. Unsightly, inadequate, or sloppy work will not be acceptable and shall be removed and replaced as necessary to achieve an acceptable installation.
- F. Commissioning of a system or systems specified in this section is part of the construction process. Documentation and testing of these systems, as well as training of the Owner's operation and maintenance personnel, is required in cooperation with the Owner's Representative and the Commissioning Agent. Project Closeout is dependent on successful completion of all commissioning procedures, documentation, and issue closure. Refer to Section 019000, General Commissioning, for detailed commissioning requirements.

#### 1.3 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, un-air-conditioned spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.

- E. 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 un-air-conditioned shelters.
- F. Furnish: The term "furnish" is used to mean supply and deliver to the project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- G. Install: The term "install" is used to describe operations at project site including the actual unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.
- H. Provide: The term "provide" means to furnish and install, complete and ready for the intended use.

#### 1.4 CODE REQUIREMENTS AND PERMITS

- A. Perform work in accordance with applicable statutes, ordinances, codes, and regulations of governmental authorities having jurisdiction.
- B. Resolve any code violation discovered in contract documents with the Engineer prior to award of the contract. After award of the contract, make any correction or addition necessary for compliance with applicable codes at no additional cost to Owner.
- C. Obtain and pay for all permits and inspections.
- D. The following building codes are applicable to this project.
  - 1. 2015 International Mechanical Code
  - 2. 2015 International Building Code
  - 3. 2015 International Energy Conservation Code
  - 4. State Energy Conservation Office (SECO) mandated state building compliance with ASHRAE 90.1-2013

#### 1.5 REFERENCES

- A. Materials which are specified by reference to Federal Specifications; ASTM, ASME, ANSI, AWWA Specifications, Federal Standards or other standard specifications must comply with latest editions except where specified otherwise in individual Sections, revisions, amendments, or supplements in effect on date bids are received.
- B. Requirements in reference specifications and standards are minimums for all equipment, materials and work. In instances where capacities, size or other features of equipment, devices, or materials exceed these minimums, meet listed or shown capacities.

#### 1.6 SUBMITTALS

- A. Equipment and Materials submittals must show sufficient data to indicate complete compliance with contract documents as follows:
  - 1. Proper sizes and capacities.
  - 2. That the item will fit in the available space in a manner that will allow proper service.
  - 3. Construction methods, materials, and finishes.

- B. Material and Equipment List: Within 30 days after award of the contract and before orders are placed or shop drawings are submitted, submit a list of equipment and principal materials specified. Give names of manufacturers, catalog and model numbers, and such other supplementary information as necessary for identification.
- C. Material and Equipment Shop Drawings: Submit all detailed shop drawings, descriptive literature, physical data, and performance data for review for items of equipment and for principal materials proposed for installation. HVAC controls may be submitted separately provided the controls submittal is complete and coordinated with all other applicable trades. Include identifying symbols and equipment numbers used in plans and specifications, with reference to specification paragraphs, and drawing numbers of all equipment and material submitted.
- D. Final Submittal: In addition to number of copies of shop drawings and other data required for review submittals, maintain a separate file of final approved copies of such material. Deliver approved copies in a hard-back binder for the Owner's use. Incorporate changes and revisions made throughout construction period. Delivery of approved copies is a condition of final acceptance for the project.
- E. Contractor's Check: Shop drawings will be submitted only by the Contractor. Indicate by signed stamp that the drawings have been checked, that the work shown on the drawings is in accordance with contract requirements and that dimensions and relationship with work of other trades have been checked. If drawings are submitted for approval that have not been checked and signed by the Contractor, they will be returned for checking before being considered by the Architect/Engineer.
- F. Refer to Section 01 33 00 for additional submittal requirements

#### 1.7 COORDINATION DRAWINGS

- A. Prior to starting work, the Contractor shall provide coordination drawings for all areas of the building. The Contractor shall submit the coordination drawing for confirmation of the coordination process. The Contractor is responsible for all trade confirmation.
- B. CAD. Provide 1/4 inch scale coordination drawings.
  - 1. Drawings shall show all equipment, ductwork, fire protection system, coil pull spaces, heating water and condensate piping and trap, electrical conduit, electrical and control panels, etc. installed in mechanical room to verify space allocation and coordination of trades.
  - 2. Provide plan and elevation views detailing installation.
  - 3. Contractor may not proceed with construction of MEP systems until trade coordination process has been demonstrated to be completed by the Contractor to the Architect, Engineer and Owner.

#### 1.8 INTERFERENCE DRAWINGS

- A. Interference drawings are drawings that indicate conflict between the various systems and other components of the building such as beams, columns, walls, etc. They shall be drawn to scale and shall include plans, elevations, sections and other details as required to clearly define the interference and to indicate the contractor's proposed solution.

- B. They shall be submitted for approval whenever job measurements and an analysis of the drawings and specifications by the contractor indicate that the various systems cannot be installed without significant deviation from the intent of the contract. When such interference is encountered, work shall cease in the general area of the conflict until a resolution to the question has been approved.

#### 1.9 GUARANTEE

- A. Guarantee work for one year from the date of final acceptance of the project. During that period make good any faults or imperfections that may have arisen due to defects or omissions in materials or workmanship.

#### 1.10 SERVICE

- A. Perform service work required during the guarantee period including lubrication of bearings. Perform manufacturer's recommended monthly service and provide Owner with written report. Cleaning of air filters and pipe strainers is not included.

#### 1.11 RESOLUTION OF CONFLICTS

- A. Where conflicts may exist between and/or within the drawings and/or specifications, the contractor shall contact the A/E to clarify. The Contractor shall notify the A/E for resolution of the issue prior to executing the work in question.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS AND EQUIPMENT

- A. Furnish new and unused materials, pipes, pipe fittings, and equipment of domestic manufacture, where available. Where two or more units of same type or class of equipment are required, provide units of a single manufacturer.

#### 2.2 ACCEPTABLE MANUFACTURERS

- A. Acceptable manufacturers are listed in individual Sections of Division 23. Where two or more units of same type or class of equipment are required, provide units of a single manufacturer.
- B. Manufacturers' names and catalog numbers specified under Sections of Division 23 are used to establish standards of design, performance, quality and serviceability and not to limit competition.
- C. Equipment of similar design, equal to that specified, manufactured by a manufacturer named in the acceptable manufacturers' list will be acceptable on approval.
- D. Substitutions:
  - 1. If the Contractor desires to substitute a material or manufacturer as an equal to the specified item, he shall request permission from the Architect/ Engineer, in writing, and shall include such literature, samples, etc., deemed necessary to establish the equal quality of his proposal.
  - 2. If the Architect/Engineer deems it necessary in order to establish the equality between two or more products, he may require laboratory testing at the Contractor's expense in order to obtain information upon which to base a decision.

3. The Architect/Engineer will not give approval to material salesmen or subcontractors, and only in writing to the successful Contractor after the project has been awarded.
  4. For each proposed substitution product, clearly show how the proposed product meets the requirements of the specifications, including performance.
  5. No substitution will be considered unless it is presented in writing within 14 days of the time the bids are due.
  6. Proposers of substitute products shall present samples, literature, test and performance data, record of other installations, names of Owners, architects, engineers, contractors and subcontractors as references, statement of current financial condition, and other technical information applicable to their products, to aid in determining the worth of the substitute product offered in relation to the material and work specified from the standpoint of the Owner's best interest. Substitute materials and products shall be used only if approved in writing by the Architect/Engineer in advance.
  7. Approval of substitute materials offered shall not be a basis for contingent extra charges because of changes in other work or related work, such as roughing-in, electrical, structural or architectural, which may result from the substitution.
  8. For any Contractor initiated substitutions or changes, Contractor shall be responsible for achieving results equal to or better than the product or design originally specified.
- E. Basis of Design: Where a basis of design is indicated (i.e., scheduled products), that product was used for the purposes of established space requirements, structural design for the building, utility connections, etc. If the contractor elects to furnish a product other than the basis of design product (either another named acceptable manufacturer or via substitution) the contractor is responsible for any construction or design costs associated with the non-basis of design product.

## 2.3 NOISE AND VIBRATION

- A. Select equipment to operate with minimum noise and vibration. If objectionable noise or vibration is produced or transmitted to or through the building structure by equipment, piping, ducts or other parts of work, rectify such conditions without cost to the Owner. If the item of equipment is judged to produce objectionable noise or vibration, demonstrate (without cost to the Owner) that equipment performs within designated vibration limits indicated in the specifications, or as specified by manufacturer.
- B. Seal all wall and partition penetrations (the penetration opening shall be one inch larger than penetrating member) by ducts and piping by stuffing the annular void with fiberglass insulation and then caulking over fully with a non hardening acoustical caulking applied to both sides of wall or partition.

## 2.4 AIR FILTERS AND PIPE STRAINERS

- A. Immediately prior to final acceptance of project, inspect, clean and service hydronic system strainers and replace disposable type air filters.
- B. Turn over to Owner additional sets of spare filters and other spare parts as specified.

## 2.5 ACCESS DOORS

- A. Provide access doors for all walls or ceiling locations as required for access to valves, controls, regulating devices, water arresters, fire dampers, air distribution boxes, and other concealed equipment requiring maintenance adjustment or operation. Coordinate location with General Contractor.
- B. Refer to architectural Sections for access door requirements.
- C. Basis-of-Design Product: Design of access doors is based on model numbers manufactured by Milcor unless otherwise indicated. Subject to compliance with requirements, provide named product or approved equal.
  - 1. Non-Fire Rated Doors:
    - a. Furnish Milcor non-fire rated doors with 16-gage frames and 14 gage door panels.
    - b. Provide continuous concealed hinges and flush screwdriver cam lock.
    - c. Use Style M for prime painted steel, and MS for stainless steel.
    - d. Use Style DW access door for drywall or gypboard construction.
    - e. Use Style CF for suspended drywall ceilings.
    - f. Use Style K for plastered walls and ceilings.
    - g. Use Style AP for acoustical plastered ceilings with all galvanized construction.
  - 2. Fire-Rated Access Doors:
    - a. Furnish Milcor, UL listed, 1-1/2 hour, "B" label for service access in walls of stairwell, corridors and all other areas where fire-rated construction occurs.
    - b. Access doors shall have a 16 gage steel frame and 20 gage insulated sandwich type insulated panel.
    - c. Use ATR for fire-rated suspended drywall ceilings.
  - 3. Provide spring-loaded door for automatic closure and exterior key lock for security.

## 2.6 FLAME SPREAD PROPERTIES OF MATERIALS

- A. Materials and adhesives incorporated in this project shall conform to NFPA Standard 255, "Method of Test of Surface Burning Characteristics of Building Materials" and NFPA 90. The classification shall not exceed a flame spread rating of 25 for all materials, adhesives, finishes, etc., specified for each system, and shall not exceed a smoke developed rating of 50.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Cooperation with Other Trades: Cooperation with trades of adjacent, related, or affected materials or operations and of trades performing continuations of work under subsequent contract is considered a part of this work in order to effect timely and accurate placement of work and to bring together in proper and correct sequence the work of such trades.
- B. Workmanship: Work must be performed by workmen skilled in their trade.
- C. Installation of all equipment and materials must be complete. Installation shall meet requirements of specifications and manufacturer's recommendations.

- D. Electrical Wiring of Motors and Equipment. The Contractor shall note that the electrical design was based upon the mechanical equipment indicated on the mechanical construction documents and specifications. If Contractor proposes any mechanical equipment that requires changes to the electrical design, the required electrical changes shall be made at no cost to the Owner.

### 3.2 SPACE REQUIREMENTS

- A. Consider space limitations imposed by contiguous work, including clearances required for service, in selection and location of equipment and material. Do not provide equipment or material which is not suitable in this respect.
- B. The following space allocation and coordination shall be followed, unless otherwise indicated on the construction drawings or not possible in the field. In all cases field conditions shall govern:
  - 1. Gravity-fed plumbing and roof drain line shall take priority over all other systems.
  - 2. Light fixtures and arrangements shall take priority in spatial layout. In areas with ceilings, other systems shall be routed above the light fixtures, and offset from above allowing for access and maintenance clearance.
  - 3. Install HVAC ductwork as close to the bottom of structural framing as possible while allowing clearance for installation of insulation wrap. Install ductwork to be accessible from the ceiling plane.
  - 4. Install HVAC hot water piping in the plane directly below HVAC ductwork unless indicated otherwise on drawings.
  - 5. Install fire sprinkler piping in the plane directly beneath the HVAC hot water piping. Do not install sprinkler piping directly below equipment requiring maintenance.
  - 6. Install domestic hot and cold water in the plane directly above the light fixtures.
  - 7. Refer to Division 26 for electrical and control wiring requirements.
  - 8. Install piping to permit removal of coils at air handling units and to permit access to all terminal unit components.

### 3.3 OBSTRUCTIONS

- A. The drawings indicate certain information pertaining to surface and subsurface obstructions which has been taken from available drawings. Such information is not guaranteed, however, as to accuracy of location or complete information.
- B. Before any cutting or trenching operations are begun, verify with Owner's Representative, utility companies and other interested parties that all available information has been provided. Verify locations given.
- C. Should obstruction be encountered, whether shown or not, alter routing, remove obstruction where permitted, or otherwise perform whatever adjustments necessary to resolve the conflict.
- D. Assume total responsibility for and repair any damage caused by conflicts.

### 3.4 OPENINGS

- A. Framed, cast or masonry openings for ductwork, equipment and piping are specified under other divisions. However, drawings and layout work for exact size and location of all such openings are included under this division.



### 3.5 ACCESS DOORS

- A. Coordinate location of access doors for ease of operation and maintenance of concealed equipment.

### 3.6 DELIVERY, STORAGE AND HANDLING

- A. Adequately protect work, equipment, fixtures and materials from damage during storing, installation, start-up and testing.
- B. Cover all equipment stored exposed to elements with waterproof tarps, provide adequate ventilation.
- C. At work completion, all work must be clean and in like new condition.
- D. Storage of all mechanical equipment, piping materials and ductwork shall be in strict accordance with manufacturers written installation instructions.
- E. Rotate air handler fans and pump shafts on routine basis.
- F. Provide factory installed pipe caps for all pipes to be installed on the project.
- G. Provide covers over all openings in ductwork stored or installed on the project.
- H. Air Handling Units shall not be used as storage containers

### 3.7 LUBRICATION AND OIL

- A. Provide a complete charge of correct lubricant and/or oil for each item of equipment requiring lubrication. Contractor shall lubricate per manufacturers requirements until equipment is turned over to the owner.

### 3.8 PAINTING

- A. Painting of HVAC systems, equipment, and components is specified in Division 09 Sections for Interior Painting and Exterior Painting.
- B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.
- C. Preparation and application shall be in accordance with Division 09 Painting Sections.
- D. Mechanical items to be painted shall be where noted on the drawings.
- E. Ductwork:
  - 1. First Coat: Rust inhibitive primer. Use galvanized iron primer where applicable. Omit first coat on pre-sized insulated pipe.
  - 2. Second Coat: Enamel.
  - 3. Third Coat: Enamel.
- F. General: Cut and patch walls, floors, etc., resulting from work or by failure to provide proper openings or recesses in new construction.

- G. Methods of cutting: Openings cut through concrete and masonry shall be made with masonry saws and/or core drills and at such locations acceptable to the Architect/Engineer.
    - 1. Do not use impact-type equipment except where specifically acceptable to the Architect/Engineer.
    - 2. Core drill openings in precast concrete slabs for pipes, conduits, outlet boxes, etc., to exact size.
  - H. Restoration: Restore all openings to "as-new" condition under the appropriate Specification Section for the materials involved
  - I. Match remaining surrounding materials and finishes.
  - J. Masonry: Where openings are cut through masonry walls, provide and install lintels or other structural supports to protect the remaining masonry.
  - K. Provide adequate support during cutting operation to prevent any damage to the masonry occasioned by the operation. All structural members, supports, etc., shall be of the proper size and shape, and shall be installed in a manner acceptable to the Architect/Engineer.
  - L. Special Note: No cutting, boring, or excavating which will weaken the structure shall be undertaken.
- 3.9 TEMPORARY CONDITIONING OF BUILDING SPACES FOR COMPLETION OF CONSTRUCTION
- A. The following mechanical system items shall be completed for conditioning of the building for finish out of interior spaces.
    - 1. All hydronic water piping systems must be complete.
    - 2. All hydronic-piping systems must be cleaned in accordance with specifications.
    - 3. All hydronic water piping must be insulated and sealed.
    - 4. All pumps, air handlers and other associated equipment must be installed in their permanent location with all valves, strainers, piping, vibration isolation, electrical connections and safety devices in place.
    - 5. Controls to regulate temperature and water flow must be in place and operational.
    - 6. Provide and service fine mesh construction inserts in pump strainers.
  - B. All permanent filters for air handlers must be in place. Temporary filters must be installed on VFD drives during construction. Provide temporary filter media ahead of permanent filters and replace when dirty. Do not operate exhaust devices during gyp board finishing.
  - C. Factory startup of the VFD drives shall occur prior to turning on units.
  - D. A preliminary air balance of the supply air shall be performed within one week of start-up by the TAB firm. All air unit and fan motors amperage ratings shall be measured and provided to the owner in the preliminary Air Balance Report.
  - E. All equipment utilized will be checked out by a factory representative, serviced, lubricated, checked for rotation, pressure, amp draw and vibration isolation, adjusted and certified. Record of this service must be provided monthly to the Owner. Submit appropriate reports to the University prior to submitting a written request for service.
  - F. All equipment operated shall be serviced on a regular basis by the contractor.

- G. Prior to final inspection, clean all equipment inside and out to a like new condition, remove temporary filters, install new permanent filters in preparation for final inspection by Owner.
- H. All warranties will be commenced at the time of final acceptance.
- I. Refer to Division 1 requirements for a clean building.

### 3.10 OPERATING TESTS

- A. After all mechanical systems have been completed and put into operation, subject each system to an operating test under design conditions to ensure proper sequence and operation throughout the range of operation witnessed by Owner's Representative.
- B. Prove operations of control systems and all safeties, freeze-stats and alarms.
- C. Make adjustments as required to ensure proper functioning of all systems.
- D. Special tests on individual systems are specified under individual Sections.
- E. Functional Performance Testing is part of the Commissioning Process. Functional performance testing shall be performed by the contractor and witnessed and documented by the Commissioning Agent. Refer to Section 019113, General Commissioning, for functional performance testing and commissioning requirements.

### 3.11 OPERATING AND MAINTENANCE INSTRUCTIONS

- A. Furnish copies of commercially available standard operation and maintenance data, including operating instructions, maintenance instructions and parts listings in accordance with Specification 01 78 32. Detailed requirements for these items are as follows:
  - 1. Information required for the preparation of O&M manuals may be furnished in the form of manufacturers' standard brochures, schematics, and other printed instructions. Clearly distinguish between information which applies to the equipment and information which does not apply. Data shall include as a minimum the following items:
    - a. Recommended procedures and frequencies for preventive maintenance; inspection, adjustment, lubrication, cleaning, etc.
    - b. Special tools and equipment required for testing and maintenance.
    - c. Parts lists reflecting the true manufacturer's name, part number and nomenclature.
    - d. Recommended spares by part number and nomenclature and spare stocking levels.
    - e. Integrated mechanical and electrical system schematics and diagrams to permit operation and troubleshooting after acceptance of the system.
    - f. Troubleshooting, checkout, repair and replacement procurement procedures.
    - g. Operating instructions including start up and shutdown procedures.
    - h. Safety considerations including load limits, speed, temperature and pressure.
  - 2. Provide O&M manuals for all HVAC equipment.

### 3.12 PROJECT RECORD DOCUMENTS

- A. Maintain at the job site a separate set of white prints of the contract drawings for the sole purpose of recording the "as-built" changes and diagrams of those portions of work in which actual construction is significantly at variance with the contract drawings.

- B. Mark the drawings with a colored pencil.
- C. Prepare, as the work progresses and upon completion of work, drawings clearly indicating locations of various lines, valves, ductwork, traps, equipment, and other pertinent items, as installed.
- D. Record underground and underslab piping installed, dimensioning exact location and elevation of such piping.
- E. At conclusion of project, obtain without cost to Owner, reproducibles of original mechanical drawings and transfer as-built changes to these.
- F. Delivery of as-built prints and reproducibles is a condition of final acceptance.

3.13 TRAINING:

- A. Upon completion of work, and at time designated by the Owner's Representative, provide services of a competent representative of the manufacturer/Contractor to instruct the Owner's Representative and up to 8 members of the Owner's staff in the operation and maintenance of the entire system. Record training sessions on DVDs for instructing future technicians.
- B. Provide training for the following pieces of equipment:

Items:	HRs of Training Pre-Substantial Completion	HRs of Training at 6 months from Substantial Completion	HRs of Training at 11 months from Substantial Completion	Video Taping Required
Pumps	4			X
DDC Controls	16	8	8	X
VFDs	4	4		X
Air Handling Units	4			X
Boilers	8	4		X

- C. All training sessions shall be scheduled in coordination with the Owner's Representative 14 days in advance, attendance taken, and sign-in sheet and training materials included in the O&M manuals.

END OF SECTION 23 00 00

## SECTION 23 05 19- METERS AND GAUGES FOR HVAC PIPING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including "Uniform General Conditions and Supplementary General Conditions For The State Of Texas Building Construction Contracts" and Division 01 Specification Sections, apply to the work of this Section.
  - 1. Where the term "Owner's Designated Representative" is used, it shall mean a member of the project's capital team.

#### 1.2 SUMMARY

- A. Section Includes the following for hydronic piping:
  - 1. Thermometers.
  - 2. Gauges.
  - 3. Pressure and Temperature Taps.

#### 1.3 SUBMITTALS

- A. Product Data: For each type of product indicated, submit detailed shop drawings and manufacturer's data, including:
  - 1. Measurement tolerances.
  - 2. Range.
  - 3. Accuracy.
  - 4. Device dimensions and connection sizes (include schedule indicating stem length versus pipe diameter).
  - 5. Scales.
  - 6. Materials of construction.
  - 7. Valves that will be used for isolating gauges.
- B. Submit a schedule for each device to be installed, including:
  - 1. Location.
  - 2. Pressure or temperature range of device and fluid measured.
  - 3. Temperature or pressure of fluid.
  - 4. Pipe size and bulb length of thermometers.
  - 5. Type of valve used with the Pressure Gauge.

- C. Operation and maintenance data.

#### 1.4 QUALITY ASSURANCE

- A. Thermometers: Calibrate against standards traceable to the NIST and guaranteed accurate to plus or minus one scale division.
- B. Pressure Gauges: ASME B40.1 Grade 2A accuracy 0.5 percent of scale range.

## PART 2 - PRODUCTS

### 2.1 ACCEPTABLE MANUFACTURERS

- A. Products meeting all requirements of this specification Section of the following manufacturers are acceptable:
1. Thermometers: Ashcroft, Dwyer, Marsh Instrument, Terrice, Weiss, Weksler
  2. Pressure Gauges: Ashcroft, Dwyer, Terrice, Weiss, Weksler
  3. Pressure/Temperature Taps: Peterson Engineering Company, Sisco or Terrice

### 2.2 BIMETAL THERMOMETERS

- A. Construction: All stainless steel bi-metal type construction with 5 inch dial.
- B. Window: Glass.
- C. Connector: Adjustable type, 180 degrees in vertical plane, 360 degrees in horizontal plane, with locking device.
- D. Dial: Black figures on white background with black pointer.
- E. Stem: Stainless steel thermowell installation, 1/4-inch diameter, minimum 2-1/2 inch straight or angle form of length to suit installation.
- F. Coil: Bimetallic, hermetically sealed with silicone dampened
- G. Accuracy: Plus or minus 1 percent of range or plus or minus 1 scale division to maximum of 1.5 percent of range.
- H. Furnish thermometers for services in the following ranges and divisions:
1. Heating Hot Water: 20 to 240 degrees F, 2 degree divisions

### 2.3 THERMOWELLS

- A. Manufacturers: Same as manufacturer of thermometer being used.
- B. Description: Brass or stainless steel with pressure and temperature ratings suitable for their application. Wells for insulated piping shall have a 2-1/2 inch lagging protrusion. Locate thermometer wells so the sensing bulb will give a true and correct reading. Install thermometer so as not to cause undue restriction in small piping. Where wells are located in pipelines 1-1/2 inch and smaller, provide a section of pipe of such diameter that the net area of the pipeline will not be reduced by the thermometer well.

### 2.4 PRESSURE GAUGES

- A. Direct-Mounting, Dial-Type Pressure Gauges: Indicating-dial type complying with ASME B40.100.
1. Case: Liquid-filled type, polypropylene case, 4-1/2 inch diameter, solid front with blow-out back.
  2. Bourdon Tube: Bronze or 316 stainless steel with brass or stainless steel socket.
  3. Movement: 300 series stainless steel rotary type with stainless steel bushings
  4. Dial: White face with black figure.

5. Pointer: Red or black, micro adjustable.
  6. Window: Molded Acrylic.
  7. Ring: Fiberglass polypropylene.
  8. Accuracy: Grade A, plus or minus 1 percent of middle half scale.
  9. Gauge Ranges
    - a. Provide 0 - 160 psi gauges for 150 psi hydronic water service.
  10. Provide liquid filled gauges for all pressure gauges upstream and downstream of pumps.
- B. Pressure-Gauge Fittings:
1. Valves: NPS 1/4 brass or stainless-steel needle type.
  2. Siphons: NPS 1/4 coil of brass or stainless steel tubing with threaded ends.
  3. Snubbers: ASME B40.5, NPS 1/4 brass bushing with corrosion-resistant, porous-metal disc of material suitable for system fluid and working pressure.

## 2.5 PRESSURE AND TEMPERATURE TAPS:

- A. Taps. Provide 1/2" solid brass fittings which will receive either a pressure or temperature probe, with valve core of Nordel and fitted with a color coded cap and gasket. P/T Taps shall be rated for 275 degrees F. and 1000 psig. Provide long stem type for insulated pipe.
- B. Instruments. Provide two each, No. 500 "Pete's Plug" pressure gauge adapters with four gauges and probes and four each 5" stem pocket thermometers: Two each, thermometers for chilled water, heating and domestic hot water systems, when applicable. Applicable meaning the system is being installed as part of the project. "Pete's Plugs" to match insulation thickness.

## PART 3 - EXECUTION

### 3.1 THERMOMETER INSTALLATIONS

- A. Provide thermometers and thermometer wells in the following locations:
1. Inlet and outlet of each air handling unit coil connection.
  2. Inlet and outlet of for supply and return connections of each heat exchanger.
  3. As shown on Drawings and control schematics.
- B. Install direct-mounting thermometers and adjust vertical and tilted positions.
- C. Install thermowells with socket extending a minimum of 2 inches into fluid and in vertical position in piping tees where thermometers are indicated.

### 3.2 GAUGE INSTALLATIONS

- A. Provide pressure gauges in the following locations:
1. Suction and discharge side of each pump.
  2. Each hydropneumatic tank.
  3. Inlet and outlet of each air handling unit coil.
  4. Supply and return piping connections of coils (where shown on details).
  5. Inlet and outlet of each heat exchanger vessel.
  6. As shown on Drawings and control schematics.

- B. Install direct-mounting pressure gauges in piping tees with pressure gauge located on pipe at most readable position.
- C. Install needle-valve in piping for each pressure gauge for fluids.
- D. Install snubber for gauges associated with pumps.
- E. Provide fittings as necessary to install pressure gauge in the vertical position.

### 3.3 PRESSURE AND TEMPERATURE TAP INSTALLATIONS

- A. Provide pressure and temperature taps at the following locations:
  - 1. Inlet and outlet of each coil connection.
  - 2. Inlet and outlet of each hydronic control valve
  - 3. Inlet and outlet of for supply and return connections of each heat exchanger.
  - 4. Where shown in details on mechanical drawings.
- B. Provide liquid filled gauges upstream and downstream of all pumps.

### 3.4 CONNECTIONS

- A. Install thermometers and gauges adjacent to machines and equipment to allow service and maintenance for thermometers, gauges, machines, and equipment. Thermometer

### 3.5 ADJUSTING

- A. Adjust faces of meters and gauges to proper angle for best visibility.

END OF SECTION 23 05 19



## SECTION 23 05 23 - GENERAL-DUTY VALVES FOR HVAC PIPING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including "Uniform General Conditions and Supplementary General Conditions For The State Of Texas Building Construction Contracts" and Division 01 Specification Sections, apply to the work of this Section.
  - 1. Where the term "Owner's Designated Representative" is used, it shall mean a member of the project's capital team.

#### 1.2 SUMMARY

- A. This Section includes requirements for furnishing and installing heating water, piping valves and appurtenances, including fittings and strainers.
- B. Related Sections:
  - 1. Division 23 HVAC piping Sections for specialty valves applicable to those Sections only.
  - 2. Section 23 05 53, Identification for HVAC Piping and Equipment, for valve tags and schedules.

#### 1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's product data showing compliance with requirements of Part 2. Clearly indicate piping, equipment, materials of construction, pressure rating and which options are to be provided.

#### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Protect all piping, valves, fittings, etc. before installation in accordance with manufacturer's written instructions.
- B. Piping shall be sent from the factory with capped ends and shall be stored on supports off of the ground with ends covered to prevent nesting of insects, birds and other animals, or the accumulation of dirt and debris in and around the piping components.

#### 1.5 QUALITY ASSURANCE

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- B. ASME Compliance: ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.

### PART 2 - PRODUCTS

#### 2.1 GENERAL REQUIREMENTS FOR VALVES

- A. Provide only domestically manufactured piping and fittings.

- B. Refer to HVAC valve schedule articles for applications of valves.
- C. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- D. Valve Sizes: Same as upstream piping unless otherwise indicated.
- E. Valve Actuator Types:
  - 1. Gear Actuator: For quarter-turn valves NPS 8 and larger.
  - 2. Handwheel: For valves other than quarter-turn types.
  - 3. Handlever: For quarter-turn valves NPS 6 and smaller except plug valves.
  - 4. Chainwheel: Device for attachment to valve handwheel, stem, or other actuator; of size and with chain for mounting height, as indicated in the "Valve Installation" Article.
- F. Valves in Insulated Piping: With 2-inch stem extensions and the following features:
  - 1. Ball Valves: Provide an insulated stem extension.
  - 2. Butterfly Valves: With extended neck.
- G. Valve-End Connections:
  - 1. Flanged: With flanges according to ASME B16.1 for iron valves.
  - 2. Solder Joint: With sockets according to ASME B16.18.
  - 3. Threaded: With threads according to ASME B1.20.1.

## 2.2 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Check Valves: Apco, Crane, Kitz, Mission, Milwaukee, Mueller, Nibco, Powell, Stockham and Weco.
  - 2. Plug Valves: DeZurik, Keystone, Mueller, or Stockham.
  - 3. Globe Valves: Crane, Kitz, Milwaukee, Nibco, Powell, or Stockham.
  - 4. Butterfly Valves: Bray, Clow, Demco, DeZurik, Crane, Kitz, Milwaukee, Nibco, Pratt, or Stockham.
  - 5. Ball Valve: Apollo, Crane, DeZurik, Kitz, Milwaukee, Nibco, or Watts.
  - 6. Strainers: Armstrong, Keckley, Mueller Spirax or Watts.
  - 7. Coil Packs: IMI Hydronic Engineering Inc., Nexus, Nibco, Pro Hydronic Specialties.

## 2.3 CHECK VALVES

- A. For pipe 2 inches in diameter and smaller, furnish 150-pound (class 150) screwed, horizontal, swing check valve, all bronze construction, with screwed cap.
- B. For pipe 2-1/2 to 10 inches in diameter, provide 125-pound (class 125), lugged style, drill and tapped, or retainerless wafer lug style, double door valve, with cast iron body and aluminum bronze doors, Buna-N seat, and Type 316 stainless steel spring.

## 2.4 PLUG VALVES

- A. For pipe 2 inches in diameter and smaller, use 150-pound (class 150) screwed, eccentric plug valve with a bronze body, bolted bonnet, Fluorinated Hydrocarbon (Viton) Filled PTFE packing, Isobutene-Isoprene or Viton faced plug, stainless steel bearings, lever operated with adjustable memory stop, non-lubricated, short pattern plug valve.

- B. For pipe 2-1/2 inches in diameter or larger, furnish 150-pound (class 150) flanged eccentric plug valve, with cast iron steel, bolted bonnet, Buna (Vee) packing, Isobutene-Isoprene or Viton faced plug, stainless steel bearings, lever operated with memory stop through 8 inch size, and totally enclosed handwheel actuators above 8-inch size, non-lubricated, short pattern plug valve.

## 2.5 GLOBE VALVES

- A. For pipe 2 inches in diameter and smaller, provide 150-pound (class 150) screwed, rising stem, globe valve with bronze body, TFE disc, union bonnet.
- B. For pipe 2-1/2 through 10 inches in diameter, provide 125-pound (class 125) flanged, OS&Y globe valve, with cast iron body, renewable bronze trim.

## 2.6 BUTTERFLY VALVES

- A. For pipe 2-1/2 through 12 inches in diameter, furnish 200-pound flanged or tapped lug type butterfly valve with ductile iron body, stainless steel stem, aluminum-bronze disc with EPDM liner. Provide lever-operated valves 6 inches and smaller. Furnish valves 8 inches and larger with totally enclosed worm gear operators. Provide valves with enclosed worm gear operators with chain wheel and chain on valves installed higher than 84 inches above floor. Use valves designed for drip-tight shutoff in dead end service against 200 psi.
- B. For 14 inch diameter pipe and larger, employ 150-pound, full-flanged or tapped lug butterfly valve with ductile iron body, stainless steel stem, and aluminum bronze disc with EPDM liner. Provide totally enclosed worm gear operators for all valves. Provide valves with enclosed worm gear operators with chain wheel and chain on valves 84 inches above floor or as indicated on drawings. Provide valves designed for drip tight shutoff in dead end service against 150 psi.
- C. Where balancing valve is shown, provide butterfly valve with position lock operator (memory stop) for valves 6 inches and smaller and worm gear operator with memory stop for valves 8 inches and larger.

## 2.7 BALL VALVES

- A. For pipe 2 inches in diameter and smaller, provide 600 psi WOG screwed, two piece bronze or forged brass body, Teflon seat, full port, stainless steel stem and ball. Provide extension stem and insulated handle for valves installed in insulated piping. Where ball valves are used as balancing valves, provide valve with memory stop.

## 2.8 STRAINERS

- A. For pipe 2 inches in diameter and smaller, use 125-pound (class 125) cast bronze screwed Y-type strainer with 12-mesh stainless steel screen. Provide full size blowoff ball valve where shown on drawings.
- B. For pipe 2-1/2 inches and larger, provide 150-pound (class 150) cast steel or iron flanged Y-type strainer with 0.045 inch stainless steel screen through 4, and 1/8 inch stainless steel screen for 6 inches and larger. Provide full size blowoff ball valve where shown on drawings.

## 2.9 VALVES FOR FAN COIL UNITS (COIL PACK)

- A. General. The following products are for terminal boxes and fan coil units with pipe sizes 2-inches and less.
- B. Combination Ball Valve w/PT Test Port and Strainer w/blowdown valve. Provide dezincification resistant or forged brass construction, 600-pound, 325F construction with multiple 1/4" tapped ports for test plugs or other accessories and union end. Valve shall have blowout proof stem with stainless steel ball. Strainer shall have 20 mesh Type 304 stainless steel screen and 3/4" hose bib & cap.
- C. Combination Ball Valve w/Memory Stop and PT Test Port. Provide dezincification resistant or forged brass construction, 600-pound, 325F construction with multiple 1/4" tapped ports for test plugs or other accessories and union end. Valve shall have blowout proof stem with stainless steel ball.
- D. Combination PT Test Port w/Manual Air Vent. Provide dezincification resistant or forged brass construction, 600-pound, 325F construction with multiple 1/4" tapped ports for test plugs or other accessories and union end.
- E. PT Test Ports. Shall be rated for 1000 psi, 325F with brass body, Nordel check plugs and sealed cap.
- F. Stainless Steel Flex Hoses. Shall be designed for water and conform to ASTM codes E84, with stainless steel outer braid. Hoses 1/2-inch thru 1-inch shall have a Kevlar reinforced EPDM tube core, brass end fittings, and designed for a working pressure of 400 psi, 248F. Hoses 1 1/4-inches thru 2-inches shall have Rayon reinforced EPDM tube core, brass end fittings, and designed for a working pressure of 300 psi, 248F. All hoses shall have at least one union or swivel end fitting and be maximum 18-inches in length.
- G. Manual Air Vents. Shall be of brass construction and rated at 400 psi, 325F.
- H. Shaft extensions (2" and smaller). For insulated pipe shall be at least 2 1/4" tall and constructed of brass with a stationary external shaft housing to ensure vapor barrier seal.

## PART 3 - EXECUTION

### 3.1 STORAGE:

- A. Protect all piping, valves, fittings, etc. before installation in accordance with manufacturer's written instructions. All piping shall be sent from the factory with capped ends and shall be stored on supports off of the ground with ends covered to prevent nesting of insects, birds and other animals, or the accumulation of dirt and debris in and around the piping components.

### 3.2 EXAMINATION

- A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

- B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- C. Examine threads on valve and mating pipe for form and cleanliness.
- D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- E. Do not attempt to repair defective valves; replace with new valves.

### 3.3 VALVE INSTALLATION

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Provide clearance for access to valves, fittings and equipment for operation and maintenance.
- D. Install valves in horizontal piping with stem at or above center of pipe.
- E. Install valves in position to allow full stem movement and with operators and stems upright or horizontal.
- F. Install swing check valves for proper direction of flow and in horizontal position with hinge pin level.
- G. All piping shall be clean when it is installed.
- H. Check Valves. Install lugged check valves between flat flange and full-face gasket. Install check valves a minimum three to four pipe diameters downstream of pump discharge or elbows to avoid flow turbulence.

### 3.4 ISOLATION VALVES

- A. Provide piping systems with line size shutoff valves located at the risers, at main branch connections at each floor and at branch takeoffs serving equipment, and at other locations as indicated and required for isolation of piping or equipment.
- B. At air handling units, where multicoil (stacked) arrangement is used, provide each supply and return line to and from each stacked coil section with a union, pressure gauge and thermometer well and a balancing valve (with memory stop) for balancing, and valves for isolation of each coil.

### 3.5 DRAIN VALVES AND VENTS

- A. Install drain valves at all low points and at base of all risers of water piping systems so that these systems can be entirely drained.
- B. Install 2 inch drain for 2 inch pipes and larger.

- C. Install a line size drain valve for pipes smaller than 2 inches.
- D. Provide hose adapter and cap on all drain lines.
- E. Provide automatic vents with isolation valves or manual vents at locations as indicated on Drawings and all high points in piping systems.

### 3.6 TESTING

- A. Apply a hydraulic pressure 1-1/2 times the operating pressure, 150-psig minimum, and carefully check for leaks.
- B. Remove or isolate valves, expansion joints, strainers and equipment that are rated at pressures less than test pressure.
- C. Repair all leaks and retest the system until proven leak tight.

### 3.7 ADJUSTING

- A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

END OF SECTION 23 05 23

## SECTION 23 05 29 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including "Uniform General Conditions and Supplementary General Conditions For The State Of Texas Building Construction Contracts" and Division 01 Specification Sections, apply to the work of this Section.
  - 1. Where the term "Owner's Designated Representative" is used, it shall mean a member of the project's capital team.

#### 1.2 SUMMARY

- A. This Section includes requirements for furnishing and installing supports, anchors, hangers, sleeves, and concrete equipment pads for all direct and isolated suspended, roof mounted, and floor mounted HVAC equipment and exterior pipe and ductwork.
- B. See Division 05 Section, Metal Fabrications, for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
- C. See Section 23 05 48, Vibration Isolation for HVAC Piping and Equipment, for vibration isolation devices.
- D. See Section 23 31 00, Ductwork, for duct hangers and supports.

#### 1.3 DEFINITIONS

- A. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

#### 1.4 PERFORMANCE REQUIREMENTS

- A. Design supports for multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.
- B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

#### 1.5 SUBMITTALS

- A. Product Data: Submit manufacturer's catalog data, dimensional drawings and construction materials for the following:
  - 1. Steel pipe hangers and supports.
  - 2. Thermal-hanger shield inserts.
- B. Shop Drawings: Show fabrication and installation details and include calculations for the following:
  - 1. Trapeze pipe hangers. Include Product Data for components.
  - 2. Metal framing systems. Include Product Data for components.

3. Equipment supports.

C. Welding certificates.

## 1.6 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX.

## 1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver all roof support material materials to project site in manufacturer's original packaging, marked with manufacturer's name, product model names and catalog numbers, identification numbers, and other related information.

B. Store material under cover until needed for installation

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following manufacturers as applicable:

1. Anvil Intl., Inc.
2. Superstrut, Mult-A-Frame, Unistrut and Power-Strut pipe support systems
3. Specified Technologies, Inc.
4. Pipe Shields, Inc.

### 2.2 STRUCTURAL METAL

A. Furnish structural metal as specified in Division 05 and as shown on Drawings.

### 2.3 PIPE HANGERS AND SUPPORTS

A. Provide hangers for insulated and non-insulated pipes, provide galvanized carbon steel adjustable clevis hangers. Anvil Fig. 260 or equal.

B. Multiple or Trapeze Hangers: Provide Galvanized steel channels with welded spaces and hanger rods.

C. Wall supports: Provide galvanized welded steel brackets and galvanized wrought steel clamp, galvanized adjustable steel yoke and cast iron roll. Anvil Fig. 194, 195, 199 as required by pipe size and weight. Submit to structural engineer for approval detailing method of attachment to wall.

D. Vertical Support: Provide galvanized riser clamp with field welded shear lugs. Anvil Fig 261 or Fig 40 as required by installation and loads to be supported. Refer to mechanical details for main riser supports.

E. Floor supports for Pipe sizes to 4 inches and all cold pipe sizes: Cast iron adjustable pipe saddle, locknut nipple, floor flange and steel support. Anvil Figures 264 or 265 as required.



- F. Floor supports for Hot pipe 6 inches and larger: Provide adjustable cast iron roll and stand, adjusting screws and steel support all galvanized. Anvil Fig. 274.
- G. Copper Piping Supports and Hangers: Provide copper plated carbon steel clevis hanger. Anvil Fig. Anvil CT-65.
- H. Provide galvanized hangers and supports for all piping and ductwork located in pipe shafts and chases and above suspended ceiling spaces.
  - 1. Provide hanger rods, bolts and nuts and all metal parts coated with same material as hangers.
  - 2. Prime coat and paint exposed steel hangers and supports.

#### 2.4 PIPE SHIELDS

- A. Provide pipe shields for piping 2 inches and smaller fabricated of 20 gauge galvanized steel over insulation in 180 degree segments, minimum 12-inches long.
- B. Provide pipe shields for piping 2-1/2 inches and larger fabricated of galvanized steel over insulation in 180 degree segment as follows:

PIPE SIZE	METAL GAUGE	SHIELD LENGTH
2-1/2 to 6 inches	18	12 inches
8 to 16 inches	16	18 inches
18 inches and larger	12	24 inches

- C. Provide high density segment of insulation at shields at least two inches longer than shield. Foamglas blocks (HLB 1600) or factory made insulation shields as made by Pipe Shields, Inc. are acceptable. High density insulation segment shall be of sufficient compressive strength to prevent indentation of insulation jacket. Submit data indicating compressive strength of insulation segment. Furnish vapor barrier and sealant where used on low temperature service (below 100°F).
- D. Secure insulation shields to insulation jacket with adhesive as recommended by insulation manufacturer or 2 stainless steel bands, 1/2 inch wide by 0.015 inch thick with matching seals.

#### 2.5 HANGER RODS

- A. Provide cadmium plated or galvanized steel, threaded both ends continuous sized for supported load. If rod couplings have to be used the contractor shall seek permission from engineer. If permitted, each end of threaded rod shall be threaded until they join in the middle of the coupler.

#### 2.6 INSERTS

- A. Provide malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded rods. Submit data to structural engineer for approval. Anvil Fig. 282.

## 2.7 SLEEVES

- A. Fit with sleeves all pipes passing through masonry and concrete construction. Provide sleeves in floors and walls of mechanical rooms, pump rooms, etc. constructed of schedule 40 steel with galvanized finish. Sleeves outside mechanical room type spaces shall be galvanized EMT conduit for 2 inch and less diameter sleeves. Sleeves outside mechanical room type spaces over 2 inch and thru walls shall be rolled 20 gauge galvanized steel with welded seam. All galvanizing shall be done after welding.
- B. Sleeves thru roofs: schedule 40 galvanized steel pipe.
- C. Caulk all sleeves water and air tight. Provide firestop compound at all penetrations of floor slabs and fire rated walls.
- D. Provide Link Seal casings at sleeves at all exterior walls above and below grade. Use stainless steel retainers, nuts and bolts in sleeves below grade. Size sleeves in accord with Link Seal recommendations.
- E. Size sleeves one pipe size larger than the pipe it serves including insulation thickness as appropriate.
- F. Extend each sleeve through the floor or wall. Cut the sleeve 1" inch beyond flush from each surface, except that in exposed locations, extend floor sleeves 2 inches above finished floor line.
- G. Refer to section 23 31 00 for sleeve requirements for ductwork.

## 2.8 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
  - 1. Properties: Nonstaining, noncorrosive, and nongaseous.
  - 2. Design Mix: 5000-psi, 28-day compressive strength.

## PART 3 - EXECUTION

### 3.1 HANGER AND SUPPORT APPLICATIONS

- A. Specific hanger and support requirements are specified in Sections for piping systems and equipment.
- B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized or stainless steel, metallic coatings for piping and equipment that will not have field-applied finish.

- D. Use copper hangers with copper pipe and nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing. As an alternate, tape copper pipe at all points contacting steel hangers, structural members or sleeves. Use a dual wrap of polyvinyl tape.
- E. Use padded hangers for piping that is subject to scratching.

### 3.2 PIPE HANGER AND SUPPORT INSTALLATION

- A. Support horizontal steel piping on center as follows:

PIPE SIZE	MAX HANGER SPACING
1/2 to 1-1/4 inches	6 feet
1-1/2 to 2 inches	10 feet
2-1/2 to 6 inches	10 feet
6 to 12 inches	10 feet
14 inches and larger	10 feet

- B. Support horizontal copper piping on center as follows:

PIPE SIZE	MAX HANGER SPACING
1 inches and less	5 feet
1-1/4 to 1-1/2 inches	7 feet
2 to 3 inches	9 feet

- C. Support horizontal plastic piping on center as follows:

PIPE SIZE	MAX HANGER SPACING
All sizes	4 feet

- D. Place a hanger within 6 inches of each elbow.
- E. Provide hangers with vertical adjustment of 1-1/2 inches minimum.
- F. Larger Sizes: Support as recommended by manufacturer.
- G. Submit manufacturer's support and hanging recommendations.
- H. Support piping from structure independent from other piping installed above.
- I. Support risers as detailed on drawings at each floor and independently from connected horizontal pipe.
- J. Where insulation occurs, design hangers to protect insulation from damage. Pipe saddles and insulation shields, where required, are specified above.
- K. Perforated bar hangers, straps, wires or chains are not permitted.

- L. Support piping from precast and pan joist structure as detailed on drawings.
- M. Powder actuated anchors are not permitted.
- N. Sleeves penetrating beams must be submitted for approval by Structural Engineer.

### 3.3 CONCRETE PADS

- A. Pour 6-inch pads on roughened floor slabs unless otherwise noted.
- B. Extend outer edges of pads minimum 2 inches beyond equipment.
- C. Chamfer edges of pads.
- D. Secure equipment with anchor bolts in accordance with equipment installation instructions.
- E. Air handling units shall be installed on concrete pads with adequately sized neoprene isolation pads at each air unit support point.
- F. Verify that housekeeping pads for air handling units are high enough to provide a condensate drain trap deep enough to override the air handler static pressure.
- G. Install equipment on on 6 inch pads unless indicated otherwise on drawings.

### 3.4 EQUIPMENT SUPPORTS

- A. Support equipment as shown on drawing, mechanical sheet and structural.
- B. Grouting: Place grout under supports for equipment and make smooth bearing surface.

### 3.5 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Hot dip galvanize after fabrication.
- D. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and 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. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

### 3.6 ROOF CURBS

- A. Provide prefabricate curbs for roof mounted equipment.

- B. Furnish curbs suitable for slope of roof to ensure equipment is set level.

### 3.7 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

### 3.8 PAINTING

- A. Touch Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
  - 1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 23 05 29

## SECTION 23 05 48 - VIBRATION ISOLATION FOR HVAC PIPING AND EQUIPMENT

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including "Uniform General Conditions and Supplementary General Conditions For The State Of Texas Building Construction Contracts" and Division 01 Specification Sections, apply to the work of this Section.
  - 1. Where the term "Owner's Designated Representative" is used, it shall mean a member of the project's capital team.

#### 1.2 SUMMARY

- A. Section includes requirements for furnishing, installing, and adjusting vibration isolation, for mechanical equipment and piping, including bases of structural steel and concrete, with steel pouring forms and concrete reinforcing bars.
- B. Related Sections Include:
  - 1. Section 23 05 29, Hangers and Supports for HVAC Piping and Equipment.
  - 2. Section 23 20 00, Hydronic Pumps.
  - 3. Section 23 21 00, Hydronic Piping and Fittings.
  - 4. Section 23 34 00, Fans.

#### 1.3 PERFORMANCE REQUIREMENTS

- A. Wind-Restraint Loading:
  - 1. Basic Wind Speed: 150 miles per hour.
  - 2. Minimum 10 lb/sq. ft. multiplied by the maximum area of the HVAC component projected on a vertical plane that is normal to the wind direction, and 45 degrees either side of normal.

#### 1.4 SUBMITTALS

- A. Product Data: Submit product data showing type, size, load, deflection, and other required information. Include clearly outlined procedures for installing and adjusting isolators. Submit Drawings for each item of equipment with complete isolation installation information.
- B. Submit detailing of inertia bases and locations of vibration, including weight of inertia base.

#### 1.5 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

#### 1.6 OPERATION AND MAINTENANCE DATA

- A. Submit operation and maintenance data under provisions of Section 23 00 10.
- B. Include copies of approved submittals and any submittal comments.

- C. Provide tab for each major type of equipment (fan coil units, pumps, piping, fans, etc.). Provide schedule of vibration isolator type with location and load on each. Include data on each isolator type that corresponds to:
1. Spring diameter.
  2. Deflection.
  3. Compressed spring height.
  4. Point location of each isolator.
  5. Calculated load at each point.
  6. Field static deflection.
- D. Include copy of written certification from factory representative as required in Part 3 of this specification.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Amber/Booth Company, Inc.
  2. Kinetics Noise Control
  3. Korfund Dynamics
  4. Mason Industries.
  5. Metraflex
  6. Vibration Eliminator Co., Inc.

### 2.2 ISOLATOR DESIGN

- A. Materials:
1. Design and treat vibration isolators for resistance to corrosion.
  2. Steel components shall be PVC coated or phosphatized and painted with industrial-grade, corrosion-resistant enamel.
  3. Furnish zinc-electroplated or cadmium plated nuts, bolts and washers.
  4. All isolators exposed to the weather shall have the steel parts hot dip galvanized and a PVC coating.
  5. Clean steel bases thoroughly of welding slag and prime with zinc-chromate or metal etching primer.

### 2.3 ISOLATOR TYPES

- A. Type NGS: Pad-type mounting consisting of two layers of 3/8 inch thick ribbed or waffled neoprene pads bonded to a 16-gage galvanized steel separator plate. Size pads for approximately 20 to 40 psi load and a deflection of 0.1 inch to 0.16 inch.
- B. Type RH: Elastomeric hanger consisting of a rectangular steel box and an elastomeric isolation element of neoprene. A high-quality synthetic rubber may be used if it contains anti-ozon and antioxidant additives. Design elements for approximately 1/2 inch deflection and load so that the deflection does not exceed 15 percent of the free height of the element.

- C. Type SS: Type 321 stainless steel hose and Type 304 stainless braid sheath, with carbon steel threaded fittings for pipe sizes 2 inches and less, and carbon steel flanges for pipe sizes 2-1/2 inches and greater. Hose shall have a maximum working pressure of 200 psi at 70°F through 4", 155 psi at 70°F through 12".
- D. Type REJ: Flexible pump connectors/expansion joints shall be of the molded twin spherical type. Provide neoprene with nylon construction or EPDM. Unit shall be rated at 225 PSI and maximum temperature of 225°F. Provide 150# flanges and galvanized aircraft cable or control rods.
- E. Expansion Loop: Flexible expansion loop consisting of two Series 300 stainless steel hoses and braids, two 90 degree carbon steel elbows, and a 180 degree return. Provide drain plug and flanged connections. Rate 10 inch expansion loop for 220 psi at 70°F. Rate 6 inch expansion loop for a minimum of 200 psi at 70°F.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Installation shall meet or exceed all applicable federal, state and local requirements, referenced standards and conform to codes and ordinances of authorities having jurisdiction.
- B. All installation shall be in accordance with manufacturer's published recommendations.
- C. Installation of vibration isolators must not cause any change of position of equipment, piping or duct work resulting in stresses or misalignment.
- D. The contractor shall not install any equipment, piping, duct or conduit which makes rigid connections with the building unless isolation is not specified. "Building" includes, but is not limited to, slabs, beams, columns, studs and walls.
- E. Install motor driven equipment with vibration isolators as indicated in schedule below.
- F. Isolate pumped water-piping systems within mechanical room with spring-type vibration isolators.
- G. All open-type spring isolators shall be restrained as recommended by the manufacturer.
- H. Install full line size flexible connectors at the suction and discharge connection of each piece of equipment as indicated in schedule below. All connectors to be suitable for use at the pressure and temperature encountered at point of operation. Do not insulate Type REJ flex pump connectors installed in heating hot water systems.

#### 3.2 APPLICATION

- A. The following is a schedule of equipment and piping on a typical project that requires vibration isolation and base isolators of the types specified. Refer to Drawings for equipment scheduled for the Project. Any equipment, system or condition that may be altered, added, or changed; or that is not specifically described in the Contract Documents shall be isolated in a manner specified for similar equipment, system or condition in order to comply with these Specifications.



B. Provide isolation for the following equipment:[Engineer to revise based on project and acoustical requirements]

Equipment	Isolator Type	Minimum Deflection (inches)
Air Handling Units: Floor/Roof Mounted	NGS	1 0.1 – 0.16
Pumps: Up to 5 HP 5 HP, 7-1/2 HP 10 HP and over	FDS/CIB-L FDS/ CIB-L FDS/CIB-L	1 1 2

C. Provide isolation for the following piping systems:

Piping Systems	Isolator Type	Minimum Deflection (inches)
Piping in Pump Rooms:		
Heating Hot Water Piping – First two hangers adjacent to pumps	SH	Equal to Equipment Isolation
Heating Hot Water Piping – All piping 1-1/2 inches and larger, except first two hangers adjacent to pumps.	SH	1
Pumps Suction/Discharge:		

<b>Piping Systems</b>	<b>Isolator Type</b>	<b>Minimum Deflection (inches)</b>
Hot Water Pump	REJ	

### 3.3 STOCK REQUIREMENTS

- A. The isolation manufacturer's representative must maintain an adequate stock of springs and isolators of type used so that changes required during construction and installation can be made.

### 3.4 ADJUSTING

- A. Adjust isolators after piping system is at operating weight.
- B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.
- C. Adjust active height of spring isolators.
- D. Adjust restraints to permit free movement of equipment within normal mode of operation.

### 3.5 FACTORY REPRESENTATION:

- A. After installation, furnish factory-trained representative of the isolation manufacturer to check various isolators and report measured versus anticipated deflection on all isolators. Have the representative submit written certification that the isolators have been installed in accordance with the specifications, manufacturer's recommendations and approved submittals

END OF SECTION 23 05 48

## SECTION 23 05 53 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including "Uniform General Conditions and Supplementary General Conditions For The State Of Texas Building Construction Contracts" and Division 01 Specification Sections, apply to the work of this Section.
  - 1. Where the term "Owner's Designated Representative" is used, it shall mean a member of the project's capital team.

#### 1.2 SUMMARY

- A. This section includes:
  - 1. Equipment labels.
  - 2. Warning signs and labels.
  - 3. Pipe labels.
  - 4. Stencils.
  - 5. Valve tags.
  - 6. Warning tags.
  - 7. Duct labels.

#### 1.3 SUBMITTAL

- A. Product Data: For each type of product indicated.
- B. Samples: For color, letter style, and graphic representation required for each identification material and device.
- C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.
- D. Valve numbering scheme.
- E. Valve Schedules: For each piping system to include in maintenance manuals.

#### 1.4 COORDINATION

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

#### 1.5 RELATED WORK

- A. Painting. Division 09.

## 1.6 OPERATION AND MAINTENANCE DATA

- A. Submit operation and maintenance data under provisions of Section 23 00 10.
- B. Valve Tags
  - 1. Each service shall be individually tabbed in the binder.
  - 2. Provide valve charts listing functions of each valve in a metal frame and behind glass placed as directed by Owner
  - 3. For each valve tag, indicate service, function, valve position (NC or NO), floor, room location and nearest column numbers.
- C. Equipment Labels
  - 1. Provide three ring binder including equipment label information (8-1/2 x 11 inch paper).
  - 2. Each type of equipment (pumps, AHUs, etc) shall be individually tabbed in the binder.
  - 3. For each item of equipment to be labeled, provide equipment identification number, floor, room location, and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Acceptable Manufactures: Subject to compliance with requirements, provide products by one of the following:
  - 1. Brady Corporation.
  - 2. Marking Services, Inc.
  - 3. Seton Identification Products.

### 2.2 EQUIPMENT LABELS

- A. Metal Labels for Equipment:
  - 1. Material and Thickness: Brass, 0.032 inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
  - 2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 x 3/4 inch.
  - 3. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
  - 4. Fasteners: Stainless-steel rivets or self-tapping screws.
  - 5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- B. Plastic Labels for Equipment:
  - 1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
  - 2. Letter Color: Black.
  - 3. Background Color: Background to contrast with letter color.
  - 4. Maximum Temperature: Able to withstand temperatures up to 160°F.
  - 5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 inch x 3/4 inch.

6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
7. Fasteners: Stainless-steel rivets or self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Label Content: Include equipment's Drawing designation or unique equipment number.

## 2.3 WARNING SIGNS AND LABELS

- A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
- B. Letter Color: Black.
- C. Background Color: Background to contrast with letter color.
- D. Maximum Temperature: Able to withstand temperatures up to 160°F.
- E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 inch x 3/4 inch.
- F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering 2/3 to 3/4 the size of principal lettering.
- G. Fasteners: Stainless-steel rivets or self-tapping screws.
- H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- I. Label Content: Include caution and warning information, plus emergency notification instructions.

## 2.4 PIPE LABELS

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
- B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.
- C. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.
  1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
  2. Lettering Size: At least 1-1/2 inches high.

## 2.5 VALVE TAGS

- A. Provide valves with 1 1/2 inch diameter stainless steel or brass valve tag with stamped and black-filled numbers. Service designations shall be 1/4 inch letters, and valve numbers shall be 1/2 inch letters. Service designations shall be approved by Architect/Engineer. Secure tags to valves by use of brass "S" hooks and brass chain. Secure chain to valve by use of copper or monel meter seals.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

### 3.2 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment. Use fasteners for all equipment labels where possible. Where it is not possible to use fasteners, use adhesive.
- B. Locate equipment labels where accessible and visible.

### 3.3 VALVE TAG

- A. Install valve tags for all major valves. This shall include branch isolation and balancing valves, isolation valves for equipment such as air handling units, pumps, chillers, etc.
- B. Do not provide valve tags for isolation valves directly adjacent to fan coil units and terminal boxes.

### 3.4 PIPE LABEL INSTALLATION

- A. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
  1. Near each valve and control device.
  2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
  3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
  4. At access doors, manholes, and similar access points that permit view of concealed piping.
  5. Near major equipment items and other points of origination and termination.
  6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
  7. Do not label drain piping where the floor drain is located adjacent to the equipment.
- B. Some of the below piping may not exist on this project, but when they do provide labels as noted. Provide pipe labels for the following piping systems:
  1. Chilled Water Systems

2. Heating Hot Water Systems
3. Condenser Water Systems
4. Make-up Water Systems
5. Drain lines
6. Process Chilled Water Systems
7. Refrigerant Piping
8. Steam Piping Systems
9. Steam Condensate Piping Systems

END OF SECTION 23 05 53

## SECTION 23 05 93 – SYSTEM TESTING, ADJUSTING AND BALANCING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including "Uniform General Conditions and Supplementary General Conditions For The State Of Texas Building Construction Contracts" and Division 01 Specification Sections, apply to the work of this Section.
  - 1. Where the term "Owner's Designated Representative" is used, it shall mean a member of the project's capital team.

#### 1.2 SUMMARY

- A. Testing, adjusting and balancing (TAB) of the air conditioning systems and related ancillary equipment will be performed by an impartial technically qualified TAB firm as part of General Contractors scope of work.
- B. The firm shall be capable of performing the services specified at the location of the facility described within the time specified, of preparing and submitting the detailed report of the actual field work performed, and following up the basic work as may be required.

#### 1.3 QUALIFICATIONS

- A. The Firm shall be one which is organized to provide professional services of this specified type in the State of Texas and as a minimum shall have one (1) professional engineer licensed in the State of Texas, with current registration, to perform such professional services. This engineer shall be personally responsible for developing the job site data as required in the test procedures outlined in these Specifications.
- B. The Firm shall have operated a minimum of five (5) years under it's current Firm name, and shall be in good standing with the State of Texas, Franchise Tax Board. The firm shall submit their full incorporated name, Charter Number and Taxpayer's I.D. Number for proper verification of the firm's status.
- C. The Firm shall be capable of providing a performance bond, by a bonding company licensed to do business in the State of Texas, if determined by the Owner that such a bond is required. The amount of the bond which may be required shall be equal to the cost of the proposal submitted, or in the case of more than one proposal, the sum of all such proposals and any awarded work in progress.
- D. The Firm shall maintain current insurance coverages in the minimum amounts shown below. If the Firm normally carries such insurance coverages (minimum or higher) incident to it's operation, additional insurance for the specific proposal or proposals is not required. The minimum insurance coverages required are:
  - 1. Worker's Compensation as required by law.
  - 2. General Liability for not less than \$1,000,000 aggregate refer to Division 01, General Conditions.



3. Fire Damage, and Extended Coverage, Vandalism and Malicious Mischief, in the full amount of Contract. The above policies shall be carried with companies satisfactory to the Owner. Certificates of each of the above policies, together with a written statement by the issuing company, stating that said policy will not be canceled without ten (10) days prior written notice to the owner (Lamar State College) and shall be delivered to the Owner before any work is started.
- E. All personnel used on the job site shall be either professional engineers or engineering technicians, who shall have been permanent, full time employees of the firm for a minimum of six (6) months prior to the start of work for this specific project.
- F. The TAB firm shall submit biographical data on the individual proposed to directly supervise the TAB work, as well as other personnel scheduled to perform the technical work under the contract. It shall also submit a background record of at least five years of specialized experience in the field of air hydronic system balancing, and shall possess properly calibrated instrumentation. The supervisory personnel for the TAB firm shall be registered engineers in the mechanical field and all of the employees used in the TAB firm shall be permanent, full-time employees of the firm.
- G. The scope of the TAB work as defined herein is indicated in order that the Mechanical Contractor will be advised of the coordination, adjustment and system modification which will be required under the project work in order to complete the Owner's requirements for final TAB. The General Contractor shall engage one of the certified TAB firms from the approved list below:

Engineered Air Balance, Inc. - (713)873-7084

Technical Air Balance, Inc. - (281) 651-1849

Precision Air of Texas - (281) 449-0961

Air balance work shall be done by one of the above approved contractors and not by the Mechanical Contractors nor as a subcontract to the Mechanical Contractor.

#### 1.4 REFERENCES

- A. National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems, Fifth Edition 1989.
- B. ASHRAE - 1991 HVAC Applications Chapter 34: Testing, Adjusting and Balancing.
- C. ANSI/ASHRAE Standard 111-1988 - Practices for Measurement, Testing, Adjusting and Balancing of Buildings, Heating, Ventilation, Air Conditioning and Refrigeration Systems.

#### 1.5 DOCUMENTS

- A. The TAB firm shall, as a requirement of the TAB contract, arrange with the Architect to compile one set of mechanical specifications, all pertinent change orders, and the following:
  1. One complete set of Drawings less the structural sheets.
  2. One set of mechanical floor plans of the conditioned spaces. These Drawings shall be ozalid type (blue or black on light background) reproductions to facilitate marking.

- B. Approved submittal data on equipment installed, and related changes as required to accomplish the test procedures outlined in Paragraphs 1.6 through 1.10 of this Specification will be available through the Construction Inspector.

#### 1.6 RESPONSIBILITIES OF THE TAB FIRM

- A. The TAB personnel shall check, adjust, and balance the components of the air conditioning system which will result in optimal noise, temperature, and airflow conditions in the conditioned spaces of the building while the equipment of the system is operating economically. This is intended to be accomplished after the system components are installed and operating as provided for in the contract documents. It is the responsibility of the Mechanical Contractor to place the equipment into service. Variable air volume systems shall be balanced in accordance with AABC 1989 Standard, Fifth Edition.
- B. Liaison and Early Inspection:
  - 1. The TAB firm personnel on the job shall act as liaison between the Owner, Architect and Contractor. The following reviews (observations) and tests shall be performed by the TAB Agency:
    - a. During construction, review all HVAC submittals such as control diagrams, air handling devices, etc., that pertain to commissioning work and balance ability.
    - b. During the balancing process, as abnormalities and malfunctions of equipment or components are discovered by the TAB personnel, the Construction Inspector shall be advised in writing so that the condition can be corrected by the Mechanical Contractor. The written document need not be formal, but must be understandable and legible. Data from malfunctioning equipment shall not be recorded in the final TAB report. The TAB firm shall not instruct or direct the Contractor in any of the work, but will make such reports as are necessary to the Owner.

#### 1.7 FINAL AIR BALANCE

- A. General: When systems are complete and ready for operation, the TAB Consultant will perform a final air balance for all air systems and record the results. The outside, supply, exhaust and return air volume for each air handling unit, supply fan and exhaust fan and the supply, exhaust or return air volume for each distribution device shall be adjusted to within +5% of the value shown on the drawings. Air handling unit and fan volumes shall be adjusted by changing fan speed and adjusting volume dampers associated with the unit. Air distribution device volume shall be adjusted using the spin-in tap damper for flexible duct connected devices and the device OBD for duct connected devices. Air distribution devices shall be balanced with air patterns as specified. Duct volume dampers shall be adjusted to provide air volume to branch ducts where such dampers are shown. The general scope of balancing by the TAB Consultant will include, but is not limited to, the following:
  - 1. Filters: Check air filters and filter media and balance only system with essentially clean filters and filter media. The Division 23 Contractor shall install new filters and filter media prior to the final air balance.
  - 2. Blower Speed: Measure RPM at each fan or blower to design requirements. Where a speed adjustment is required, the Division 23 Contractor shall make any required changes.
  - 3. Ampere Readings: Measure and record full load amperes for motors.

4. Static Pressure: Static pressure gains or losses shall be measured across each supply fan, cooling coil, heating coil, return air fan, air handling unit filter and exhaust fan. These readings shall be measured and recorded for this report at the furthest air device or terminal unit from the air handler supplying that device. Static pressure readings shall also be provided for systems which do not perform as designed.
5. Equipment Air Flow: Adjust and record exhaust, return, outside and supply air CFM (s) and temperatures, as applicable, at each fan, blower and coil.
6. Coil Temperatures: Set controls for full cooling and for full heating loads. Read and record entering and leaving dry bulb and wet bulb temperatures (cooling only) at each cooling coil, heating coil.
7. Outlet Air Flow: Adjust each exhaust inlet and supply diffuser, register and grille to within +5% of design air CFM. Include all terminal points of air supply and all points of exhaust. Note: For Labs and Rooms that are negative exhaust air flow shall be set to design +10% and supply to design -5%. Positive areas will have opposite tolerances.
8. Pitot Tube Traverses: For use in future troubleshooting by maintenance personnel, all exhaust ducts, main supply ducts and return ducts shall have air velocity and volume measured and recorded by the traverse method. Locations of these traverse test stations shall be described on the sheet containing the data.

#### 1.8 FINAL HEATING HOT WATER BALANCE

- A. General: When systems are completed and ready for operation, the TAB Consultant will perform a final water balance for each hot water system. The general scope of balancing by the TAB Consultant will include, but not be limited to, the following:
  1. Adjusted System Tests: Adjust balancing valves at each coil and heat exchanger for design flow, +5%. Adjust balancing valves at pumps to obtain design water flow. Record pressure rise across pumps and GPM flow from pump curve. Permanently mark the balanced position for each valve (Note: If discharge valves on the pumps are used for balancing record the head being restricted by the valves).
  2. Temperature Readings: Read and record entering and leaving water temperature at each water coil, converter and heat exchanger. Adjust as necessary to secure design and conditions. Provide final readings at all thermometer well locations.
  3. Pressure Readings: Water pressure shall be recorded at all gauge connections. Pressure readings at coils and pumps shall be related to coil and pump curves in terms of GPM flow through flow measuring status, if provided and installed, at each air handler. The flow of water through all water coils shall be adjusted by manipulating valves until the rated pressure drops across each coil is obtained and total water flow is verified by flow measuring status. For coils equipped with 3 way valves, the rated pressure drop shall first be adjusted through the coils. The bypass valve shall then be adjusted on each coil until an equal pressure drop between supply and return connections is the same as with the flow through the coil.
  4. Ampere Readings: Reading and record full load amperes for each pump motor.

#### 1.9 TESTING OF TEMPERATURE CONTROL SYSTEMS

- A. In the process of performing the TAB work, the TAB Agency shall:
  1. Work with the temperature control contractor to ensure the most effective total system operation within the design limitations, and to obtain mutual understanding of intended control performance.
  2. Verify that all control devices are properly connected.
  3. Verify that all dampers, valves and other controlled devices are operated by the intended controller.

4. Verify that all dampers and valves are in the position indicated by the controller (open, closed or modulating).
5. Verify the integrity of valves and dampers in terms of tightness of close-off and full-open positions.
6. Observe that all valves are properly installed in the piping system in relation to direction of flow and location.
7. Observe the calibration of all controllers.
8. Verify the proper application of all normally opened and normally closed valves.
9. Observe the locations of all thermostats and humidistats for potential erratic operation from outside influences such as sunlight, drafts or cold walls.
10. Observe the locations of all sensors to determine whether their position will allow them to sense only the intended temperatures or pressures of the media. Control Contractor will relocate as deemed necessary by the TAB Agency.
11. Verify that the sequence of operation for any control mode is in accordance with approved shop drawings and specifications. Verify that no simultaneous heating and cooling occurs except during dehumidification cycle.
12. Verify that all controller set points meet the design intent.
13. Check all dampers for free travel.
14. Verify the operation of all interlock systems.
15. Perform variable volume system verification to assure the system and its components track with changes from full flow to minimum flow.

- B. A systematic listing of the above testing and verification shall be included in the final TAB report.

#### 1.10 REPORTS

- A. The activities described in this section shall culminate in a report to be provided in quadruplicate (4) individually bound to the RCM. Neatly type and arrange data. Include with the data the date tested, personnel present, weather conditions, nameplate record of test instrument and list all measurements taken after all corrections are made to the system. Record all failures and corrective action taken to remedy incorrect situation. The intent of the final report is to provide a reference of actual operating conditions for the Owner's operations personnel.
- B. All measurements and recorded readings (of air, water, electricity, etc.) that appear in the reports must have been made onsite by the permanently employed technicians or engineers of the firm.
- C. At the option of the Construction Inspector, all data sheets tabulated each day by TAB personnel shall be submitted for initial by the Construction Inspector. Those work sheets so initialed, or copies thereof, shall be presented as a supplement to the final TAB report.
- D. Submit reports on forms approved by the Owner & Engineer which will include the following information as a minimum:
1. Title Page:
    - a. Company Name.
    - b. Company Address.
    - c. Company telephone number.
    - d. Project name.
    - e. Project location.
    - f. Project Manager.

- g. Project Engineer.
  - h. Project Contractor.
  - i. Project Identification Number.
2. Instrument List:
- a. Instrument.
  - b. Manufacturer.
  - c. Model.
  - d. Serial Number.
  - e. Range.
  - f. Calibration date.
  - g. What test instrument was used for.
3. Fan Data (Supply and Exhaust):
- a. Location.
  - b. Manufacturer.
  - c. Model.
  - d. Air flow, specified and actual.
  - e. Total static pressure (total external), specified and actual.
  - f. Inlet pressure.
  - g. Discharge pressure.
  - h. Fan RPM.
4. Return Air/Outside Air Data (If fans are used, same data as for 3 above):
- a. Identification/location.
  - b. Design return air flow.
  - c. Actual return air flow.
  - d. Design outside air flow.
  - e. Return air temperature.
  - f. Outside air temperature.
  - g. Required mixed air temperature.
  - h. Actual mixed air temperature.
5. Electric Motors:
- a. Manufacturer.
  - b. HP/BHP.
  - c. Phase, voltage, amperage, nameplate, actual.
  - d. RPM.
  - e. Service factor.
  - f. Starter size, heater elements, rating.
6. 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.
7. 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.
  8. 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.
  9. 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.
  10. Pump Data:
    - a. Identification/number.
    - b. Manufacturer.
    - c. Size/model.
    - d. Impeller.
    - e. Service.
    - f. Design flow rate, pressure drop, BHP.
    - g. Actual flow rate, pressure drop, BHP.
    - h. Discharge pressure
    - i. Suction pressure.
    - j. Total operating head pressure.
    - k. Shut off, discharge and suction pressure.
    - l. Shut off, total head pressure.
    - m. Pressure differential settings.
  11. Heating Coil Data:
    - a. Identification/number.
    - b. Location.
    - c. Service.
    - d. Manufacturer.
    - e. Air flow, design and actual.
    - f. Water flow, design and actual.
    - g. Water pressure drop, design and actual.
    - h. Entering water or steam 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.
  12. Sound Level Report:
    - a. Location (Location established by the design engineer).

- b. NC curve for eight (8) bands - equipment off.
  - c. NC curve for eight (8) bands - equipment on.
  - d. Test readings:
    - 1) Horizontal, velocity and displacement.
    - 2) Vertical, velocity and displacement.
    - 3) Axial, velocity and displacement.
  - e. Normally acceptable readings, velocity and acceleration.
  - f. Unusual conditions at time of test.
  - g. Vibration source (if non-complying).
13. Control verification indicating date performed and any abnormalities identified.
- a. Point Location/Description.
  - b. EMS Readout (Setpoint and Actual).
  - c. Actual Readout.
  - d. Interlocks.
  - e. Safeties:
    - 1) VSD Normal Operation.
    - 2) VSD Bypass Operation.
  - f. Alarms.
  - g. Sequences of Operation.

END OF SECTION 23 05 93

## SECTION 23 07 00 – HVAC INSULATION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including "Uniform General Conditions and Supplementary General Conditions For The State Of Texas Building Construction Contracts" and Division 01 Specification Sections, apply to the work of this Section.
  - 1. Where the term "Owner's Designated Representative" is used, it shall mean a member of the project's capital team.

#### 1.2 WORK INCLUDED

- A. This Section specifies the general requirements for furnishing and installing insulation. These requirements apply to all other Mechanical Division sections specifying insulation.
- B. All the ductwork and piping in pump rooms, mechanical rooms and equipment rooms including areas without ceilings is to be considered as exposed piping or ductwork.

#### 1.3 RELATED WORK

- A. Internal insulation for air units is specified in the sections on air handling units. The units do not require external insulation.
- B. Insulation. Refer to specific sections on individual insulation types.
- C. Division 9, Painting.

#### 1.4 FIRE HAZARD RATING

- A. All equipment, duct and piping insulation used on the project must have a flame spread rating not exceeding 25 and a smoke developed rating not exceeding 50 as determined by test procedures ASTM E 84, NFPA 255 and UL 723. These ratings must be as tested on the composite of insulation, jacket or facing, and adhesive. Components such as adhesives, mastics and cements must meet the same individual ratings as the minimum requirements.

#### 1.5 QUALITY ASSURANCE:

- A. Applicator shall be a company specializing in insulation application with minimum 5 years' experience.
- B. Mockups: Before installing insulation, build mockups for each type of insulation and finish listed below to demonstrate quality of insulation application and finishes. Build mockups in the location indicated or, if not indicated, as directed by Owner. Use materials indicated for the completed Work. Mockups shall include piping insulation, ductwork insulation and equipment insulation.



## 1.6 SUBMITTALS

- A. Product Data. Submit product data on each insulation type, adhesive and finish to be used in the work. Include manufacturer's installation instructions, list of materials and thickness for equipment scheduled.
- B. Samples. Make an application of each type of insulation to display the material, quality and application method. Obtain approval of the sample application before proceeding with the work.
- C. Shop Drawings: Show details for the following:
  - 1. Application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
  - 2. Attachment and covering of heat tracing inside insulation.
  - 3. Insulation application at pipe expansion joints for each type of insulation.
  - 4. Insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
  - 5. Removable insulation at piping specialties, equipment connections, and access panels.
  - 6. Application of field-applied jackets.
  - 7. Application at linkages of control devices.
  - 8. Field application for each equipment type.
- D. LEED Certificates:
  - 1. Provide certificates showing compliance with the LEED requirements. Failure to provide LEED Certificates will result in rejection of submittal.

## 1.7 LEED REQUIREMENTS

- A. EQ Credit Low-Emitting Materials. General. Building products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method V1.1-210. All adhesives, sealants and coatings shall meet the VOC limits as established by the South Coast Air Quality Management District (SCAQMD) Rule #1168. All paints and primers shall meet the VOC limits as established by the California Air Resources Board (CARB) 2007, Suggested Control Measure (SCM) for Architectural Coatings, or the South Coast Air Quality Management District (SCAQMD) Rule #1113.
- B. LEED for Schools EQ Credit Low-Emitting Materials: Adhesives, sealants, and coatings applied on site must meet the VOC limits of the California Air Resources Board (CARB) 2007 Suggested Control Measure (SCM) for Architectural Coatings, and South Coast Air Quality Management District (SCAQMD), Rule #1168.

## PART 2 - PRODUCTS

### 2.1 ACCEPTABLE MANUFACTURERS

- A. Acceptable manufacturers are listed under individual specification sections.

### 2.2 INSULATION

- A. Insulate in accordance with appropriate specification section.

## PART 3 - EXECUTION

### 3.1 COMMON INSULATION REQUIREMENTS

- A. All materials shall be delivered to the site shall be dry, undamaged and maintained in good condition throughout the progress of the project.
- B. Insulation shall not be installed until all testing and inspection of pipe, duct, vessel, etc. has been completed and approved by Engineer/Owner's representative.
- C. Insulate valves, fittings, flanges and special items in accordance with appropriate specification section.
- D. Replace insulation damaged by either moisture or other means. Insulation which has been wet, whether dried or not, is considered damaged. Make repairs where condensation is caused by improper installation of insulation. Also replace any damage caused by the condensation.
- E. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment, ducts and fittings, and piping including fittings, valves, and specialties.
- F. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment, duct system, and pipe system as specified in insulation system schedules.
- G. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- H. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- I. Install multiple layers of insulation with longitudinal and end seams staggered.
- J. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- K. Keep insulation materials dry during application and finishing.
- L. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- M. Install insulation with least number of joints practical.
- N. Where vapor barrier is indicated, seal joints, duct wrap seams, vapor retarder (ASJ) film seams and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier coating/mastic.
  - 1. Install insulation continuously through hangers and around anchor attachments.
  - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier coating/mastic.

3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
  4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- O. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

### 3.2 ACCESSORIES

- A. Installation of accessories such as jacketing, bands, adhesives, insulation shields, coatings, finishes, etc. is specified under individual specification sections.

END OF SECTION 23 07 00

## SECTION 23 07 13 - EXTERNAL DUCT INSULATION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including "Uniform General Conditions and Supplementary General Conditions For The State Of Texas Building Construction Contracts" and Division 01 Specification Sections, apply to the work of this Section.

#### 1.2 SUMMARY

- A. This Section provides for furnishing and the installation of external insulation on concealed and exposed ductwork, including single wall supply ductwork, outside air ductwork, and relief and return air duct work in non air conditioned spaces and other miscellaneous ductwork. It also includes insulating the tops of all supply diffusers.
- B. All the ductwork exposed to view in public spaces, in mechanical and pump rooms, crawl space and equipment rooms including all areas without ceilings is to be considered as exposed ductwork.
- C. Consider space above ceilings air conditioned if floor above is air-conditioned or if the space is a return air plenum. Consider exterior vertical chases and vertical chases leading to spaces not air-conditioned as un-air conditioned spaces.
- D. No lined ductwork is allowed on the project unless specifically noted on drawings.

#### 1.3 RELATED WORK

- A. Section 23 07 00, Insulation - General.
- B. Section 23 31 13, Ductwork.

#### 1.4 REFERENCES STANDARDS

- A. ASTM C 411 - Temperature Range.
- B. ASTM C 553 - Mineral Fiber Blanket and Felt Insulation.
- C. ASTM C 612 - Mineral Fiber Block and Board Thermal Insulation.
- D. ASTM C 1290 - Standard Specification for Flexible Fibrous Glass Blanket Insulation Used to Externally Insulate HVAC Ducts
- E. ASTM E 96 Procedure A - Jacket Vapor Transmission.
- F. ASTM E 119 – Standard Method of Fire Test of Building Construction and Materials.

## PART 2 - PRODUCTS

### 2.1 ACCEPTABLE MANUFACTURERS

- A. Fiberglass:
  - 1. CertainTeed.
  - 2. JohnsManville.
  - 3. Owens-Corning.
  - 4. Knauf Insulation.

### 2.2 INSULATION

- A. Type D1, Flexible Glass Fiber Insulation: Provide flexible glass fiber insulation with factory-applied, reinforced foil scrim kraft (FSK) facing vapor barrier, 1.0- pound per cubic foot density. A "K" factor of 0.27 at 75°F mean is required. Shall comply with ASTM C553 and C1290.
- B. Type D2, Semi-Rigid Glass Fiber Insulation: Provide semi-rigid glass fiber insulation adhered to UL labeled, reinforced foil scrim kraft (FSK) facing vapor barrier on the outside surface, 2.5 pound per cubic foot density. A K factor of 0.24 at 75°F mean is required.
- C. Type D3, Rigid Glass Fiber Insulation: Provide rigid board glass fiber duct insulation with integral, UL labeled, reinforced foil scrim kraft (FSK) facing vapor barrier on the outside surface, minimum density of 6 pounds per cubic foot. A "K" factor of 0.22 at 75°F mean is required.

### 2.3 COATINGS AND ADHESIVES

- A. Glass Fiber Insulation
  - 1. Coating. Foster 30-80 or Childers CP-38 vapor barrier coating. Permeance shall be 0.013 perms or less as tested by ASTM E96/ASTM F1249. Coating must comply with MIL-C-19565C, Type II and be QPL listed.
  - 2. Adhesive. Fosters 85-60 or Childers CP-127 adhesive. Product must comply with ASTM C916 and ASTM E84 25/50 requirements.
- B. Reinforcing Mesh. Fiberglass or polyester, 10 strands by 10 strands per square inch. Similar to Foster Mast A Fab or Childers Chil Glas #10.

## PART 3 - EXECUTION

### 3.1 GENERAL

- A. Do not apply insulation until ductwork has been tested.
- B. Verify surfaces are clean, foreign material removed, and dry.
- C. Where trapeze hangers are used, provide strip of non-compressible insulation between ductwork and hanger.

3.2 FIRE SAFETY REQUIREMENTS

- A. Do not extend duct coverings through walls or floors required to be fire stopped or required to have fire resistance rating. Interrupt duct coverings in the immediate vicinity of heat sources such as electric resistance or fuel-burning heaters.

3.3 DUCT INSULATION SCHEDULE, GENERAL

- A. Plenums and Ducts Requiring Insulation:
  1. Indoor, concealed supply and outdoor air ductwork.
  2. Indoor, exposed supply and outdoor air ductwork.
  3. Indoor, concealed or exposed return and exhaust ductwork located in nonconditioned spaces.
  4. Indoor, concealed & exposed return air ductwork, from connection of outside air ductwork to air handling unit.
  5. Return and exhaust ductwork in chases located on exterior walls.
- B. Air Devices:
  1. Supply Diffuser.
  2. Uninsulated Plenums on Slot Diffusers and Linear Bar Grilles.
- C. Definitions
  1. Oval ductwork shall be insulated the same as round ductwork.
  2. Outside air duct shall be considered ductwork (or plenum) from louver or intake hood to air handling unit.

3.4 DUCTWORK INSULATION APPLICATION AND THICKNESS SCHEDULE

- A. Provide insulation with minimum thickness and installed “R” valves in accordance with ASHRAE Standard 90.1-2013 Tables 6.8 2A & B, but not less than thickness specified in this specification and as required to prevent condensation:

Ductwork System	Application	Insulation Type	Insulation Thickness
Supply & Outside Air – Rectangular/Round (Hot, Cold, Combination)	Concealed Ductwork	D1	2”
Supply & Outside Air – Round (Hot, Cold, Combination)	Exposed Ductwork	D2	2”
Air Devices	Where shown	D1	1”
Return Air, and Exhaust Air – Rectangular/Round	Concealed,	D1	2”

### 3.5 TYPE D1, FLEXIBLE GLASS FIBER INSULATION

- A. Insulation shall be wrapped, in accordance with manufacturer's recommendations, on the ductwork with all circumferential joints butted and longitudinal joints overlapped a minimum of 2 inches.
- B. Adhere insulation to ductwork with 4 inch wide strips of adhesive at 8 inches on center. In addition, secure insulation to the bottom of rectangular horizontal ductwork and on vertical ductwork over 24 inches wide by the use of mechanical fasteners at no more than 18 inches on center. Weld stick clips to duct work to secure insulation. Stick clips material shall match the material of the ductwork to which they are welded. Adhesive applied stick pins are not acceptable.
- C. On circumferential joints, the 2 inch flange on the facing shall be stapled with outward clinching steel staples on 2 inch centers, and taped with a minimum 3-inch-wide strip of reinforcing mesh and vapor barrier coating. Cover all seams, joints, pin penetrations and other breaks with two coats of vapor barrier coating reinforced with reinforcing mesh. Coating shall completely cover and conceal mesh.

### 3.6 TYPE D2, SEMI-RIGID GLASS FIBER INSULATION

- A. All exposed ductwork in public areas and mechanical rooms shall be wrapped in accordance with manufacturer's recommendations. Firmly butt all joints together and seal longitudinal laps of factory-applied vapor barrier jacket with adhesive. Cover butt joints with a 4 inch wide strip of factory-supplied vapor barrier jacket facing adhered with adhesive. Cover all seams, joints, pin penetrations and other breaks with two coats of vapor barrier coating and reinforcing mesh.

### 3.7 STANDING SEAMS

- A. Insulate standing seams and stiffeners which protrude through insulation with 3-pound density, 1-1/2 inch thick, faced duct insulation, flexible blanket or rigid insulation to match duct insulation. As a vapor seal on exposed edges, use glass cloth with vapor barrier coating. Insulation should not prevent adjustment of damper operators.

### 3.8 AIR DEVICES

- A. Insulate backside of diffusers and uninsulated plenums on slot diffusers as indicated in application schedule.
- B. All edges of insulation should be taped to diffuser backpan with pressure-sensitive aluminum foil tapes listed and labeled under UL 181A, Part I.

### 3.9 TRANSFER DUCTS

- A. Line return air transfer ducts with 1/2 inch dual density type acoustical insulation. Coat exposed edges of insulation with sealant.

### 3.10 HEATING COILS

- A. Install insulation on heating coil casings same as specified for adjacent ductwork.

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END OF SECTION 23 07 13



## SECTION 23 07 16 - EQUIPMENT INSULATION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including "Uniform General Conditions and Supplementary General Conditions For The State Of Texas Building Construction Contracts" and Division 01 Specification Sections, apply to the work of this Section.
  - 1. Where the term "Owner's Designated Representative" is used, it shall mean a member of the project's capital team.

#### 1.1 WORK INCLUDED

- B. This Section provides for furnishing and installing insulation for both high and low temperature vessels and equipment.
- C. High temperature installations include hot water storage tanks and heaters, converters, heat exchangers, expansion tanks, air eliminators and other vessels containing liquids or gases above 85°F.
- D. Low temperature installations include chilled water pumps, heat exchangers, expansion tanks, air eliminators, chilled water storage (buffer) tanks and other vessels containing liquids and gases below 60°F.

#### 1.2 RELATED WORK

- A. Section 23 07 00, Insulation - General.

#### 1.3 SUBMITTALS

- A. Provide Submittals in accordance with Section 23 07 00.

### PART 2 - PRODUCTS

#### 2.1 ACCEPTABLE MANUFACTURERS

- A. Fiberglass (Type E1)
  - 1. Knauff.
  - 2. Owens-Corning.
  - 3. Johns Manville.
- B. Flexible Elastomeric (Type E2)
  - 1. Armacell
  - 2. K-Flex USA.

#### 2.2 INSULATION

- A. Type E1, Semi-Rigid Glass Fiber Insulation: Provide semi-rigid glass fiber insulation adhered to UL labeled, reinforced foil scrim kraft (FSK) facing vapor barrier on the outside surface, 2.5 pound per cubic foot density. A K factor of 0.24 at 75°F mean is required.

- B. Type E2, Flexible Elastomeric insulation: Provide flexible elastomeric insulation complying with ASTM C534, Type 1 for tubular materials. Insulation shall have a maximum "K" factor of 0.25 Btu-in./h-ft<sup>2</sup>- °F at a 75°F mean temperature when tested in accordance with ASTM C 177 or ASTM C 518, latest revisions.

2.3 CEMENT AND COATINGS

- A. High Temperature:
  - 1. Cement. Provide Ryder One Coat cement to seal insulation for high temperature vessels.
  - 2. Coating. Furnish Childers CP-50AHV2 or Foster 30-36 lagging adhesive/coating to provide a finish coat and to secure glass cloth for high temperature vessels.
- B. Reinforcing Mesh:
  - 1. Reinforcing Mesh: Fiberglass or polyester. 10 strands by 10 strands per square inch. Similar to Foster Mast A Fab or Childers Chil Glas #10.

PART 3 - EXECUTION

3.1 GENERAL

- A. Pressure test all piping prior to insulating equipment.
- B. Clean surfaces prior to installation and remove all dirt.

3.2 EQUIPMENT INSULATION APPLICATION AND THICKNESS SCHEDULE

Service	Application	Insulation Type	Insulation Thick-ness-Inches
Air Separators, Expansion Tanks	Hot Water System	E1	1-1/2
Heat Exchangers	Hot Water System	E1	1-1/2

Service	Application	Insulation Type	Insulation Thickness-Inches

3.3 TYPE E1, SEMI-RIGID GLASS FIBER INSULATION

- A. Lay insulation blocks with edges tightly butted. Secure the blocks in place with wire or stainless steel bands wrapped on 9-inch centers. After insulation is secure, stretch 1-inch hexagonal galvanized wire mesh over the blocks and wire securely with edges of mesh tied together.
- B. Apply cement in two coats to a total thickness of 1/2 inch. After cement is dry, prime with 50% diluted lagging adhesive and apply a final finish lagging adhesive/coating with reinforcing per manufacturer's instructions.

END OF SECTION 23 07 16

## SECTION 23 07 19 - PIPING INSULATION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including "Uniform General Conditions and Supplementary General Conditions For The State Of Texas Building Construction Contracts" and Division 01 Specification Sections, apply to the work of this Section.
  - 1. Where the term "Owner's Designated Representative" is used, it shall mean a member of the project's capital team.

#### 1.2 SUMMARY

- A. Section includes:
  - 1. Piping insulation for Heating Water Piping within building envelope, other than Crawl Spaces and wet areas.
  - 2. Furnishing and installation of insulation.
  - 3. Jackets and accessories.
  - 4. Refrigerant piping insulation.

#### 1.3 REFERENCES

- A. ANSI/ASTM C 195 - Mineral Fiber Thermal Insulation Cement.
- B. ANSI/ASTM- C 547 - Mineral Fiber Preformed Pipe Insulation.
- C. ANSI/ASTM C 552 - Cellular Glass Block and Pipe Thermal Insulation.
- D. ASTM B 209 - Aluminum and Aluminum-alloy Sheet and Plate.
- E. ASTM C 449 - Mineral Fiber Hydraulic-setting Thermal Insulating and Finishing Cement.

#### 1.4 QUALITY ASSURANCE

- A. Applicator. Company specializing in piping insulation application with five years minimum experience.
- B. Materials. UL/ULC Classified per UL 723 or Flame spread/fuel contributed smoke developed rating of 25/50 in accordance with ASTM E84.

#### 1.5 SUBMITTALS

- A. Refer to Specification 23 07 00.
- B. Submit product data on insulating materials, including manufacturer's safety and installation instructions.
- C. Include product description, list of materials and thickness for each service, and locations.

## PART 2 - PRODUCTS

### 2.1 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with requirements, provide products by one of the following:
1. Fiberglass
    - a. Owens-Corning.
    - b. JohnsManville.
    - c. Knauff Insulation
  2. Flexible Elastomeric
    - a. Armacell; AP Armaflex.
    - b. RBX Corporation.
  3. Cellular Glass
    - a. Owens-Corning.

### 2.2 INSULATION

- A. Type P1: Furnish fiberglass insulation with factory applied, all service reinforced vapor barrier (ASJ) jacket having integral laminated aluminum vapor barrier and self sealing labs. Jacketing shall have a maximum water vapor permeance of 0.02 perms. Insulation shall be in accordance with ANSI/ASTM C 547 with a "K" factor of 0.23 BTU-in/hr-ft<sup>2</sup>-°F at 75°F. Insulation shall be certified by Greenguard Gold. Insulation shall be rated for continuous use on pipe conveying services up to 850 degrees Fahrenheit.
- B. Type P2. Furnish closed-cell expanded rubber materials complying with ASTM C534, Type 1 for tubular materials. Insulation shall have a maximum "K" factor of 0.27 Btu-in./h-ft<sup>2</sup>- °F at a 75°F mean temperature when tested in accordance with ASTM C 177 or ASTM C 518, latest revisions.
- C. Type P3: Cellular Glass One Insulation with a "K" factor of 0.29 BTU-In/Hr.-degree F at 75°F manufactured by Pittsburgh Corning Corporation and fabricated by a Pittsburgh Corning Corporation-approved fabricator. Water vapor permeability shall be 0.00 perm-in.The insulation shall comply with ASTM C 552 Type II, furnished in half sections up to 36 inches long or segments 18 inches long.

### 2.3 INSULATION SHIELDS AND SADDLES

- A. Field Fabricated:
1. Use high compression strength Cellular Glass blocks (HLB 1600) that will support the bearing area at hangers and supports.
  2. Further support insulation at hangers and supports with a shield of galvanized metal extending not less than 2 inches on either side of the support bearing area, covering at least half of the pipe circumference, and conforming to the schedule below.
  3. When pipe is guided at top and bottom, metal shields should cover the whole pipe circumference.
  4. Adhere metal shield to insulation so that metal will not slide with respect to insulation. Furnish vapor barrier and sealant where used on low temperature service (below 100°F).

<b>Pipe Diameter</b>	<b>Insulated Section Length in Inches</b>	<b>Minimum U.S. Standard Gauge of Metal Shield</b>
2 1/2" and smaller	14	16

3" to 4"	14	16
6" to 12"	24	14
14" and larger	24	12

5. At Contractor's option, factory-made insulation shields may be provided as made by Anvil Fig 168, equivalent by Pipe Shields, Inc., or equal. Insulation should extend at least 1 inch beyond metal. Select proper shield for service and pipe span.
6. For Type P2 insulation, factory-made insulation shields such as Armafix IPH may be used at Contractor's option.

B. Saddles: Fit piping 2 inches through 10 inches operating at high temperatures with Anvil Figure 161 through 164 protection saddles, or similar saddles of proper design for specified insulation thickness. Fit pipe sizes over 10 inches with Anvil Figure 163A through 165A or similar saddle as required by insulation thickness specified.

C. All shields are to be secured by 2 stainless steel bands, 1/2 inch wide by 0.015 inch thick with matching seals

#### 2.4 JACKETS

A. PVC Jackets: Provide molded or mitered covers for flanges, valves and fittings similar to Schuller Zeston 2000.

B. Canvas or Glass Jackets and Lagging Adhesive/Coating: UL listed treated cotton fabric, 6 ounce/square yard or low odor glass cloth, Childers CP-50AMV1, F Foster 30-36 AF; Childers CP-137 AF, or approved equal. Coatings shall meet ASTM D 5590.

C. Cellular Glass. Provide aluminum jacketing meeting requirements of this section. Underground Piping: Provide Pittwrap CW Plus 50 mil thick self-sealing, modified bituminous membrane on piping operating below 140°F. Provide Pittwrap 125 mil thick bituminous resin reinforced with a woven, glass fabric, an integral aluminum foil layer and a protective plastic fill coating on piping operating above 140°F. Jacketing shall provide a complete encapsulation of all insulation including end flanges and reducers.

#### 2.5 BANDING – CELLULAR GLASS

A. Aluminum Steel bands, 1/2 inch wide by 0.0015 inch thick with matching seals.

B. Reinforced tape for insulation, 3/4 inch with fiber reinforcement, Scotch Brand No. 880 by 3M, or equal.

#### 2.6 SEALANT, ADHESIVE AND FINISH

A. Fiberglass - High Temperature (Above 100°F):

1. Lap Adhesive. Same as low temperature.
2. Finish: Furnish Childers CP-10/11 or Foster 46-50 weather barrier mastic with reinforcing mesh.
3. Cement: Furnish Ryder One Coat on insulated fittings, flanges and valves.
4. Primer and Finish. Furnish Childers CP-50A MV1 diluted 50% with water to prime cement prior to applying coating.

5. Lagging Adhesive: Used in conjunction with canvas or glass lagging cloth to protect equipment/piping indoors. Foster 30-36 Seal fast, Childers CP-50AMV1 Chil Seal or approved equal.
- B. Flexible Elastomeric
  1. Adhesive: Furnish Armaflex 520 BLV Low VOC Adhesive, Foster 85-75, or Childers CP-82 to seal longitudinal laps and to adhere butt joint covers.
  2. Finish: Furnish Armaflex WB or Foster 30-64 water based latex enamel finish.
- C. Cellular Glass:
  1. Sealant: Pittseal 444N Sealant by Pittsburgh Corning Corporation.
  2. Primer: Foster 60-26 or other rust-inhibitive primer. Note: Primer does not meet LEED requirements when used indoors]
- D. Reinforcing Mesh: Fiberglass or polyester. 10 strands by 10 strands per square inch. Similar to Foster Mast A Fab or Childers Chil Glas #10

## 2.7 FITTINGS

- A. Provide pre-molded fittings and elbows molded in two matching half sections of same insulation thickness as adjoining piping. As an alternative, provide mitered sections of insulation equivalent in thickness and composition to that installed on straight pipe runs. No insert or blanket insulation allowed.
- B. Cellular Glass. Provide Cellular Glass One pre-molded insulation at flanges, valves, and fittings. Provide fiberglass blanket insulation to fill small voids around flanges and valves as required.

## 2.8 PRIMER

- A. Polyguard RG-CHW for surface temperatures less than 130F, RG-2400 LT for piping with surface temperatures between 130F and 250F. Application thickness shall be 25 mils.
- B. Global Encasement Rust Inhibition Primer. Application thickness shall be minimum 3 mils (dry)
- C. Sherwin Williams Pro-Cryl Universal Acrylic Primer. Application thickness shall be minimum 3 mils (dry).

## 2.9 ALUMINUM JACKET

- A. Piping. Furnish for finishing interior insulated pipe, a prefabricated jacket of ASTM B209 aluminum, 0.020 inch thick, with factory-applied 2-mil moisture barrier. On all piping in the Mechanical Room.
- B. Valves, Fittings and Flanges in Mechanical Room. Provide complete coverage of all valves, fittings and flanges, provide aluminum covers, 0.020 inch thick, ASTM B209 aluminum.
- C. Straps and Seals. Furnish 1 inch x 0.010 inch, ASTM B209 aluminum strapping and seals for applying aluminum jacket and covers to provide completely weather tight covering of all insulation including caps, flanges and end of lines.

- D. Metal Jacketing Sealant: Furnish 1/8" bead of Foster 95-44 or Childers CP-76 underneath all metal jacketing laps to prevent water entry on outdoor applications.

### PART 3 - EXECUTION

#### 3.1 PIPE

- A. Pressure testing of piping systems shall be complete prior to application of insulation.
- B. Prior to insulating piping,
  - 1. Remove all oil, grease, cutting oils, dirt and other contaminants. Use suitable solvents, steam cleaning with detergent, or fresh water wash with detergent. Follow with thorough fresh water rinse.
- C. Butt insulation joints firmly together. Seal longitudinal laps and butt strips with sealant.
- D. Type P1 Fiberglass - Low Temperature:
  - 1. Where piping is interrupted by fittings, flanges, valves or hangers and at intervals not to exceed 25 feet on straight runs, an isolating vapor seal shall be formed between the vapor barrier jacket and the bare pipe by liberal application of the vapor barrier sealant to the exposed joint faces carried continuously down to and along 4 inches of pipe and up to an along 2 inches of the jacket.
- E. Type P2.
  - 1. Provide finish as specified on all insulation.
- F. Type P3 Cellular Glass
- G. Insulation shall be applied to piping with all joints tightly fitted to eliminate voids. For systems operating at or below 55°F, all joints must be sealed full-depth with sealant. Sealant shall not be used to fill voids or cracks.
- H. Insulation sections shall be secured with stainless steel bands. Two strips of reinforced tape may be used in place of bands or wire if exterior bands are used with jacketing. The tape shall overlap itself by 50 percent.
- I. Insulate valves, flanges, and fittings in a manner like that for piping using materials in Part 2.

#### 3.2 VALVES, FLANGES AND FITTINGS

- A. High Temperature:
  - 1. Omit insulation at screwed unions and at valves smaller than 1-1/2 inches.
  - 2. On concealed (other than mechanical and pump rooms) piping, insulate fittings and valves 2-1/2 inches IPS and larger, with pre-molded fitting covers. Thickness of insulation shall be equal to that of adjoining pipe. Finish with mastic reinforced with reinforcing mesh.
  - 3. On concealed piping, insulate fittings and valves 2 inches IPS and smaller with pre-molded fitting covers with a thickness equal to or greater than adjoining straight pipe. Finish with mastic reinforced with reinforcing mesh.
  - 4. In exposed (mechanical, pump and equipment rooms) area, insulate all fittings, flanges and valves with pre-molded fitting covers. Thickness of insulation shall be equal to that of adjoining pipe. Finish with mastic reinforced with reinforcing mesh.



5. Omit insulation on heating hot water flexible pump connectors or expansion joints.

### 3.3 SHIELDS AND HANGERS

- A. When the insulation is jacketed in aluminum, install a length of 40-pound roofing felt 1/2 inch longer than the insulation shield between shield and jacket.
- B. Where piping hangers or anchors must be in direct contact with pipe, seal off the pipe insulation on both sides of the hanger by carrying the vapor seal down to the bare pipe. Apply insulation around the hanger ring or anchor and pipe and carry vapor barrier upward and outward along the hanger rod or anchor members to a point not less than 12 inches from the adjacent pipe. Draw wire loops tight over the vapor barrier jacket, with ends of wire bent down. Take care to avoid puncturing the vapor seal. Finish insulation as specified for flanges, and seal over adjacent vapor barrier jacket.

### 3.4 INSTALLATION

- A. Install materials in accordance with manufacturer's instructions.
- B. Continue insulation with vapor barrier through penetrations.
- C. In exposed piping areas, locate insulation and cover seams in least visible locations. For outdoor installations seal jacket lap with 1/8" bead of metal jacketing sealant underneath each lap to prevent infiltration of water beneath jacket. On horizontal piping place over lap at side of pipe arranged so that water will run off of jacket and not into seam lap.
- D. On insulated piping with vapor barrier, insulate fittings, valves, unions, flanges, strainers, flexible connections, and expansion joints.
- E. Neatly finish insulation at supports, protrusions, and interruptions. Use 1-1/2 inch Type P2 insulation to insulate drains gauges, thermometers, and strainers.

### 3.5 PIPING INSULATION APPLICATION AND THICKNESS SCHEDULE

- A. Provide insulation with minimum thickness and conductivity values in compliance with ASHRAE standard 90.1-2013, Table 6.8.3A&B, but not less than thicknesses specified in this specification and as required to prevent condensation. Where multiple materials are listed for a single service and location, it is the Contractor's option to choose from the allowable insulations.

Service	Location	Insulation Type	Pipe Sizes	Insulation Thickness-Inches
AHU/FCU Condensate Drains	Interior	P2	All sizes	1
Heating Hot Water	Interior	P1	1-1/4" and smaller	1-1/2
Heating Hot Water	Interior	P1	1-1/2" to 4"	2
Refrigerant Piping	Interior/exterior	P2	All sizes	1-1/2

### 3.6 ALUMINUM JACKET

- A. Apply aluminum jacket and covers according to manufacturer's recommendations, using aluminum strapping and metal jacketing sealant to provide completely weathertight covering. Completely encapsulate insulation on all piping, valves, flanges, reducers, etc.
- B. Provide aluminum jacket for all piping within 84 inches of finished floor in air handler mechanical rooms, pump rooms, penthouses and exposed occupied spaces in the building. Do not install jacketing on AHU Condensate drains unless noted otherwise. Do not install jacketing on flexible pump connectors or expansion joints.

### 3.7 EXTERIOR JACKET

- A. Apply aluminum jacketing and covers according to manufacturer's recommendations. Completely encapsulate insulation on all piping, valves, flanges, reducers, etc.
- B. Provide exterior jacket for all insulated refrigerant piping located outdoors.

END OF SECTION 23 07 19

## SECTION 23 09 23 - DIRECT DIGITAL CONTROL SYSTEMS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including "Uniform General Conditions and Supplementary General Conditions For The State Of Texas Building Construction Contracts" and Division 01 Specification Sections, apply to the work of this Section.
  - 1. Where the term "Owner's Designated Representative" is used, it shall mean a member of the project's capital team.

#### 1.2 RELATED SECTIONS

- A. 23 05 19 – Meters and Gauges for HVAC Piping
- B. 23 21 00 – Hydronic Piping and Fittings
- C. 23 33 00 – Air Duct Accessories
- D. Division 26
- E. Division 27

#### 1.3 REFERENCED STANDARDS

- A. ASHRAE Standard 135 Latest Edition: BACnet® – A Data Communication Protocol for Building Automation and Control Networks
- B. UL 916 – Energy Management Equipment
- C. NFPA 70 – National Electric Code

#### 1.4 SYSTEM DESCRIPTION

- A. A complete automatic Building Management System (BMS) using field-programmable micro-processor based units. System shall communicate with the existing BMS. Contractor shall interface all new field controllers and devices and provide all necessary programming to establish communication with the existing Operator Stations on campus. Communication shall be established in one of two acceptable ways, by either extending existing field communications trunks to new field controllers or by tying in new open protocol controllers utilizing the existing Campus-wide Ethernet LAN via an OPC client/server data path to the Operator Stations. The Contractor shall be responsible for verifying and establishing new controls databases on the existing Operator Stations and provide for a Human/Machine interface to the new equipment including generating graphics compatible with existing, manual override for start/stops, manual override for setpoint resets, schedule changes, and displaying values of all binary and analog field points.

#### 1.5 SUBMITTALS

- A. Submit under provisions of Division 01.

- B. Shop Drawings:
  - 1. Trunk cable schematic showing programmable control unit locations, and trunk data conductors.
  - 2. List of connected data points, including connected control unit and input device.
  - 3. System graphics indicating monitored systems, data (connected and calculated) point addresses, and operator notations.
  - 4. System configuration with peripheral devices, batteries, power supplies, diagrams, modems, and interconnections.
  - 5. Schematic diagrams of each controlled system with control points labeled and control elements graphically shown, with wiring and pneumatic details.
  - 6. Descriptive data and sequence of operation of operating, user, and application software.
- C. Product Data: Provide data for each system component and software module. Markup datasheet to easily reference the intended component and part number being supplied.
- D. Data Communications Protocol Certificates: Certify that each proposed DDC system component complies with ASHRAE Standard 135.
- E. Samples for Initial Selection: Submit one sample of each color of thermostat and/or sensor cover with factory colors. Where applicable, match the color of existing thermostats and/or sensor covers.
- F. Manufacturer's Installation Instructions: Include for all manufactured components. Markup installation instructions to easily reference the intended installation method.

#### 1.6 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Division 01.
- B. Accurately record final location of control components, including panels, thermostats, and sensors.
- C. Revise shop drawings as necessary to reflect actual installation and operating sequences.
- D. Include data specified in "Submittals" in final "Record Documents" form.
- E. Provide final documentation in electronic and hard copy formats.

#### 1.7 OPERATION AND MAINTENANCE DATA

- A. Submit under provisions of Division 01.
- B. Include interconnection wiring diagrams of complete field installed system with identified and numbered, system components and devices.
- C. Include keyboard illustrations and step-by-step procedures indexed for each operator function.
- D. Include inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.

- E. Product Data: Provide data for each system component and software module. Markup datasheet to easily reference the intended component and part number supplied.
- F. Manufacturer's Installation Instructions: Include for all manufactured components. Markup installation instructions to easily reference the installation method.
- G. Provide final documentation in electronic and hard copy formats.

#### 1.8 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the products specified in this Section with minimum five years documented experience. Manufacturer shall have a local Branch office staffed with Factory trained engineers and system representatives fully capable of providing instruction, routine maintenance, and emergency maintenance service on all system components.
- B. Installer: Company specializing in applying the work of this Section with minimum five years documented experience. Installer shall be a local Branch office of the Manufacturer with resident factory trained personnel. Branches shall be certified for ISO-9002 quality standards to assure adherence to quality standards adopted for their manufactured products.

#### 1.9 PRE-INSTALLATION CONFERENCE

- A. Convene a conference **one** week prior to commencing work of this Section, under provisions of Division 1.
- B. Require attendance of all parties directly affecting, or responsible for coordinating with the work of this Section. Attendance shall include but not be limited to: General Contractor, Controls Contractor, HVAC Contractor, Electrical Contractor, Testing and Balancing Contractor, and Owner's Representative.
- C. Controls contractor shall provide all attendees with a meeting agenda at least two working days in advance of the scheduled meeting. The agenda shall include but not be limited to the review of: overall design, major components, component locations, and coordination with other trades.
- D. All BMS point names (Including BACNet device names) and applicable database names will be approved by the owner. The intent is to conform to the standard owner point naming and database naming convention.
- E. New BMS point alarming and trending shall match existing typicals and will be approved by the owner.

#### 1.10 COORDINATION

- A. Coordinate work under provisions of Division 01.
- B. Ensure installation of components is complementary to installation of similar components in other systems.
- C. Coordinate installation of system components with installation of mechanical systems equipment such as air handling units and air terminal units.

- D. Coordinate power requirements with Division 26 contractor.

#### 1.11 WARRANTY

- A. Provide two year warranty under provisions of Division 01.
- B. Provide two-year manufacturer's warranty for materials on all field-programmable, micro-processor based units.

#### 1.12 MAINTENANCE SERVICE

- A. Furnish service and maintenance of energy management and control system for two years beginning on the date of acceptance of the system by the Owner.
- B. Provide two complete inspections per year, one in each season, to inspect, calibrate, and adjust controls as required. Submit written inspection and service reports.

#### 1.13 EXTRA MATERIALS

- A. Submit maintenance materials under provisions of Division 01.
- B. Provide to Owner two extra units of each type of sensor under provisions of Division 01 and provisions herein.

#### 1.14 PROTECTION OF SOFTWARE RIGHTS

- A. Prior to delivery of software, the Owner and the party providing the software will enter into a software license agreement with provisions for the following:
  1. Limiting use of software to equipment provided under these specifications.
  2. Limiting copying.
  3. Preserving confidentiality.
  4. Prohibiting transfer to a third party.
- B. Contractor shall provide all registrations and agreements with software copyright holders executed on behalf of the Owner.

### PART 2 - PRODUCTS

#### 2.1 ACCEPTABLE MANUFACTURERS

- A. Unify.
- B. Automated Logic.
- C. Substitutions: Under provisions of Division 01.

#### 2.2 LOCAL OPERATOR ACCESS AND DISPLAY PANEL

- A. Provide local display and adjustment panel. Panels shall be portable programmable control units. Panel shall contain a digital display and keyboard for displaying and editing the following parameters:
  1. Input/output point information.

2. Controller set points.
3. Controller tuning constants.
4. Program execution times.
5. High and low limit values.
6. Limit differential.
7. Time, date, year.

## 2.3 OPERATOR STATION

- A. Unless otherwise required in this specification, the Operator Stations and printers already exist on campus. New control system shall communicate through the campus LAN to the existing Operator Stations.
- B. Description:
  1. Provide one Operator Interface as described herein. Locate as shown on plans or as indicated by Owner's Agent. Operator PC shall be able to access all operator-level information in the system through the use of a standard, commercially available web browser. Access for a remote desktop shall also be made possible. The Operator Interface shall reside on the same peer-to-peer network as the building controllers.
  2. The Operator Interface shall connect via Ethernet to a local area network and be able to serve controller information to users connected via the LAN or via telephone through standard web browser software.
- C. Hardware:
  1. Operator Interface PC shall have all hardware, peripherals, cables, interfaces, etc. necessary to optimally run the operating system and BMS software.
  2. PC shall be of speed, performance, capacity, etc., that is considered current technology and is commercially available at the time of the installation of the system. At a minimum include: 19" Monitor capable of displaying at 1024x768 resolution or better, Inkjet or Laser printer, 2.0 times the minimum system memory and hard drive capacity as recommended for the operating system, CD/DVD read and write drive, multi-button optical or laser mouse with scroll wheel.
  3. Software: Contractor shall provide all required software including the database. Provide the latest professional version of Microsoft Windows operating system. Provide a non-proprietary internet browser interface with capabilities as described herein.
- D. Graphical User Interface (GUI): Provide a comprehensive GUI using a collection of graphically-oriented pages accessed via standard web browser software or Remote Desktop session.. The GUI shall be constructed to operate like a single application, and shall provide a complete and intuitive point-and-click operator interface for access to system data.
  1. Graphics shall have the ability to show animations of equipment such as fans/pumps rotating, dampers operating, etc. Provide a complete clip-art library of standard HVAC equipment (chillers, air-handling units, pumps, etc.).
    - a. Graphics have a nested or "Drill Down" structure beginning at the Campus Map level down to individual components.
    - b. Graphics shall include detailed floor drawings with device (ie, Air terminals, thermostats, discrete devices) locations clearly and accurately displayed.
  2. Custom Graphics: Custom graphic files may be created with the use of a graphics generation package. Graphics may be downloaded to the Web server to use as graphical backgrounds for Dynamic data sent to a Web browser.
  3. GUI pages shall be grouped in a logical manner.

4. The system shall provide a search function to allow users to search for GUI pages or groups of pages by name or partial name.
  5. The system shall provide the necessary means to add, remove, and manage GUI pages.
  6. The system shall provide summary tables by equipment type per site. Room or space summary tables shall provide names, space temperatures, set points, and variance from set point. Provide a means to sort columns of data viewed by ascending or descending value for any chosen data type.
  7. An operator shall be able to access a tabular listing of the system's most recent alarms and acknowledge, print, delete, and link to trouble areas. Provide the ability to reset diagnostic messages and perform control overrides.
  8. The system default setting shall be to display data in Imperial/English units. The user shall have the option to select the display of data in SI/Metric units.
- E. Operator Interface Applications Editors. The GUI shall support dedicated screens for the editing of control system applications. The application programs shall be executed at the appropriate controller panels.
- F. Scheduling. An editor for an enterprise-wide scheduling application shall be provided. Provide a method by which a system operator can make permanent changes to one or many building schedules without the need to repeat any steps. The system shall be able to provide temporary changes to one or more schedules at one or more building locations. The scheduling application shall have the following features:
1. Scheduling by system type, building area, zone, groups of zones, individually controlled equipment and groups of individually controlled equipment.
  2. Schedules may be entered for up to nine years in advance.
  3. Schedules shall automatically adjust for leap year and Daylight Savings Time.
  4. Schedules shall be self-deleting when effective dates have passed.
- G. Optimum Start/Stop. The scheduling application shall provide and support an optimal start algorithm. This algorithm shall calculate the thermal characteristics of a zone and start the equipment prior to occupancy to achieve the desired space temperature at the specified occupancy time. The algorithm shall calculate separate sets of heating and cooling rates for zones that have been unoccupied for less than and greater than 24 hours. Provide the ability to modify the algorithm based on outdoor air temperature. Provide an early start limit in minutes to prevent the system from starting before an operator determined time limit.
- H. Timed Local Override. A standard application shall be utilized to enable/disable temperature control when a user selects on/cancel at the zone sensor, workstation, or the operator display. The amount of time that the override takes precedence shall be defined by the operator from the workstation. The system shall allow the operator to define a maximum number of overrides allowed in a given time period.
- I. Day/Night Setback. The system shall allow the space temperature to drift within an adjustable, user-defined temperature range when the building or zones are in unoccupied mode. The heating/cooling shall be activated if the space temperature leaves the setback range and shall remain active until the space temperature reaches the setback range.



- J. Staggered Start/Stop. This application shall prevent all controlled equipment from simultaneously restarting after a power outage. The order in which equipment (or groups of equipment) is started and the time delay between starts shall be user-selectable. This application shall also prevent all major controlled equipment from simultaneously stopping during normal shut down. The order in which equipment (or groups of equipment) is stopped and the time delay between stops shall be user-selectable.
  
- K. Demand Limiting. The demand limiting program shall monitor building power consumption from signals generated by a pulse generator (provided by others) mounted at the building power meter, or from a watt transducer or current transformer attached to the building feeder lines. The system shall be capable of handling no less than six separate time of day KW demand billing rate periods. The system shall be capable of measuring electrical usage from multiple meters serving one building and each piece of equipment being controlled on the LAN shall be programmable to respond to the peak demand information from its respective meter.
  - 1. The demand limiting program shall be based on a predictive sliding window algorithm. The sliding window interval shall be operator selectable in increments of one minute, up to 60 minutes. The operator shall be able to establish the kilowatt threshold for a minimum of three adjustable demand levels.
  - 2. Control system shall be capable of demand limiting by resetting HVAC system set points to reduce load while maintaining a widened band of comfort control in the space. The system shall allow the operator to set the individual equipment temperature set points for each operator defined demand level. If these reset set points are not satisfied, the set point shall be revised for the different established demand levels.
  - 3. The system shall have failed meter protection, such that when a KW pulse is not received from the utility within an operator adjustable time period, an alarm will be generated. The system software will automatically default to a predetermined fail-safe shed level.
  - 4. Information Archiving. The system shall have the ability to archive demand and usage information for use at a later time. System shall permit the operator access to this information on a current day, month-to-date, and a year-to-date basis. Input capability shall be provided for an end-of-billing period indication.
  
- L. Maintenance Management. The system shall monitor equipment status and generate maintenance messages based upon user designated run time, starts, and/or calendar date limits.
  
- M. Online Help. Operator Interface shall have a context-sensitive online help tool to provide help with operating and editing the system.

## 2.4 CONTROL UNITS

- A. Unitized, capable of stand-alone operation with sufficient memory to support its operating system, database, and programming requirements, and with sufficient I/O capacity for the application.
  - 1. Configuration: Local keypad and display; diagnostic LEDs for power, communication, and processor; wiring termination to terminal strip or card connected with ribbon cable; memory with bios; and 72-hour battery backup.
  - 2. Operating System: Manage I/O communication to allow distributed controllers to share real and virtual object information and allow central monitoring and alarms. Perform scheduling with real-time clock. Perform automatic system diagnostics; monitor system and report failures.

3. ASHRAE 135 Compliance: Communicate using read (execute and initiate) and write (execute and initiate) property services defined in ASHRAE 135. Reside on network using MS/TP datalink/physical layer protocol and have service communication port for connection to diagnostic terminal unit.
- B. Provide the following functions:
  1. Mathematical: Absolute value, calculate, square root, power, sign, average, totalize.
  2. Logic: OR, AND, compare negate.
  3. Fixed Formula: High and low select, span, rate, ramp, enthalpy, wet bulb, dew point, relative humidity, humidity ratio, filter differential pressure.
  4. Data Manipulation: Store, file and set.
  5. Control Routines: Proportional, integral, lead lag, hysteresis correction and incremental control.
  6. Energy Management: Duty cycling, load shed, optimal run time, economizer, holiday and daylight savings time correction.
- C. Provide self-test procedure for checking digital display and computer. Display advisories for maintenance, performance, or software problems. Identify variables as reliable or unreliable. Variables identified as unreliable will flash when displayed and calculation will use default.
- D. Indicate alarms and deviations. Alarm scan shows alarms and identification. Continue alarm indication until acknowledged and alarm condition is corrected.
- E. BACnet Compliance: Control units shall be compatible with BACnet.

## 2.5 BUILDING SYSTEMS INTEGRATION

- A. Protocol Translator Module (PTM): The BMS System shall establish a seamless interconnection with other building, electrical and/or mechanical subsystems as well as other manufacturers control systems using a Protocol Translator as specified below and related equipment sections of the specification. These systems shall be controlled, monitored and graphically programmed with the same Graphical Programming Language (GPL) used for all other control modules.
  1. System Information. All system information specified in the I/O Point Summary and related documents shall be available to the BMS server.
  2. OEM Cooperation. Full cooperation by the Original Equipment Manufacturer (OEM) in this open protocol effort shall be a requirement for bidding this project. OEM manufacturers shall bid BACnet® compliant devices. OEM manufacturers that utilize other protocols shall include the cost of a PTM in their bid.
  3. Necessary Equipment Included Price. If the equipment manufacturer does not have this capability, they shall contact the authorized representative of the BMS for assistance and shall include in their equipment price any necessary equipment obtained from the BMS manufacturer to comply with this section.
  4. PTM Specification:
    - a. The PTM shall be a microprocessor based communication device designed to provide seamless, two-way translation between two or more standard or non-standard protocols.
    - b. The PTM shall be available for a variety of Data Link\Physical Layer configurations including PTP (point-to-point) via EIA-232, MS/TP via EIA-485 and Ethernet.

- c. In addition to BACnet®, the PTM shall also support other protocols including Modbus, J-Bus and other protocols as specified herein for electrical/mechanical subsystems.
- d. The PTM shall have at least three communication ports. One shall be for communication between native BACnet® controllers residing on the controller network. The other two ports shall have the ability to be configured for different protocols.
- e. The PTM shall provide full custom programmability of the data flowing between the networks using the same graphical programming as specified herein. The system shall have the ability to create custom building control strategies using global data between networks.

## 2.6 INPUT/OUTPUT SENSORS

### A. Temperature:

1. Resistance temperature detectors (RTD's) with resistance tolerance of plus or minus 0.1 percent at 70 degrees F, interchangeability less than plus or minus 0.2 percent, time constant of 13 seconds maximum for fluids and 200 seconds maximum for air, 1800 ohm or 10,000 ohm thermistor sensors are also acceptable.
2. Use insertion elements in ducts not affected by temperature stratification or smaller than nine square feet. Use averaging elements where larger or where prone to stratification. Sensor length as recommended by manufacturer for given installation conditions.
3. Insertion elements for liquids shall be with brass socket with minimum insertion length of 2-1/2 inches (60 mm). Chilled water and condenser water sensors shall have an accuracy of  $\pm 0.25^{\circ}$  F at calibration point. Hot water temperature sensors shall have an accuracy of  $\pm 0.75^{\circ}$  F at calibration point.
4. Provide room sensors with locking mechanism (physical or software; intent is to restrict access to local adjustment). Unless otherwise noted, public areas (ie, Rest rooms, corridors, hallways, etc) shall use Flush Mount Room Temperature sensors of Stainless Steel or white blank cover plate construction without local display or adjustments. All room sensors shall be locally labeled with it's point name for easy identification. Room sensors shall have an accuracy of  $\pm 1.0^{\circ}$ F at calibration point.
5. Provide outside air sensors with watertight inlet fitting and shielding from direct sunlight. OA sensors shall have an accuracy of  $\pm 0.5^{\circ}$ F at calibration point.

### B. Humidity Sensors:

1. Elements: Accurate within  $\pm 2$  percent 10-90%RH @ 25°C with linear output.
2. Room Sensors: With locking mechanism (physical or software; intent is to restrict access to local adjustment), range of 0 - 100 percent relative humidity.
3. Duct and Outside Air Sensors: With element guard and mounting plate, range of 0 - 100 percent relative humidity.

### C. Pressure Sensors:

1. Differential Pressure and Pressure Sensors: Sensors shall have a 4-20mA output proportional signal with provisions for field checking. Sensors shall withstand up to 150% of rated working pressure without damaging the device. Accuracy shall be  $\pm 2\%$  of full scale.

2. Water Differential Pressure Switches: Pressure switches shall have a repetitive accuracy of  $\pm 2\%$  of range and withstand up to 150% of rated pressure. Sensors shall be diaphragm or bourbon tube design. Switch operation shall be adjustable over the operating pressure range. The switch shall have an application rated Form C, snap-acting, self-wiping contact of platinum alloy, silver alloy, or gold plating.
  3. High static limit switch: Switches shall be diaphragm operated with 3-1/2" diaphragm to actuate a single pole double throw snap switch. Motion of the diaphragm shall be transmitted to the switch button by means of a direct mechanical linkage. It should include a 1.4 – 5.5" WG range pressure switch with manual reset snap switch.
  4. Static pressure sensor: Provide a differential pressure transmitter with a 4-20mA output to the BMS. It shall operate on the capacitance principle and be capable of sensing very low positive, negative or differential pressures. Sensor shall be accurate within  $\pm 1\%$  of range. Range shall be from 0.1 to 5.0 inches WG over a temperature range of 32 to 125°F and humidity range of 20 – 90% RH; additional sensor ranges may be necessary to accommodate the system being monitored or controlled.
- D. Flow Switches: Flow Switches shall be either paddle or differential pressure type and have a repetitive accuracy of  $\pm 1\%$  of their operating range.
1. Paddle Paddle type switches (water service only) shall be UL listed, SPDT snap-acting with pilot duty rating (125 VA minimum). Adjustable sensitivity with NEMA 1 Type enclosure unless otherwise specified.
  2. Differential pressure switches (air or water service) shall be UL listed, SPDT snap-acting, pilot duty rated (125 VA minimum), NEMA 1 Type enclosure, with scale range and differential suitable for intended application, or as specified.
- E. Water Flow Meters:
1. Turbine Meter: Provide inline turbine type flow meter with bronze or stainless steel body, plastic turbine (stainless steel above 150 deg. F), and sensor and indicator as appropriate for the application for which it is installed. Flow meter shall be rated for minimum working pressure and temperature as appropriate for the application for which it is installed. Accuracy shall be  $\pm 1.5\%$  or better with at least 1% repeatability.
  2. Vortex Shedding Meter. Provide inline vortex shedding type flow meter with stainless steel body, stainless steel shredder bar, and sensor and indicator as appropriate for the application in which it is installed. Flow meter shall be rated for minimum working pressure and temperature as appropriate for the application for which it is installed. Accuracy shall be  $\pm 1.5\%$  or better.
- F. Equipment Operation Sensors:
1. Status Inputs for Fans: Differential pressure switch with adjustable range of 0.1 to 5.0 inches WG (0 to 1250 Pa); additional sensor ranges may be necessary to accommodate the system being monitored or controlled.
  2. Status Inputs for Pumps: Differential pressure switch piped across pump with adjustable pressure differential range of 8 to 60 PSI (50 to 400 kPa).
  3. Status Inputs Where Differential Pressure Sensing is Impractical: Current sensitive relay with current transformers, adjustable and set to 175 percent of rated motor current.
  4. Status Inputs for Electric Motors: Comply with ISA 50.00.01, current-sensing fixed- or split-core transformers with self-powered transmitter, adjustable and suitable for 175 percent of rated motor current.
  5. Electronic Valve/Damper Position Indicator: Visual scale indicating percent of travel and 2- to 10-V dc, feedback signal.

6. Water-Flow Switches: Bellows-actuated or snap-acting type with pilot-duty rating, stainless-steel or bronze paddle, with appropriate range and differential adjustment, in NEMA 250, Type 1 enclosure.
- G. Watt-hour Transducers shall have an accuracy of  $\pm 0.25\%$  for KW and KWH outputs from full lag to full lead power factor. Input ranges for KW and KWH transducers shall be selectable without requiring the changing of current or potential transformers, and shall communicate with the server via Modbus or BACNet or BMS specific protocols.
- H. Digital to Pneumatic Transducers: Convert plus or minus 12 vdc pulse width modulation outputs and/or continuous proportional current or voltage to 0 to 20 psi (0 to 138 kPa).
- I. Voltage-to-Digital Alarm Relays shall monitor status of equipment safeties and overloads and shall be sized and connected so as not to impede the function of the monitored contacts. Switch shall have self-wiping, snap-acting Form C contacts rated for the application.
- J. Damper Position Indication: Potentiometer mounted in handbox enclosure with adjustable crankarm assembly connected to damper to transmit 0 - 100 percent damper travel.
- K. Photocells shall have transmitters for 4-20mA output signal. Sensor shall be mounted in a waterproof enclosure. Unit shall be calibrated for 4mA at greater than 100 foot-candles and 20mA at less than 0.1 foot-candles.
- L. Airflow Measuring Devices:
  1. Airflow/temperature measurement device (ATMD). Each ATMD shall consist of one or more sensor probes and a single, remotely mounted, microprocessor-based transmitter capable of independently processing up to 16 independently wired sensor nodes contained in one or more probe assemblies per measurement location. Provide transmitter with appropriate communications interface with the Building Control System. Sensor probe shall be constructed of aluminum alloy or Stainless Steel with Stainless Steel mounting brackets. Sensor shall utilize bead-in-glass thermistor probes. Airflow sensing shall be accurate within  $\pm 2\%$  over a temperature range of  $-20^{\circ}\text{F}$  to  $120^{\circ}\text{F}$ .
  2. Air Monitoring Station with multi-point, self-averaging Pitot traverse and aluminum "honeycomb" air straightener section in one assembly (Honeycomb air straightener section shall have access doors installed before and after per Section "23 33 00 – 3.3 A. Access Doors" for cleaning of Honeycomb). Aluminum **or** stainless steel frame with mounting flanges on both sides. Unit shall be capable of operating over a temperature range of  $-20^{\circ}\text{F}$  to  $120^{\circ}\text{F}$  and an airflow velocity range of 400 to 5,000 FPM with an accuracy of 2% of total flow and a pressure drop of no more than .085" WC at 2000 FPM. AMS model submitted shall require owner review and approval.
- M. Motorized Dampers:
  1. Control dampers shall be AMCA-rated opposed [parallel] blade design and rated for leakage less than 10 CFM/SF of damper area at a differential pressure of 4"WC. Modulating dampers shall have linear flow output characteristics.
  2. Frame shall be 16 gauge galvanized steel, or 1/8" extruded aluminum with reinforced corner bracing.
  3. Damper blades shall be a maximum of 8" wide and a maximum of 48" long. Applications requiring longer dampers shall have multiple sections with multiple linkages to prevent binding.

4. Blade material shall be galvanized steel, not less than 16 GA, formed for extra strength. Secure blades to 1/2-inch diameter, zinc-plated axles using zinc-plated hardware, with nylon blade bearings, blade-linkage hardware of zinc-plated steel and brass, ends sealed against spring-stainless-steel blade bearings, and thrust bearings at each end of every blade.
  5. Dampers used for outside air intake shall have frames, blades, and other internal parts exposed to outside air constructed of 316 stainless steel.
  6. Edge seals shall be inflatable blade edging or replaceable rubber blade seals and spring-loaded stainless steel side seals rated for leakage of less than 10 CFM/SF of damper area at a differential pressure of 4"WC when damper is held by a torque of 50 IN-LB.
- N. Damper Actuators:
1. Provide UL-listed electronic damper actuators designed for a minimum of 60,000 full stroke cycles at the actuator's rated torque.
  2. Actuators shall have electronic overload or digital rotation sensing circuitry to prevent damage to the actuator throughout the rotation of the actuator.
  3. All rotary spring return actuators shall be capable of both clockwise and counter clockwise spring return operation. Linear actuators shall spring return to the retracted position.
  4. Proportional actuators shall accept a 0-10 VDC or 0-20 mA control signal and provide a 2-10 VDC or 4-20 mA operating range.
  5. All non-spring return actuators shall have an external manual gear release to allow manual positioning of the damper when the actuator is not powered. Spring return actuators with more than 60 in-lb. torque capacity shall have a manual crank for this purpose.
  6. Modulating damper operators shall be sized with sufficient reserve power to provide smooth modulating action.
- O. Valve Actuators:
1. Provide UL-listed electronic valve actuators designed for a minimum of 60,000 full stroke cycles at the actuator's rated torque.
  2. Actuators shall have electronic overload or digital rotation sensing circuitry to prevent damage to the actuator throughout the rotation of the actuator.
  3. Proportional valve actuators shall accept a 0-10 VDC or 0-20 mA control signal and provide a 2-10 VDC or 4-20 mA operating range.
  4. Rotary spring return actuators shall be capable of both clockwise and counter clockwise spring return operation. Linear actuators shall spring return to the retracted position
  5. All non-spring return actuators shall have an external manual gear release to allow manual positioning of the valve when the actuator is not powered. Spring return actuators with more than 60 in-lb. torque capacity shall have a manual crank for this purpose.
- P. Control Valves:
1. Pressure ratings shall be 125 psig or 1.25 times the maximum system operating pressure.
  2. 2" and smaller:
    - a. ANSI class 250, spring loaded, Teflon packing. Two-way valves shall have replaceable composition disc or stainless steel ball and shall be quick acting for two-position service unless otherwise indicated.

- b. Screwed.
    - c. Bodies and internal parts shall be bronze, cast brass, stainless steel or other approved corrosion-resistant metal as required for the application.
  3. 2-1/2" and larger:
    - a. ANSI class 125, guided plug, Teflon packing.
    - b. Flanged.
    - c. Bodies shall be cast iron or cast steel.
    - d. Seats and parts exposed to fluid shall be bronze, stainless steel or other approved corrosion resistant metal as required for the application.
  4. Three-way valves: linear throttling plugs allowing total flow through valve to remain constant regardless of position.
  5. Sizes shall be by the control system manufacturer based on the following minimum criteria:
    - a. Valves for two-position service shall be line size unless indicated otherwise.
    - b. Valves for modulating service shall have a pressure drop equal to twice the pressure drop through the coil/exchanger, 50% of the pressure difference between supply and return mains, or 5 PSI, whichever is greater.
    - c. Valves for three-way modulating service shall have a Pressure drop equal to twice the pressure drop through the coil/exchanger load, 5 PSI maximum.
    - d. Relief and bypass valves shall be sized according to pressure available and/or flow required.
- Q. Gas Detection Equipment:
  1. Carbon Monoxide Detectors: Single or multichannel, dual-level detectors using solid-state plug-in sensors with a 3-year minimum life; suitable over a temperature range of -4 to 122°F; with 2 factory-calibrated alarm levels at 50 and 100PPM. Maximum response time to 100 PPM CO calibration gas shall be two minutes.
  2. Carbon Dioxide Sensor and Transmitter: Single detectors using solid-state infrared sensors suitable over a temperature range of 32 to 130°F and calibrated for 0 to 2 percent, with continuous or averaged reading 4-20 mA output, for wall mounting.
  3. Oxygen Sensor and Transmitter: Single detectors using solid-state zircon cell sensing suitable over a temperature range of 4 to 122°F and calibrated for 0 to 5 percent with continuous or averaged reading 4-20 mA output, for wall mounting.
  4. Nitrogen Dioxide Sensor and Transmitter: Single detectors using electro-chemical sensors suitable over a temperature range of 25 to 104°F and calibrated for 0-20 PPM with continuous or averaged reading 4-20 mA output, a 2-year minimum life, for wall mounting.
  5. Storage Tank Level Sensor. Pulse radar transmitter that provides a continuous level measurement up to 98 feet with a 4-20 mA signal output and is configurable via an integral push button display module. The antenna and mount shall be 316L stainless steel. The sensor shall have auto-temperature compensation and fail-safe diagnostics. The sensor shall be housed in an IP67 aluminum enclosure with polycarbonate window.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install electrical work in accordance with Division 26. Electrical material and installation shall be in accordance with appropriate requirements of Division 26.

- C. Each Programmable Control Unit shall be provided a 120V AC, 15 amp dedicated emergency power circuit provided by Division 26. Mission critical PCU's shall have appropriately sized UPS's to ride out a power event while emergency power is being restored.
    - 1. 120 V AC Circuits shall be the responsibility of and coordinated with Division 26 and shown on Division 26 Drawings.
    - 2. Each PCU unit will include a local copy of its wiring diagram as well as pertinent sequences of operations.
  
  - D. Each Air Terminal Unit shall be provided a 120V AC, circuit provided by Division 26.
    - 1. 120 V AC Circuits shall be the responsibility of and coordinated with Division 26 and shown on Division 26 Drawings.
    - 2. The number of ATU's per circuit shall not exceed the 120 V circuits 15 Amp rating.
    - 3. Each ATU unit will include a local copy of its wiring diagram as well as pertinent sequences of operations.
  
  - E. Verify location of thermostats, humidistats, and other exposed control sensors with Drawings and room details before installation. Generally, install devices 48 inches above the floor in alignment with light switches.
    - 1. Install averaging elements in ducts and plenums in crossing or zigzag pattern.
  
  - F. Install raceways, boxes, and cabinets according to Division 26 Section "Raceways, Conduit and Boxes ."
  
  - G. Install building wire and cable according to Division 26 Section " Cable, Wire, and Connectors ."
    - 1. All input-output, communications, and low voltage control wiring shall have each end labeled with the appropriate identification information, ie Point name and termination location info, etc.
  
  - H. Data communications (Ethernet) shall be the responsibility of and coordinated with Division 27
    - 1. In addition to any data connections required for each PCU, a spare data connection shall be provided by Division 27 within 15 feet of the PCU for technician use.
  
  - I. Connect manual-reset limit controls independently of manual-control switch positions. Automatic duct heater resets may be connected in interlock circuit of power controllers.
  
  - J. Connect hand-off-auto selector switches to override automatic interlock controls when switch is in hand position.
- 3.2 MANUFACTURER'S FIELD SERVICES
- A. Prepare and start systems under provisions of Division 01
  
  - B. Start-up, calibrate, and adjust systems. Allow sufficient time for start-up, calibration, and adjusting prior to placing control systems in permanent operation.



- C. Provide basic operator training for four persons as designated by the Owner. Include a minimum of 24 hours dedicated instructor time. Training shall consist of instruction in the operation of the BMS including but not limited to: Logging in and navigation through all parts and pages of the graphical user interface, Sequences of control (viewing, creating and adjusting), Set points (viewing, adjusting), Alarm capabilities and management, Trending capabilities (viewing, creating, editing, reporting, and storing data), Scheduling (viewing, creating, and editing) Troubleshooting communication errors, Troubleshooting hardware errors, other capabilities as designated by the Owner's Agent.
- D. Provide each attendee with a bound set of printed training materials to be used during training and to become property of the Owner.
- E. Provide service engineer to instruct Owner's representative in the operation of systems and equipment for a period of three working days.
- F. Provide Owner with video recordings on DVD of all training sessions. DVD shall have a sequentially indexed menu for easy, individual access to each session/topic.

### 3.3 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
  - 1. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation. Remove and replace malfunctioning units and retest.
  - 2. Test and adjust controls and safeties.
  - 3. Test each point through its full operating range to verify that safety and operating control set points are as required.
  - 4. Test each control loop to verify stable mode of operation and compliance with sequence of operation. Adjust PID actions.
  - 5. Test each system for compliance with sequences of operation.
  - 6. Test software and hardware interlocks.
- B. DDC VERIFICATION:
  - 1. Verify that instruments are installed before calibration, testing, and loop or leak checks.
  - 2. Check instruments for proper location and accessibility.
  - 3. Check instrument installation for direction of flow, elevation, orientation, insertion depth, and other applicable considerations.
  - 4. Check flow instruments. Inspect tag number and line and bore size, and verify that inlet side is identified and that meters are installed correctly.
  - 5. Check pressure instruments, piping slope, installation of valve manifold, and self-contained pressure regulators.
  - 6. Check temperature instruments and material and length of sensing elements.
  - 7. Check control valves. Verify that they are installed in the correct orientation.
  - 8. Check DDC system as follows:
    - a. Verify that DDC controller power supply is from emergency power supply, if applicable.
    - b. Verify that wires at control panels are tagged with their service designation and approved tagging system.
    - c. Verify that spare I/O capacity has been provided.
    - d. Verify that DDC controllers are protected from power supply surges.
- C. Replace damaged or malfunctioning controls and equipment and repeat testing procedures.

### 3.4 ADJUSTING

- A. Calibrating and Adjusting:
1. Calibrate instruments.
  2. Make three-point calibration test for both linearity and accuracy for each analog instrument.
  3. Calibrate equipment and procedures using manufacturer's written recommendations and instruction manuals. Use test equipment with accuracy at least double that of instrument being calibrated.
  4. Control System Inputs and Outputs:
    - a. Check analog inputs at 0, 50, and 100 percent of span.
    - b. Check analog outputs using milliampere meter at 0, 50, and 100 percent output.
    - c. Check digital inputs using jumper wire.
    - d. Check digital outputs using ohmmeter to test for contact making or breaking.
    - e. Check resistance temperature inputs at 0, 50, and 100 percent of span using a precision-resistant source.
  5. Flow:
    - a. Set differential pressure flow transmitters for 0 and 100 percent values with 3-point calibration accomplished at 50, 90, and 100 percent of span.
    - b. Manually operate flow switches to verify that they make or break contact.
  6. Pressure:
    - a. Calibrate pressure transmitters at 0, 50, and 100 percent of span.
    - b. Calibrate pressure switches to make or break contacts, with adjustable differential set at minimum.
  7. Temperature:
    - a. Calibrate resistance temperature transmitters at 0, 50, and 100 percent of span using a precision-resistance source.
    - b. Calibrate temperature switches to make or break contacts.
  8. Stroke and adjust control valves and dampers without positioners, following the manufacturer's recommended procedure, so that valve or damper is 100 percent open and closed.
  9. Stroke and adjust control valves and dampers with positioners, following manufacturer's recommended procedure, so that valve and damper is 0, 50, and 100 percent closed.
  10. Provide diagnostic and test instruments for calibration and adjustment of system.
  11. Provide written description of procedures and equipment for calibrating each type of instrument. Submit procedures review and approval before initiating startup procedures.
- B. Adjust initial temperature and humidity set points.

### 3.5 DEMONSTRATION

- A. Provide systems demonstration under provisions of Division 01.

3.6 INPUT/OUTPUT SCHEDULE

- A. Contractor shall provide a complete points list/matrix describing all system inputs, outputs, and functions as necessary to accomplish specified sequences of control.

END OF SECTION 23 09 23

## SECTION 23 20 00 - HVAC PUMPS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including "Uniform General Conditions and Supplementary General Conditions For The State Of Texas Building Construction Contracts" and Division 01 Specification Sections, apply to the work of this Section.
  - 1. Where the term "Owner's Designated Representative" is used, it shall mean a member of the project's capital team.

#### 1.2 SUMMARY

- A. This Section provides furnishing and installing the following hydronic pumps:
  - 1. Split Coupled Vertical In-Line Pumps

#### 1.3 RELATED WORK

- A. Section 23 00 00, Mechanical General Provisions.
- B. Section 23 05 13, Common Motor Requirements for HVAC Equipment.
- C. Section 23 05 48, Vibration Isolation for HVAC Piping and Equipment.
- D. Section 23 05 53, Identification for HVAC Piping and Equipment.
- E. Section 23 07 16, Equipment Insulation.
- F. Section 23 21 16, Hydronic Specialties.
- G. Section 23 21 00, Hydronic Piping and Fittings.
- H. Section 26 29 23, Variable Frequency Drives.

#### 1.4 REFERENCES

- A. ANSI/UL 778 - Motor Operated Water Pumps.

#### 1.5 PUMP SELECTION REQUIREMENTS

- A. Select pumps conservatively for scheduled conditions. Furnish pumps which have reasonably high efficiencies, with peak efficiency at or near rated conditions.
- B. Provide motor-driven pumps of the type and speed scheduled. Select pumps that are not overloaded throughout the entire range of pump operation. Provide pump connection sizes as scheduled.
- C. Unless otherwise indicated the maximum pump selections shall be limited to 60 HZ.

## 1.6 SUBMITTALS

- A. Include certified performance curves and rated capacities, operating characteristics, furnished specialties, final impeller dimensions, and accessories for each type of product indicated. Clearly indicate which equipment and options are to be provided
- B. Indicate pump's operating point on curves. Include NPSH curve when applicable.
- C. Show pump layout and connections. Include setting drawings with templates for installing foundation and anchor bolts and other anchorages.
- D. Submit information on electric motors per requirements and indicating compliance with Section 23 05 13. Motor data must be submitted with pump submittal. No exceptions.
- E. Submit manufacturer's installation instructions under provisions of Section 23 00 10.
- F. Provide a letter of certification from pump manufacturer that unit was manufactured and factory assembled by pump manufacturer.

## 1.7 OPERATION AND MAINTENANCE DATA

- A. Submit operation and maintenance data under provisions of Section 23 00 10.
- B. Include installation instructions, assembly views, lubrication instructions and replacement parts list.
- C. Include copy of approved submittal, vibration test results and certified pump curve with final balancing point indicated..
- D. Include letter of certification stating that pump was factory assembled by pump manufacturer.

## 1.8 EXTRA PARTS

- A. Provide one extra set of mechanical seals for each pump.

## PART 2 - PRODUCTS

### 2.1 ACCEPTABLE MANUFACTURERS

- A. Products meeting all requirements of this specification section of the following manufacturers are acceptable
  - 1. Armstrong Pumps
  - 2. Aurora
  - 3. Bell & Gossett
  - 4. Taco
  - 5. Grundfos/Paco

### 2.2 SPLIT COUPLED VERTICAL IN-LINE PUMP

- A. Description: Factory assembled and tested single stage vertical in-line split coupled pump with design to allow servicing of seal without disturbing the pump or motor.
- B. Casing:

1. Cast Iron with 125 psig ANSI flanges for working pressure below 175 psig at 150°F. Suction and discharge connections shall be flanged and the same size and shall be drilled and tapped for seal flush and gauge connections.
  2. Provide stainless steel nameplates and other data plates suitably secured to the pump.
- C. Impeller: Bronze, fully enclosed type. Dynamically balanced. Two-plane balancing is required where installed impeller diameter is less than 6 times the impeller width.
  - D. Shaft: Furnish stainless steel shaft, turned and ground to accurate dimension, of ample size to prevent deflection.
  - E. Coupling: Rigid spacer type of high tensile aluminum alloy. Coupling to be designed to be easily removed on site to reveal a space between the pump and motor shafts sufficient to remove all mechanical seal components for servicing and to be replaced without disturbing the pump or motor.
  - F. Mechanical Seals: Shall be Stainless Steel multi-spring inside or outside balanced type with Viton secondary seal, carbon rotating face and silicon carbide stationary seat. Provide 316 stainless steel gland plate. Provide factory installed flush line with manual vent. All split coupled pumps shall be provided with a lower seal chamber throttle bushing to ensure seals maintain positively cooling and lubrication.
  - G. Seal flush line accessories: Supply in the flush line to the mechanical seal a 50 micron cartridge filter and sight flow indicator, to suit the working pressure encountered.
  - H. Test run VFD pumps with motor at all speeds prior to shipping to ensure that pump assembly will not experience unacceptable levels of vibration during operation.
  - I. Name Plates. Nameplates and other data plates shall be stainless steel, suitably secured to the pump. Provide one spare stainless steel performance nameplate with each pump that is insulated and field install to be visible after pumps are insulated.

## 2.3 MOTORS

- A. Motors for base mounted pumps shall be mounted with pump on baseplate at pump manufacturer's plant and shipped as one unit.
- B. Pump and motor shall be factory aligned, and shall be realigned by the Contractor after installation.
- C. Motors shall be 1800 rpm except as otherwise scheduled ODP (for indoor application). Equipment manufacturers shall certify in the submittal data that the motors furnished with the pumps are compatible with the variable frequency drives (include manufacturer and Model number) to be installed on this project. If motors are incompatible with VFDs, pump manufacturer shall provide and install new motors at no change in contract price.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install according to manufacturer's printed recommendations and pipe as shown on drawings. Install pumps with access (minimum 2'-6") for periodic maintenance including removal of motors, impellers, couplings, and accessories.

- B. Independently support pumps and piping so weight of piping is not supported by pumps and weight of pumps is not supported by piping.
- C. Contractor shall confirm that each pump is installed level.
- D. Stored pumps shall have shafts rotated at least once a month.
- E. Name Plates: Install spare nameplate as required in Part 2 of this Specification.

### 3.2 ALIGNMENT

- A. Lubricate pumps prior to start-up. Provide manufacturer's factory representative certification for alignment of the pumps. Factory technician shall inspect pump installation and certify pump alignment is in accordance with manufacturer's instructions and that the installations comply with the manufacturer's warranty requirements.
- B. Align pump and motor shafts after piping connections have been made.
- C. Comply with pump and coupling manufacturers' written instructions.
- D. Adjust pump and motor shafts for angular and offset alignment by methods specified in HI 1.1-1.5, "Centrifugal Pumps for Nomenclature, Definitions, Application and Operation."

### 3.3 CONNECTIONS

- A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to machine to allow service and maintenance.
- C. Connect piping to pumps. Install valves that are same size as piping connected to pumps.
- D. Install suction and discharge pipe sizes equal to or greater than diameter of pump nozzles.
- E. Install strainer, check valve, isolation valves, pipe supports and other devices as shown on the detail.
- F. Install pressure gages on pump suction and discharge, at integral pressure-gage tapping, or install single gage with multiple input selector valve.
- G. Connect wiring according to Section 26 05 19, Insulated Conductors.

### 3.4 VIBRATION TESTING

- A. Vibration velocity readings shall be taken at all bearing locations of all pumps. Pumps driven by variable speed drives shall be tested throughout their range of speeds. Vibration shall not exceed 0.15 inch/second (peak).

END OF SECTION 23 20 00

## SECTION 23 21 00 - HYDRONIC PIPING AND FITTINGS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including "Uniform General Conditions and Supplementary General Conditions For The State Of Texas Building Construction Contracts" and Division 01 Specification Sections, apply to the work of this Section.
  - 1. Where the term "Owner's Designated Representative" is used, it shall mean a member of the project's capital team.

#### 1.2 SUMMARY

- A. This Section includes pipe and fitting materials, joining methods, special-duty valves, and specialties for the following:
  - 1. Hot-water heating piping.
  - 2. Makeup-water piping.
  - 3. Condensate-drain piping.
  - 4. Blowdown-drainn
  - 5. Air-vent piping.
  - 6. Safety-valve-inlet and -outlet piping.
- B. Related Specifications
  - 1. Section 23 05 19, Meters and Gauges, for HVAC Piping.
  - 2. Section 23 05 23, General Duty Valves for HVAC Piping
  - 3. Section 23 20 00, Hydronic Pumps Section 23 05 29, Hangers and Supports
  - 4. Section 23 05 48, Vibration Isolation for HVAC Piping and Equipment
  - 5. Section 23 21 16, Hydronic Specialties

#### 1.3 SUBMITTALS

- A. Product Data: For each type of the following:
  - 1. Pipe
  - 2. Fittings and accessories
- B. Shop Drawings: Detail, at 1/4 scale, the piping layout, fabrication of pipe anchors, hangers, supports for multiple pipes, alignment guides, expansion joints and loops, and attachments of the same to the building structure. Detail location of anchors, alignment guides, and expansion joints and loops.
- C. Cleaning/Flushing Plan: This must be submitted and approved prior to any piping being installed. Plan, including all steps to be taken to ensure the piping installation will be cleaned properly prior to: service, circulation through equipment, or connection to another system. This shall include, but not be limited to:
  - 1. A step by step explication of the process.
  - 2. Drawing(s) indicating flow (gpm) values required to meet the minimum velocity in each pipe.
  - 3. Drawing(s) indicating the phase(s) in which the system will be cleaned as required to ensure the minimum velocity will be maintained in each section of piping. It is expected that multiple phases will be required to achieve the minimum velocities in all of the piping safely.



4. Drawing(s) indicating locations of the required temporary connections, valves, strainers, and bypasses.
5. Cutsheet of the temporary pump to be used during flushing.
6. Water treatment and pipe cleaning chemicals.

D. Field quality-control test reports.

E. Submit certification of welder's qualifications to perform the required welding operations.

F. Operation and maintenance data.

#### 1.4 QUALITY ASSURANCE

A. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

B. Provide domestic manufactured piping and fittings.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect piping, valves, fittings, etc. before installation in accordance with manufacturer's written instructions.

B. Piping shall be shipped from the factory with capped ends and stored on supports off the ground with ends covered at all times to prevent nesting of insects, birds, and other animals. Any pipe found to be without end-caps or not raised off of the ground should be cleaned by the contractor prior to installation.

C. Protect piping from accumulation of dirt and debris in and around piping/components.

#### 1.6 OPERATION AND MAINTENANCE DATA

A. Operation and maintenance manuals shall include the following information:

1. The approved submittal with all approved items present (not a partial resubmittal)
2. Chemicals used in cleaning, flushing, inhibiting, and final water treatment.
3. Water quality test reports from the cleaning process.

### PART 2 - PRODUCTS

#### 2.1 STEEL PIPING AND FITTINGS

A. 2 inches and less in diameter. ASTM A 53, Grade B, standard-weight seamless or electric-resistance welded black steel pipe with standard-weight malleable iron threaded fittings, satisfying ASTM B16.3 and ASTM A 197

B. 2-1/2 inches to 10 inches in diameter. ASTM A 53, Grade B, standard-weight seamless or electric-resistance welded black steel pipe with standard-weight seamless steel welded fittings, satisfying ASTM A 234, Grade WPA or WPB, ANSI B16.9.

## 2.2 COPPER PIPING AND FITTINGS

- A. ASTM B88, hard drawn Type L seamless copper tube with wrought copper fittings, ASTM B16.22.

## 2.3 JOINTS

- A. Screwed (Steel Piping, 2" and smaller):
1. Make screwed joints using machine-cut ANSI taper pipe threads.
  2. Apply suitable joint compound, such as Teflon tape to the male threads only.
  3. Ream pipe to full inside diameter after cutting. All-thread nipples are not permitted.
- B. Dissimilar Metals: Make joints between copper and steel pipe and equipment along with steel pipe and ductile iron pipe using insulating unions.
1. Provide insulating unions as manufactured by Crane, EPCO Sales, Inc. or approved equivalent.
- C. Solder Joints (Copper Piping):
1. Prior to making joints, cut pipe square and ream to full diameter. Clean exterior of pipe and socket. Apply thin coat of suitable fluxing compound to both pipe and socket, and fit parts together immediately.
  2. Heat assembled joint only as required to cause the solder to flow. Run the joint full, slightly beaded on the outside, and wipe to remove excess solder.
  3. Utilize lead free solder. Use silver brazing alloy or Sil-Fos on refrigerant piping and on underground piping.
- D. Welded (Steel Piping, 2-1/2" and larger):
1. Make welded joints as recommended by the standards of the American Welding Society.
  2. Ensure complete penetration of deposited metal with base metal.
  3. Provide filler metal suitable for use with base metal.
  4. Keep inside of fittings free from globules of weld metal.
  5. Do not use mitered joints.
  6. Use standard weld elbow fittings for changes of direction or cut a standard elbow for odd angles.
- E. Flanged:
1. Prior to installation of bolts, accurately center and align flanged joints to prevent mechanical prestressing of flanges, pipe and equipment. Align bolt holes to straddle the vertical, horizontal or north-south centerline. Do not exceed 3/64 inch per foot inclination of the flange face from true alignment.
  2. Use flat-face companion flanges only with flat-faced fittings, valves or equipment. Otherwise, use raised-face flanges.
  3. Install proper gaskets, suitable for intended service and factory cut to proper dimensions. Red rubber gaskets are not acceptable. Garlock gaskets or EPDM shall be used. Apply non-stick clean surface lubricant coating to both sides of gaskets.
  4. Use ANSI nuts and bolts, galvanized or black to match flange material. Use galvanized steel nuts and bolts underground, coated with tow coats of coal tar enamel. Tighten bolts progressively to prevent unbalanced stress. Draw bolts tight to ensure proper seating of gaskets. Use anti-seize compound on all bolts above and below grade. Bolt threads not to protrude more than 2 threads past nut.

5. Use carbon steel flanges conforming to ANSI B16.5 with materials conforming to ASTM A 105, Grade II or ASTM A 108, Grade II. Use welding neck type flanges at all fittings and on all pipe.
6. Flanges for ductile iron pipe are specified in sections using that pipe.
7. Keep flange covers on equipment and shop-fabricated piping until ready to install in system.

## 2.4 JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
  1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8 inch maximum thickness unless 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.
- B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- C. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- D. Gasket Material: Thickness, material, and type suitable for fluid to be handled, and working temperatures and pressures.

## 2.5 DIELECTRIC FITTINGS

- A. Description: Combination fitting of copper-alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.
- B. Insulating Material: Suitable for system fluid, pressure, and temperature.
- C. Dielectric Unions:
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Capitol Manufacturing Company.
    - b. Central Plastics Company.
    - c. Hart Industries International, Inc.
    - d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
    - e. Zurn Plumbing Products Group; AquaSpec Commercial Products Division.
  2. Factory-fabricated union assembly, for 250-psig minimum working pressure at 180°F.
- D. Dielectric Couplings:
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Calpico, Inc.
    - b. Lochinvar Corporation.
  2. Galvanized-steel coupling with inert and noncorrosive thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225°F.

## 2.6 UNIONS

- A. Use 150-pound standard (300-pound WOG) malleable iron, ground joint unions with bronze seat. Provide flanged union joints on piping larger than 2-1/2 inches.

## 2.7 BRANCH CONNECTIONS

- A. For Pipe 2 inches and smaller, use threaded fittings for steel pipe. For threaded piping, use straight size of reducing tee.
- B. For 2-1/2 Inches through 20 inches. For welded piping, when branch size is the same as and one size smaller than header size, use welding tee. Use Weldolet when branch is two or more sizes smaller than header. For threaded branch connections, use thread-o-let welded to header.

## 2.8 GASKETS

- A. Provide gaskets between flanges of all flanged joints. Inside diameter of gaskets shall conform to nominal pipe size. Gaskets shall be ring type between raised face flanges and full face between flat face flanges with punched bolt holes and pipe opening.
- B. Gaskets shall be cut from 1/8 inch thick non-metallic, non-asbestos gasket material suitable for operating temperatures from -150°F to +750°F. Garlock or equal. For pipe smaller than 6 inches, use 1/16 inch thick gasket.

## 2.9 FLOOR AND CEILING PLATES

- A. Provide chrome-plated floor and ceiling plates around pipes exposed to view and passing through walls, floors, partitions, or ceilings in finished areas. Size plates to fit pipe or insulation and securely lock in place.

## PART 3 - EXECUTION

### 3.1 PIPING INSTALLATIONS

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- B. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping to permit valve servicing.
- F. Install piping at indicated slopes.

- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Install piping to allow application of insulation.
- J. Select system components with pressure rating equal to or greater than system operating pressure.
- K. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.
- L. Install drains, consisting of a tee fitting, NPS 3/4 ball valve, and short NPS 3/4 threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.
- M. Install branch connections to mains using tee fittings in main pipe, with the branch connected to the top of the main pipe. For up-feed risers, connect the branch to the top of the main pipe.
- N. Install valves according to the appropriate section.
- O. Install unions in piping, NPS 2 and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.
- P. Install flanges in piping, NPS 2-1/2 and larger, at final connections of equipment and elsewhere as indicated.
- Q. Install strainers on inlet side of each control valve, pressure-reducing valve, solenoid valve, in-line pump, and elsewhere as indicated. Install NPS 3/4 nipple and ball valve in blowdown connection of strainers NPS 2 and larger. Match size of strainer blowoff connection for strainers smaller than NPS 2.
- R. Identify piping as specified in the above referenced specification section.
- S. Support piping adequately to maintain line and grade, with due provision for expansion and contraction.
- T. Use only long radius elbows on steel and copper piping unless a short radius elbow is specifically shown on the drawings.
- U. Slope condensate drain piping at a minimum 1/8 inch per foot in the direction of flow.

### 3.2 WELDING

- A. Weld and fabricate piping in accordance with ANSI Standard B31.9, latest edition, Code for Pressure Piping. Machine beveling in shop is preferred. Field beveling may be done by flame cutting to recognized standards.
- B. Align piping and equipment so that no part is offset more than 1/16 inch. Set all fittings and joints square and true, and preserve alignment during welding operation. Use of alignment rods inside pipe is prohibited.

- C. Do not permit any weld to project within the pipe so as to restrict it. Tack welds, if used, must be of the same material and made by the same procedure as the completed weld. Otherwise, remove tack welds during welding operation.
- D. Do not split, bend, flatten or otherwise damage piping before, during or after installation.
- E. Remove dirt, scale and other foreign matter from inside piping before tying in sections, fittings, valves or equipment.

### 3.3 OFFSETS AND FITTINGS

- A. Because of the small scale of drawings, the indication of all offsets and fittings is not possible. Carefully investigate the structural and finish conditions affecting the work and take such steps as may be required to meet such conditions.
- B. Install all piping close to walls, ceilings and columns so piping will occupy the minimum space. Provide proper space for covering and removal of pipe, special clearances, and for offsets and fittings.
- C. Install piping as to not obstruct any equipment or architectural access doors.

### 3.4 ISOLATION VALVES

- A. Provide piping systems with line size shutoff valves located at the risers, at main branch connections at each floor and at branch takeoffs serving equipment, and at other locations as indicated and required for isolation of piping or equipment.
- B. At each reheat coil with a union, pressure gauge and thermometer well and a balancing valve (with memory stop) for balancing, and valves for isolation of each coil. Refer to mechanical details for additional requirements.

### 3.5 DRAIN VALVES AND VENTS

- A. Install drain valves at all low points and at base of all risers of water piping systems so that these systems can be entirely drained.
- B. Install 2 inch drain for 2 -inch pipes and larger.
- C. Install a line size drain valve for pipes smaller than 2 inches.
- D. Provide hose adapter and cap on all drain lines.
- E. Provide automatic vents with isolation valves or manual vents at locations as indicated on Drawings and all high points in piping systems.

### 3.6 PIPE JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
- E. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
  - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
  - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- F. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

### 3.7 REHEAT COIL CONNECTIONS

- A. Sizes for supply and return piping connections shall be the same as or larger than equipment connections.
- B. Install control valves in accessible locations close to connected equipment.
- C. Install ports for pressure gages and thermometers at coil inlet and outlet connections according to the above referenced specification section. Refer to drawings for additional requirements.

### 3.8 CLEANING OF PIPING SYSTEMS

- A. Cleaning of piping system must be performed by the mechanical contractor. Cleaning chemicals, procedure, water testing, reporting, and consultation must be provided by a qualified water treatment company specializing in this type of work. Qualified water treatment vendor will have the following features.  
Operating in the business of industrial water treatment for minimum 5 years.
  - 1. Certified to the ISO 9000 quality standard.
  - 2. Manufacture and deliver their own products.
  - 3. Provide technical specialist(s) for onsite water testing, reporting, and consultation.
  - 4. Have the ability to perform offsite analytical laboratory work and reporting if necessary.
- B. Acceptable vendors should include, but not be limited to the following companies:
  - 1. ChemCal, Inc.
  - 2. GE Water & Process Technologies
  - 3. Nalco Company
- C. Minimum velocity of 10 feet per second for steel piping must be maintained in the pipes during flushing period.
  - 1. Do not use building pumps for circulating water.
  - 2. Provide temporary pumps as required to achieve minimum velocities.
  - 3. Remove flow meters from building piping during flushing operation.

4. Provide means (instrumentation) during flushing period to prove to the Owner that the minimum velocities are maintained in the pipes.
  5. For copper piping, maintain the flushing velocity between 3 (min) and 5 (max) feet per second. Limit temperature of water inside piping to a maximum 140°F.
- D. Submit a detailed plan for the Engineer's and Owner's review and approval describing in full detail the individual steps associated with this process before any piping is installed.
1. Refer to Submittal section above for further requirements.
- E. Clean piping systems thoroughly. Purge pipe of construction debris and contamination before placing the systems in service. Provide temporary connections and valves as required for cleaning, purging and circulating. Provide temporary relief valves to protect the piping system if recommended by the pipe cleaning subcontractor.
- F. Install temporary strainers in front of pumps, tanks, water still, solenoid valves, control valves, and other equipment where permanent strainers are not indicated. Keep these strainers in service until the equipment has been tested, then remove either entire strainer or straining element only. Fit strainers with a line size blowoff valve.
- G. Provide bypasses at the following equipment as close as feasibly possible to the equipment (no more than 10 feet total of piping at each piece of equipment) and isolate equipment as required (temporary blind flanges or similar):
1. Hydronic coils
  2. Water Boilers
- H. Chemicals shall remove mill scale, oil, and greases as well as passivate surfaces with a protective oxide film. NOTE: All residuals of the cleaning and passivating chemicals must be totally blown-down prior to system startup.
1. Alkaline cleaner/penetrant/dispersant chemical. This product must be in liquid form and capable of removing mill scale, oils, greases, debris, and byproducts of construction. It shall be fed at the vendor's recommended dosage rate based on the volumes of the systems treated.
  2. Passivating chemical. This product must be in liquid poly-phosphate form and capable of laying down a protective oxide film on metal surfaces after treatment with the cleaning chemical. It shall be fed at the vendor's recommended dosage rate based on the volumes of the systems treated.
  3. Antifoam chemical. This product must be in liquid form and capable of controlling or eliminating foam in water systems.
- I. Chemical for inhibiting and controlling corrosion and deposits must be added immediately after the chemical cleaning and passivating procedure.
1. Closed loop corrosion inhibitor chemical. This product must impart the following active ingredients at the following dosages when fed in Heating Hot Water Loop water: 1) nitrite (as NO<sub>2</sub>) = 800-1200 ppm, 2) borate = 400-600 ppm, 3) azole = 40-80 ppm.
- J. Circulate chemical cleaner and passivator in closed loop water piping systems to remove mill scale, grease, oil, and silt.
1. Flush and drain loops to remove debris prior to using chemicals.
  2. Fill loops and add chemical cleaner and passivator at the dosage rates recommended by the water treatment vendor based on system volume.
  3. Add antifoam at the dosage rates recommended by the water treatment vendor.
  4. Circulate water for 24-72 hours.



5. Drain and flush system.
  6. Dispose of circulated water with chemical residuals as per local code requirements.
  7. Refill and immediately charge with the proper corrosion inhibitor – based on the type of piping system – to the recommended level.
  8. Match chemicals presently used in other systems used by Owner if possible.
  9. Submit all chemicals to Owner and Engineer prior to cleaning for approval.
  10. Match chemicals presently used in other systems used by Owner.
- K. Special requirements, if any, are specified in the appropriate Sections for each type of piping.
- L. After systems have been flushed and cleaned; as required by specifications, provide written certification from the cleaning contractor that the systems are clean and ready for use. This shall include the water quality report comparing the make-up water to the water circulated in the piping after removal of chemicals to verify pipe condition.

### 3.9 FIELD QUALITY CONTROL

- A. Prepare hydronic piping according to ASME B31.9 and as follows:
1. Leave joints, including welds, uninsulated and exposed for examination during test.
  2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
  3. Flush hydronic piping systems with clean water; then remove and clean or replace strainer screens.
  4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.
  5. Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.
- B. Perform the following tests on hydronic piping:
1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
  2. While filling system, use vents installed at high points of system to release air. Use drains installed at low points for complete draining of test liquid.
  3. Isolate expansion tanks and determine that hydronic system is full of water.
  4. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the system's working pressure, minimum 150 psig. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength or 1.7 times "SE" value in Appendix A in ASME B31.9, "Building Services Piping."
  5. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.
  6. Prepare written report of testing.
- C. Perform the following before operating the system:
1. Open manual valves fully.
  2. Inspect pumps for proper rotation.

3. Set makeup pressure-reducing valves for required system pressure.
4. Inspect air vents at high points of system and determine if all are installed and operating freely (automatic type), or bleed air completely (manual type).
5. Set temperature controls so all coils are calling for full flow.
6. Inspect and set operating temperatures of hydronic boilers to specified values.
7. Verify lubrication of motors and bearings.

3.10 PIPING APPLICATION SCHEDULE

A. Provide piping and fittings meeting the requirements of Part 2 as identified in the table below:

Service	Pipe Sizes	Pipe Material
Heating Hot Water Piping	2" and smaller	Copper
Heating Hot Water Piping	2-1/2" and larger	Steel
Condensate Piping	All	Copper,
Makeup-Water Piping	All	Copper,
Blowdown-Drain Piping	All	Steel
Air-vent Piping	All	Copper,

END OF SECTION 23 21 00

## SECTION 23 21 16 - HYDRONIC SPECIALTIES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including "Uniform General Conditions and Supplementary General Conditions For The State Of Texas Building Construction Contracts" and Division 01 Specification Sections, apply to the work of this Section.
  - 1. Where the term "Owner's Designated Representative" is used, it shall mean a member of the project's capital team.

#### 1.2 SUMMARY

- A. This Section includes hydronic specialties, including the following:
  - 1. Air Vents.
  - 2. Air Separator
  - 3. Expansion Tank
  - 4. Shot Feeder/Filter
  - 5. Pressure Reducing Valve
- B. Related Specifications
  - 1. Section 23 05 19, Meters and Gages for HVAC Piping
  - 2. Section 23 21 00, Hydronic Piping and Fittings.

#### 1.3 SUBMITTALS

- A. Product Data:
  - 1. Submit Shop Drawings and product data, including component sizes, rough-in requirements, service sizes, and finishes.
  - 2. Submit manufacturer's installation instructions

#### 1.4 QUALITY ASSURANCE

- A. Manufacturer: For each product specified, provide components by the same manufacturer throughout

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect equipment, etc. before installation in accordance with manufacturer's written instructions.

#### 1.6 OPERATION AND MAINTENANCE DATA

- A. Operation and maintenance manuals shall include the following information:
  - 1. The approved submittal with all approved items present (not a partial resubmittal)
  - 2. Shot Feeder/Filter. Include instructions and assembly views for installation of new filter media. Provide minimum two spare sets of filter media for each shot feeder/filter at completion of project (not including the one installed at substantial completion).

## PART 2 - PRODUCTS

### 2.1 GENERAL

- A. All materials shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.

### 2.2 MANUFACTURERS

- A. Expansion Tanks: Bell & Gossett, Taco, C. Adamson, Woods.
- B. Automatic Air Vents: Armstrong, APCO, Bell & Gossett,
- C. Air Separators: Spirotherm, Thrush
- D. Water Relief Valves: Keckley, Watts, Bell & Gossett
- E. Shot Feeder/Filter: Harmsco, Wingert, Neptune
- F. Water Pressure Reducing Valve: Taco, Watts, Zurn

### 2.3 EXPANSION TANKS (BLADDER TYPE):

- A. Construction: Provide captive air expansion tank with a replaceable bladder, flanged connections to replace bladder, steel skirt for vertical mounting, rated at 150 psi working pressure and constructed per ASME Section VIII. Bladder shall be able to accept the full volume of the expansion tank and shall be removable and replaceable. See drawings for specifics manuf/model for expansion tank.
- B. Provide gate valve and pressure gage at remote air connection coupling to register air pressure inside bladder chamber.
- C. Automatic Cold Water Fill Assembly: Pressure reducing valve, reduced pressure double check back flow preventer, test cocks, strainer, vacuum breaker, and valve by-pass.

### 2.4 AUTOMATIC AIR VENTS

- A. Furnish and install cast iron body fixed pivot ball automatic float-type air vents at high points of all hydronic systems and where shown on drawings. Vent body shall be cast iron, with stainless steel float, and stainless steel seat, valve and lever. Vent shall be rated for a minimum of 125 psi, 250 degrees F.

### 2.5 AIR SEPARATORS

- A. Furnish and install as shown on the drawings and schedule a full flow coalescing type air eliminator.
- B. Air separator unit shall be fabricated steel rated for 150 psig design pressure and 270 Deg. F. operating temperature. The separator shall provide non-turbulent non-centrifugal flow thru the unit at rated GPM with less than 1 foot of water pressure drop with a velocity not to exceed 4 feet per second through the unit at the specified GPM and CV rating.

- C. The air eliminator shall remove 100% of all free and entrained air during system start up and continue to eliminate 99.6% of dissolved air at rated GPM.
- D. Unit shall include internal elements filling the entire vessel to suppress turbulence and air elimination efficiency of 100% free air, 100% entrained air, and 99.6% dissolved air at the installed location. The elements must consist of a copper core tube with continuous wound copper wire medium permanently attached and followed by a separate continuous wound copper wire permanently affixed.
- E. Each unit is to have a separate air and venting chamber to prevent system contaminants from harming the float and venting valve operation. At the top of the venting chamber shall be an integral float actuated air vent that is guaranteed not to leak.
- F. The air vent shall have a 2" npt connection for testing and remote venting. Contractor shall pipe to nearest floor drain.

## 2.6 WATER RELIEF VALVES

- A. Pressure relief valves installed for the protection of the water circulating circuits shall be single seated diaphragm and spring type valve with screwed connections, similar to Watts No. 174A.
- B. 3/4 inch size of bronze construction with bronze seat, composition shut-off disc, and rubber diaphragm.

## 2.7 PRESSURE REDUCING VALVE

- A. 10 – 30 psig: Provide a Pressure Reducing Valve with integral strainer shall be installed where indicated on the drawings. The valve shall feature a Lead Free cast copper silicon alloy body suitable for water supply pressures up to 200psi and may be adjusted from 10 – 30 psig. All parts shall be serviceable without removing the valve from the line. Provide threaded inlet connection, integral stainless steel strainer, stainless steel seat, reinforced EPDM diaphragm and EPDM valve disc.
- B. 25 – 75 psig: Provide a Pressure Reducing Valve with integral strainer shall be installed where indicated on the drawings. The valve shall feature a Lead Free brass body suitable for water supply pressures up to 300psi and may be adjusted from 25 – 75 psig. Provision shall be made to permit the bypass flow of water back through the valve into the main when pressures, due to thermal expansion on the outlet side of the valve, exceed the pressure in the main supply. All parts shall be serviceable without removing the valve from the line. Provide union inlet connection, integral stainless steel strainer, gauge tapping and gauge and replaceable seat module.

## 2.8 SHOT FEEDER/FILTER

- A. Provide shot feeder where indicated on drawings and scheduled.
- B. Filter Housing. Shall consist of continuous electric welded tube body, code semi-elliptical heads, sealed filter chamber, filter, filter support device and inlet/outlet/drain and fill port. Body of shot feeder/filter shall have 5 gallon capacity and constructed of A513 tube, have three welded carbon steel legs, and for 200PSI at 200°F. Lid shall be minimum 3-1/2" in diameter and have Buna-N O-ring. Provide minimum 2 mil epoxy coating on outside of filter housing.

- C. Filter Media. Shot feeder/filter feeder shall be supplied with 20 micron high temperature re-usable pleated filter, stainless steel holder and stainless steel removal handle so that personnel shall not come in contact with vessel contents.

### PART 3 - EXECUTION

#### 3.1 PREPARATION

- A. Flush and clean expansion tanks prior to delivery to the Project Site, and keep sealed during construction.

#### 3.2 INSTALLATION

- A. Installation shall meet or exceed all applicable federal, state and local requirements, referenced standards and conform to codes and ordinances of authorities having jurisdiction.
- B. All installation shall be in accordance with manufacturer's published recommendations.
- C. Support expansion tanks from building structure in accordance with manufacturer's instructions.
- D. Provide manual air vents at entrance to all heating hot water coils, with a "cane" shaped discharge tube, positioned to permit draining to a portable receptacle.
- E. Provide valved drain and hose connection on strainer blow down connection.
- F. Support pump fittings with floor mounted pipe and flange supports.
- G. Provide relief valves on pressure tanks, low-pressure side of reducing valves, heat exchangers, and expansion tanks.
- H. Select system relief valve capacity so that capacity is greater than make up pressure reducing valve capacity. Select equipment relief valve capacity to exceed rating of connected equipment.
- I. Pipe relief valve outlet to nearest floor drain.
- J. Where one line vents several relief valves, make cross sectional area equal to sum of individual vent areas.
- K. Air Vent
  1. Provide air vents at the highest points of the hydraulic piping systems and on the uppermost connections to all hydraulic coils. Provide shutoff valves to facilitate maintenance of air vents.
  2. Locate all air vents and their discharge lines in accessible locations, preferably clustered.
  3. For automatic air vents in above-ceiling spaces or other concealed locations, extend vent tubing to nearest drain
  4. Route ½-inch discharge lines to nearest floor drain without air traps.
- L. Shot Feeder/Filter

1. Shot feeder/filter shall be installed per manufacturer's instructions and details shown on the construction documents. Provide ball valve at shot feeder/filter drain outlet and pipe to nearest floor drain. Install new filter media in shot feeder/filter at substantial completion of the project.

END OF SECTION 23 21 16

## SECTION 23 23 00 - REFRIGERANT PIPING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including "Uniform General Conditions and Supplementary General Conditions For The State Of Texas Building Construction Contracts" and Division 01 Specification Sections, apply to the work of this Section.
  - 1. Where the term "Owner's Designated Representative" is used, it shall mean a member of the project's capital team.

#### 1.2 SUMMARY

- A. This Section includes refrigerant piping and accessories used for air-conditioning applications.

#### 1.3 REFERENCES

- A. ANSI B16.22 - Wrought Copper and Wrought Copper Alloy Solder Joint Pressure Fittings
- B. ASTM B88 - Seamless Copper Water Tube
- C. ASTM B280 - Seamless Copper Tube for Air Conditioning and Refrigeration Field Service
- D. ASHRAE 15 - Safety Code for Mechanical Refrigeration
- E. AHRI 710 – Performance Rating of Liquid Line Dryers.
- F. ASTM B828 - Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings
- G. ANSI/AWS C3.4 - Specification for Torch Brazing
- H. AHRI 495 - Performance Rating Of Refrigerant Liquid Receivers
- I. ASME B31.5 – Code for Pressure Piping, Section on Refrigeration Piping and Heat Transfer
- J. AWS A5.8/A5.8M – Specification for Filler Metals for Brazing and Braze Welding.

#### 1.4 QUALITY ASSURANCE

- A. Qualify soldering processes, procedures, and solderers for copper and copper alloy pipe and tube in accordance with ASTM B 828.
- B. Qualify brazing processes for copper and copper alloy pipe and tube according to ANSI/AWS C3.4. Qualify brazing procedures and brazing performance in accordance with either Section IX of the ASME Boiler and Pressure Vessel Code, or AWS B2.2.

#### 1.5 SUBMITTALS

- A. Product Data:



1. Contractor shall submit schedule indicating the ASTM specification number of the pipe being proposed along with its type and grade and sufficient information to indicate the type and rating of fittings for each service.
  2. For each type of valve and refrigerant piping specialty indicated. Include pressure drop based on manufacturer's test data.
- B. Shop Drawings: Show layout of refrigerant piping and specialties, including pipe, tube, and fitting sizes, flow capacities, valve arrangements and locations, slopes of horizontal runs, oil traps, double risers, wall and floor penetrations, and equipment connection details. Show interface and spatial relationships between piping and equipment.
- C. Field quality-control test reports.
- D. Operation and maintenance data.
- 1.6 PRODUCT DELIVERY, STORAGE AND HANDLING
- A. Pipe and tube required by the applicable standard to be cleaned and capped shall be delivered to the job site with factory-applied end-caps. Maintain end-caps through shipping, storage, and handling to prevent pipe-end damage and prevent entrance of dirt, debris, and moisture.
- B. Protect stored pipe and tube from moisture and dirt. Elevate above grade. When stored inside, do not exceed the structural capacity of the floor.
- C. Protect fittings, flanges, and piping specialties from moisture and dirt.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Subject to compliance with requirements provide products by one of the following manufacturers:
1. Danfoss.
  2. Mueller Brass Company.
  3. Sherwood

### 2.2 REFRIGERANT PIPING AND FITTINGS

- A. ASTM B88 type L hard drawn copper tube, cleaned and capped in accordance with ASTM B280, and marked "ACR", with ANSI B16.22 wrought copper or forged brass solder-type fittings
- B. Piping shall be shipped pressurized with dry nitrogen gas and sealed under pressure with a positive plug.
- C. Solder Filler Metals: ASTM B 32. Use Alloy Sb5 95-5 Tin Antimony or Alloy HB solder to join copper socket fittings on copper pipe.
- D. Brazing Filler Metals: AWS A5.8.

## 2.3 VALVES AND SPECIALTIES

### A. General

1. All refrigerant piping specialties shall be suitable for the working refrigerant.

### B. Ball Valves

1. Features: Forged brass with full port construction to match line size ID, chrome plated ball, internally equalized ball design, rupture-proof encapsulated stem, access port, brass cap, extended copper flare connection and UL Listed.
2. Working Pressure Rating: 700 psig
3. Working Temperature Range: -40°F to 250°F

### C. Check Valves

1. Features: Screw bonnet, forged brass body, Teflon gasket, internal components shall be removable, UL Listed.
2. Working Pressure Rating: 700 psig
3. Working Temperature Range: -40°F to 300°F

### D. Y-Type Strainers:

1. Features: Forged brass body with brass clean-out plug, 100-mech monel or stainless steel screen, UL Listed.
2. Working Pressure Rating: 500 psig.
3. Maximum Operating Temperature: 275°F.

### E. Moisture/Liquid Indicators:

1. Body: Forged brass.
2. Window: Replaceable, clear, fused glass window with indicating element protected by filter screen.
3. Indicator: Color coded to show moisture content in ppm.
4. Minimum Moisture Indicator Sensitivity: Indicate moisture as required for type of refrigerant and temperature. Submit information on color for dry, intermediate and wet indications.
5. End Connections: Socket or flare.
6. Working Pressure Rating: 500 psig.
7. Maximum Operating Temperature: 160°F.

### F. Filter Dryers

1. Comply with AHRI 710.
2. Body and Cover: Provide painted-steel shell with zinc-chromated steel top cover with external access connection.
3. Filter Media (Replaceable):
  - a. For systems under 15 tons, provide 25 micron filter media.
  - b. For systems 15 tons and above, provide 15 micron filter media.
4. Desiccant Media: 100% molecular sieve solid core suitable for HFC refrigerants or 80% molecular sieve and 20% activated alumina solid core suitable for HCFC refrigerants.
5. Designed for reverse flow (for heat-pump applications).
6. Access Ports: NPS 1/4 connections at entering and leaving sides for pressure differential measurement.
7. Working Pressure Rating: 500 psig.
8. Maximum Operating Temperature: 160°F.

### G. Liquid Accumulators: Comply with AHRI 495.

1. Body: Welded steel with corrosion-resistant coating.
2. End Connections: Socket or threaded.
3. Working Pressure Rating: 500 psig.
4. Maximum Operating Temperature: 275°F.

H. Charging Valves

1. Provide ¼" SAE brass male flare access ports with finger tight, quick seal caps. Provide 2-inch long copper extension sections.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

- A. Drawing 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 unless deviations to layout are approved on Shop Drawings.
- B. Install refrigerant piping according to ASHRAE 15.
- C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping adjacent to machines to allow service and maintenance.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Select system components with pressure rating equal to or greater than system operating pressure.
- J. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.
- K. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels as specified in Division 08 Section, Access Doors and Frames, if valves or equipment requiring maintenance is concealed behind finished surfaces.
- L. Install refrigerant piping in protective conduit where installed belowground.
- M. Install refrigerant piping in rigid or flexible conduit in locations where exposed to mechanical injury.
- N. Slope refrigerant piping as follows:

1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.
  2. Install horizontal suction lines with a uniform slope downward to compressor.
  3. Install traps and double risers to entrain oil in vertical runs.
  4. Liquid lines may be installed level.
- O. When brazing or soldering, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.
- P. Install pipe sleeves at penetrations in exterior walls and floor assemblies.
- Q. Seal penetrations through fire and smoke barriers according to Division 07 Section, Penetration Firestopping.
- R. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.
- S. Install sleeves through floors, walls, or ceilings, sized to permit installation of full-thickness insulation.
- T. Seal pipe penetrations through exterior walls according to Division 07 Section, Joint Sealants, for materials and methods.
- U. Identify and label refrigerant piping and valves according to Section 23 05 53, Identification for HVAC Piping and Equipment.

### 3.2 PIPE JOINT CONSTRUCTION

- A. Soldered Joints: Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook."
- B. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."
1. Use Type BcuP, copper-phosphorus alloy for joining copper socket fittings with copper pipe.
  2. Use Type BAg, cadmium-free silver alloy for joining copper with bronze or steel.

### 3.3 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
- B. Tests and Inspections:
1. Comply with ASME B31.5, Chapter VI.
  2. Test refrigerant piping and specialties. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.
  3. Test high- and low-pressure side piping of each system separately at not less than the pressures indicated below:
    - a. Test Pressures
      - 1) Suction Lines for Air-Conditioning Applications: 185 psig.
      - 2) Suction Lines for Heat-Pump Applications: 325 psig.
      - 3) Hot-Gas and Liquid Lines: 325 psig
    - b. Fill system with nitrogen to the required test pressure.

- c. System shall maintain test pressure at the manifold gage throughout duration of test.
- d. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.
- e. Remake leaking joints using new materials, and retest until satisfactory results are achieved.

### 3.4 SYSTEM CHARGING

- A. Charge system using the following procedures:
  - 1. Install core in filter dryers (for ones with replaceable core) after leak test but before evacuation.
  - 2. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers. If vacuum holds for 12 hours, system is ready for charging.
  - 3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig.
  - 4. Charge system with a new filter-dryer core in charging line.

### 3.5 ADJUSTING

- A. Adjust thermostatic expansion valve to obtain proper evaporator superheat.
- B. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.
- C. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:
  - 1. Open shutoff valves in condenser water circuit.
  - 2. Verify that compressor oil level is correct.
  - 3. Open compressor suction and discharge valves.
  - 4. Open refrigerant valves except bypass valves that are used for other purposes.
  - 5. Check open compressor-motor alignment and verify lubrication for motors and bearings.
- D. Replace core of replaceable filter dryer after system has been adjusted and after design flow rates and pressures are established.

END OF SECTION 23 23 00

## SECTION 23 25 00 - WATER TREATMENT FOR HVAC SYSTEMS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including "Uniform General Conditions and Supplementary General Conditions For The State Of Texas Building Construction Contracts" and Division 01 Specification Sections, apply to the work of this Section.
  - 1. Where the term "Owner's Designated Representative" is used, it shall mean a member of the project's capital team.

#### 1.2 RELATED WORK

- A. Section 23 21 00 Hydronic Piping and Fittings.

#### 1.3 SUMMARY

- A. Provide complete chemical water treatment systems for the following systems:
  - 1. Closed loop heating hot water.
- B. Provide chemicals as required to control scale, corrosion, biological fouling, waterborne pathogens, and corrosion resulting from biological contamination or inhabitation of piping systems.
- C. Coordinate tap and sensor locations with Drawings and the water treatment manufacturer's requirements.
- D. Provide supervision of the water treatment program starting at initial start-up of the heating hot water systems through one year from substantial completion consisting of on-the-spot analysis of all systems treated and a submittal of a written report to Owner and Engineer stating current conditions and recommendations for maintaining optimal controls. This service shall be performed monthly.
- E. Provide passivation and cleaning of piping systems prior to contractor placing these systems in to operation.
  - 1. all chemicals
  - 2. written procedures for implementation by the Contractor
  - 3. Site visits to insure that the contractor understands the procedures and means of introducing the chemicals
  - 4. follow up report and sampling of the water to insure that the procedures were followed

#### 1.4 PERFORMANCE REQUIREMENTS

- A. Water quality for HVAC systems shall minimize corrosion, scale buildup, and biological growth for optimum efficiency of HVAC equipment without creating a hazard to operating personnel or the environment.
- B. Base HVAC water treatment on quality of water available at Project site, HVAC system equipment material characteristics and functional performance characteristics, operating personnel capabilities, and requirements and guidelines of authorities having jurisdiction.

- C. Provide initial chemical treatment for all systems on a complete water analysis prior to equipment installation.

#### 1.5 QUALITY ASSURANCE

- A. Qualified vendor will have been in continuous operation for 20-plus years, be certified to the ISO 9000 quality standard, manufacture and deliver their own products, be capable of transferring chemicals to stationary tanks, provide technical specialists as needed in addition to the routine service representative, perform borescope inspections, support an Internet database for water treatment reports and information, have personnel and expertise to install water treatment equipment, and have the ability to perform offsite analytical laboratory work and reporting.
- B. Technical service representative will have a minimum of five (5) years water treatment industry experience and live within two (2) hours drive of the site being serviced and will be a Certified Water Technologist (CWT) professional.
- C. Regulatory Requirements: Conform to applicable codes for addition of non-potable chemicals to building mechanical systems, and public sewage systems.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

#### 1.6 SUBMITTALS

- A. Product Data:
  - 1. Include rated capacities; water-pressure drops; shipping, installed, and operating weights; and furnished products listed below:
    - a. Pumps.
    - b. Chemical solution tanks.
    - c. Agitators.
    - d. Control equipment and devices.
    - e. Test equipment.
    - f. Chemicals.
    - g. Filters.
    - h. Chemical feeders.
    - i. Bypass Chemical pot feeders.
- B. Shop Drawings:
  - 1. Provide a flow schematic that indicated the piping connection points, line types, sizes, and arrangement of all chemical treatment equipment
  - 2. Provide a control schematic that indicates what variables are being measured, the measurement points, the intended setpoints, and what control devices (metering pumps, solenoids, etc) are being actuated to achieve these setpoints.
- C. Record Documents:
  - 1. Shop Drawings: Detail equipment assemblies indicating dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
    - a. Wiring Diagrams: Detail power and control wiring and differentiate between manufacturer-installed and field-installed wiring.
    - b. Flow Schematics

- c. Control Schematics
- 2. Water Analysis: Submit a copy of the water analysis to illustrate water quality available at Project Site.
- 3. Field Test Reports:
  - a. Indicate and interpret test results for compliance with performance requirements.
  - b. Provide letter after cleaning services are completed indicating analysis of system water after cleaning and treatment, date service was performed, and chemicals used.

#### 1.7 OPERATION AND MAINTENANCE DATA:

- A. For pumps, agitators, filters, system controls, and accessories to include in Operating and Maintenance Manuals.
- B. Include data on equipment including spare parts lists, procedures, and treatment programs.
- C. Include step by step instructions for test procedures including target concentrations.
- D. Include plant logs, MSDS sheets and other system information required for maintaining system.
- E. Furnish manufacturer's written instructions.

#### 1.8 MAINTENANCE

- A. Provide adequate supply of chemicals for start-up and testing period for the time system is being operated by Contractor and for a period of one year after the system has been accepted by Owner.
- B. Recommend periodic testing procedure and chemical treatment schedule for facility personnel.
- C. Provide qualified service representative on site at facilities to assist with initial application of chemicals and training of personnel.
- D. A service report shall be prepared for each visit showing test results and providing recommendations for continued system operations.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Subject to compliance with requirements, provide products by one of the following:
  - 1. ChemCal, Inc.
  - 2. GE Water & Process Technologies
  - 3. Nalco Company

#### 2.2 GENERAL

- A. All materials shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.
- B. Chemical Feed System Description:



1. Contract documents show a bypass loop from main system headers to the water treatment room with taps for chemical injection, coupons, controllers, and blowdown valves. Water treatment vendor will make connections and install equipment using these taps. Water treatment vendor shall consult with the mechanical contractor to verify exact location and orientation for his use. Unused taps will be left in place for future use by others.
- C. Performance Requirements:
  1. Maintain water quality for HVAC systems that controls corrosion and build-up of scale and biological growth for maximum efficiency of installed equipment without posing a hazard to operating personnel or the environment.
  2. Base chemical treatment performance requirements on the quality of water at the Project Site HVAC system equipment material and operating personnel capabilities, and the capability of personnel and guidelines of authorities having jurisdiction at the Project Site.
    - a. Closed System: Maintain system essentially free of scale, corrosion, and fouling to sustain the following water characteristics:
      - 1) Conductivity: 1000-7000 mmhos.
      - 2) Acceptable pH: Not less than 8.8.
    - b. Condenser Water, Medium-to-Large Cooling Tower System: Maintain system essentially free of scale, corrosion, and microbiological fouling.

## 2.3 CHEMICAL FEEDING EQUIPMENT

- A. General: Vendor must provide, install, and support all relevant chemical feed and storage equipment necessary to treat the condenser and steam boiler water systems.
- B. Chemical storage tanks with 110% containment. Tanks may come in a variety of sizes and have injection pump standpipe and vent line, as well as chemical fill point attachments.
- C. Injection pump containment boxes (i.e., Integra, Stahlin) which are splash proof. Boxes shall be wall mounted above and near their related storage tank. Boxes must have sensor capable of interlocking injection pumps with leak detection.
- D. Chemical injection pumps with controllable speed and stroke.
- E. Storage tank level sensors which can be read by the controller.
- F. Industrial grade inhibitor tag monitoring probe (i.e., similar to Turner) to ensure proper dosage of scale and corrosion inhibitor chemical (condenser program only).
- G. Industrial grade corrosion monitoring probes (mild steel, copper) to monitor corrosion rates (i.e., CorrTran) (condenser program only).
- H. Flow meters for bypass loop piping.
- I. Chemical tubing containment from storage tank to pump box and from pump box to injection point.
- J. Stainless steel chemical tubing where applicable (i.e., acid).
- K. One (1) normally closed solenoid valve for condenser water bleed line.

## 2.4 CHEMICAL TREATMENT CONTROLLERS

- A. Vendor must provide, install, program, and support Internet-accessible water treatment controllers (i.e., eController, Hydro-Triton) for condenser water treatment control. Such control equipment must have the following features:
1. Secure, password-protected access for each facility director and their chosen operators.
  2. Access to the controller from anywhere via the Internet.
  3. Secure, password-protected access at controller unit keypad.
  4. Daily status reports emailed to chosen recipients.
  5. Seven (7) 110 volt NO/NC relays, plus one (1) for alarms.
  6. Eight (8) 4-20 mA inputs.
  7. At least six (6) digital inputs.
  8. Ability to assign any input to any output online.
  9. Output up to four (4) 4-20 mA signals.
  10. Accessibility by modem or Ethernet.
  11. Industrial grade pH, ORP, inhibitor tag, and conductivity sensors and housing as required per facility and system type.
  12. Ability to read 4-20 MA output signals from Building Automation System proportional to the instantaneous totalized flow of condenser water makeup and blow down flows.
  13. Ability to record chemical tank level sensor data.
  14. Ability to feed oxidizing biocide base on ORP set point(s) and record ORP of condenser water for any given period.
  15. Ability of controller to routinely send data (i.e., conductivity, ORP, pH, tank level sensor readings) electronically to the facility's water treatment Internet database system.
  16. Daily, weekly, or monthly data logs emailed to chosen recipients.
  17. Ability to review controller data trend charts.
  18. Real-time availability of controller data.
  19. Execution of controller changes (i.e., set points, dead bands, etc.) via the Internet.
  20. Detailed email alarm notifications to chosen recipients.
  21. UBS and Ethernet direct connect access.
  22. Vendor training and in-services on use and navigation of the controller and its database system.

## 2.5 CHEMICAL TREATMENT TEST EQUIPMENT

- A. Vendor must provide a relevant test kit and components for operator's use for operator testing. Test kit must come in a carrying case for ease of handling and contain testing procedures, log sheets, and reagent MSDSs. The vendor must provide a minimum of one (1) hour in-service to operators involved in routine testing. The vendor will replenish reagents at no charge for the one (1) year term starting at Substantial Completion.
- B. If acid (pH control) is used in the condenser water program, a hand-held conductivity/pH meter (i.e., Myron L 6-P) must be included in the test kit. Otherwise, a simple conductivity meter (i.e., Myron L EP-10) must be included in the test kit.

## 2.6 CHEMICALS

- A. Furnish chemicals recommended by water-treatment system manufacturer that are compatible with piping system components and connected equipment.
- B. System Cleaner: Liquid alkaline compound with emulsifying agents and detergents to remove grease and petroleum products.

- C. Biocide: Chlorine release agents or microbiocides.
- D. Closed-Loop, Water Piping Chemicals: Sequestering agent to reduce deposits and adjust pH, corrosion inhibitors, and conductivity enhancers.

## 2.7 PASSIVATION AND CLEANING CHEMICALS - HEATING WATER LOOPS

- A. Vendor must provide chemicals for cleaning and passivating water-side surfaces prior to implementation of the regular water treatment program and HVAC system startup. Vendor must be plan and supervise the mechanical contractor's application of the heating hot water loops. Chemicals shall remove mill scale, oil, and greases as well as passivate surfaces with a protective oxide film.
  - 1. NOTE: All residuals of the cleaning and passivating chemicals must be totally blown-down prior to system startup.
- B. Alkaline cleaner/penetrant/dispersant chemical. This product must be in liquid form and capable of removing mill scale, oils, greases, debris, and byproducts of construction. It shall be fed at the vendor's recommended dosage rate based on the volumes of the systems treated.
- C. Passivating chemical. This product must be in liquid poly-phosphate form and capable of laying down a protective oxide film on metal surfaces after treatment with the cleaning chemical. It shall be fed at the vendor's recommended dosage rate based on the volumes of the systems treated.

## 2.8 INTERNET DATABASE SYSTEM

- A. Vendor must provide, configure, and support an Internet-accessible database account for the retrieving, recording, and archiving of water treatment related information. Such a system must have the following features:
  - 1. Secure, password-protected access for each manager and their chosen operators.
  - 2. Access to the system from anywhere via the Internet.
  - 3. Zero software requirements (Internet browser required for user).
  - 4. Ability for facility operators to record routine test log data online.
  - 5. Ability for facility director and operators to upload pertinent digital images and PDF files.
  - 6. Retrieve service reports, operator logs, laboratory analysis, corrosion coupon reports, inventory, digital images, MSDSs, product data sheets, technical papers, procedures, surveys, and training information.
  - 7. Graphing and trending capabilities for any recorded service report and/or facility operator test data entries.
  - 8. Ability of database system to routinely accept data (i.e., conductivity, ORP, pH, tank level sensor readings) electronically from the facility's water treatment controller(s).
  - 9. Graphing and trending capabilities that compare entries of wet test data with controller sensor data.
  - 10. Ability to set alarm limits and assign recipients for email alarm notifications for chosen test variables of service report and/or operator log entries.
  - 11. Multiple security levels for various users.

## PART 3 - EXECUTION

### 3.1 PREPARATION

#### A. Water Analysis:

1. Perform an analysis of supply water to determine the type and quantities of chemical treatment needed to maintain the water quality as specified in "Performance Requirements" Article.

### 3.2 INSTALLATION

A. Vendor is responsible for the installation of the phone line required for internet access, all test points, electrical outlets for their equipment, wiring and piping other than what is indicated to be provided by the mechanical contractor on the drawings. Vendor is solely responsible for coordinating the installation of the water treatment devices. Vendor may (at his option) negotiate the installation of any materials, equipment, or utility by the Contractor.

B. Installation shall meet or exceed all applicable federal, state and local requirements, referenced standards and conform to codes and ordinances of authorities having jurisdiction.

C. All installation shall be in accordance with manufacturer's published recommendations.

D. Install treatment equipment level and plumb.

E. Add cleaning chemicals as recommended by manufacturer.

#### F. Connections:

1. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
2. Install piping adjacent to equipment to allow service and maintenance.
3. Confirm applicable electrical requirements in Division 26 Sections for connecting electrical equipment.
4. Ground equipment.
5. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

### 3.3 TESTING

A. Engage a factory-authorized service representative to perform Start-up service.

1. Inspect field-assembled components and equipment installation, including piping and electrical connections. Report results in writing.
2. Inspect piping and equipment to determine that systems and equipment have been cleaned, flushed, and filled with water, and are fully operational before introducing chemicals for water-treatment system.
3. Place HVAC water-treatment system into operation and calibrate controls during HVAC system Start-up procedures.

B. Test chemical feed piping as follows:

1. Do not enclose, cover, or put piping into operation until it is tested and satisfactory test results are achieved.
2. Test for leaks and defects. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.

3. Leave uncovered and unconcealed new, altered, extended, and replaced water piping until it has been tested and approved. Expose Work that has been covered or concealed before it has been tested and approved.
4. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow test pressure to stand for four (4) hours. Leaks and loss in test pressure constitute defects.
5. Repair leaks and defects with new materials and retest piping until satisfactory results are obtained.
6. Prepare test reports, including required corrective action.
7. Occupancy Adjustments: Within 12 months of Substantial Completion, perform two (2) separate water analyses to prove that automatic chemical feed systems are maintaining water quality within performance requirements specified in this Section. Perform analyses at least 60 calendar days apart. Submit written reports of water analysis.

### 3.4 ROUTINE TECHNICAL SERVICE REQUIREMENTS

- A. Service visit frequency shall be a minimum of once per week the first month and once per month after that. Technical service visit commitment shall begin with the start-up of the mechanical systems being treated and continue for one (1) year after substantial completion.
- B. The technical service representative will perform the following duties during site visits:
  1. Pull and test all relevant water samples. Record results and recommendations on written reports and enter results and recommendations on the customer's Internet database account.
  2. Make recommendations regarding needed adjustments, repairs, and or improvements to water-related systems and water treatment equipment, and enter such recommendations on the Internet database account.
  3. Discuss and review in person all findings and recommendations with the mechanical contractor and project management during routine and nonroutine service visits. Be available for such discussions via telephone and email as well.
  4. Inspect water-using equipment during routine and non-routine openings. If desired, utilize videoscopes and or borescopes, as well as digital camera and visual inspection techniques. Subsequent reports and images will become available on the Internet database account.
  5. Provide in-services and technical training to the mechanical contractor and or owner operators on an as needed basis. Such training may involve test procedures and interpretation, Internet database account use and navigation, water treatment equipment use and programming, treatment chemical knowledge, and or chemical handling.
  6. Review operator logs on the Internet database account and or hardcopy during site visits.
  7. Analyze mild steel and copper corrosion coupons (condenser program only) at least twice during the one (1) year program and enter reports on the Internet database account.
  8. Make routine inventory checks of treatment chemicals and test reagents so ordering recommendations can be made and chemicals can be furnished as needed and quickly.
  9. Make adjustments to the controllers, timers, and chemical pumps as needed.

### 3.5 TRAINING

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain HVAC water-treatment systems and equipment.
- B. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining equipment and schedules.
  - 1. Schedule two four (4) hours of training with Owner. One for equipment, one for internet data base access and management.
  - 2. Provide at least seven calendar days advance notice.
  - 3. Review manufacturer's safety data sheets for handling of chemicals.
  - 4. Review data in maintenance manuals, especially data on recommended parts inventory and supply sources and on availability of parts and service.
  - 5. Review data in maintenance manuals, especially data on recommended parts inventory and supply sources and on availability of parts and service.

END OF SECTION 23 25 00

## SECTION 23 31 00 - DUCTWORK

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including "Uniform General Conditions and Supplementary General Conditions For The State Of Texas Building Construction Contracts" and Division 01 Specification Sections, apply to the work of this Section.
  - 1. Where the term "Owner's Designated Representative" is used, it shall mean a member of the project's capital team.

#### 1.2 SUMMARY

- A. Perform Work required to provide and install ductwork, flexible duct, hangers, supports, sleeves, flashings, vent flues, and all necessary accessories as indicated in the Contract Documents. Provide any supplementary items necessary for proper installation
- B. Section Includes
  - 1. Rectangular ducts and fittings.
  - 2. Round ducts and fittings.
  - 3. Spiral Double-Wall insulated Ductwork
  - 4. Sheet metal materials.
  - 5. Sealants and gaskets.
  - 6. Hangers and supports.
- C. Related Sections:
  - 1. Division 09 Section, Painting, for interior painting of metal ductwork exposed to view through grilles, registers, and other openings.
  - 2. Section 23 05 93, System Testing, Adjusting, and Balancing.
  - 3. Section 23 07 13, External Ductwork Insulation.
  - 4. Section 23 33 00, Air Duct Accessories.

#### 1.3 DEFINITIONS

- A. Low Pressure: Up to 2 inches w.g. positive or negative static pressure and velocity equal to 1500 fpm. Constructed and tested for +2 inches W.G.
- B. Duct Size. The supply, return and exhaust duct sizes shown on drawings are clear inside sheet metal dimensions. Contractor shall add to the dimensions show the thick of required insulation.

#### 1.4 GUARANTEE

- A. Guarantee all ductwork for 1 year from the date of final acceptance. The guarantee will cover workmanship, noise, chatter, whistling or vibration. Ductwork shall be free from pulsation under all conditions of operation.

## 1.5 CONTRACTOR COORDINATION

- A. Erect all ducts in the general locations shown on the drawing(s), but conform to all structural and finish conditions of the building. Before fabricating any ductwork, Contractor to check the physical conditions at the job site and make all necessary changes in cross sections, offsets and similar items, whether they are specifically indicated on drawing(s) or not.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.

## 1.6 STANDARDS AND CODES

- A. Except as otherwise indicated, sheet metal ductwork material, fabrication and installation shall comply with second edition of SMACNA HVAC Construction Standards Metal and Flexible, except where indicated otherwise. All air distribution devices (such as dampers) included in this Section shall comply with the third edition of SMACNA HVAC Construction Standards Metal and Flexible.
- B. In addition, construct ductwork and all air distribution devices to the following:
  - 1. IMC International Mechanical Code
  - 2. NFPA 90A Installation of Air Conditioning and Ventilating Systems.
  - 3. NFPA 90B Installation of Warm Air Heating and Air Conditioning Systems

## 1.7 SUBMITTALS

- A. Product Data
  - 1. Submit product data for each product. Refer to Section 23 00 10.
  - 2. Provide acoustical data on insulated flexible ductwork as indicated in Part 2.
- B. Delegated-Design Submittal. Include the following for each system furnished on the project.
  - 1. System name and type
  - 2. Duct system design pressure.
  - 3. Sheet metal thicknesses and materials.
  - 4. Reinforcement details and spacing.
  - 5. Seam and joint construction and sealing.
  - 6. Fittings, construction and details.
  - 7. Hangers and supports, including materials, fabrication, methods for duct and building attachment.
- C. Ductwork shop drawings. Provide CAD-generated shop drawings of mechanical rooms and building ductwork drawn at a minimum scale of ¼ inch per foot. Include the following as a minimum:
  - 1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
  - 2. Factory and shop fabricated duct and fittings.
  - 3. Duct layout indicating sizes, configuration and pressure classes.
  - 4. Elevations of top and bottom of ducts.
  - 5. Dimensions of main duct runs from building grid lines.
  - 6. Reinforcement and spacing.
  - 7. Penetrations through fire-rated and other partitions.







2. Scrim tape shall be fiberglass open weave tape, 3 inches wide, with maximum 20/10 thread count.
- F. Hangers and Supports.
1. Support ductwork with continuously threaded hanger rods of galvanized steel or 20 gauge straps as indicated in these specifications.

#### 2.4 RECTANGULAR DUCTS AND FITTINGS GENERAL REQUIREMENTS

- A. General Fabrication Requirements: Comply with SMACNA based on indicated static-pressure class unless otherwise indicated. In no case shall the ductwork be less than 26 gage for low pressure ductwork, 24 gage for medium pressure ductwork.
- B. Transverse Joints: Select joint types and fabricate according to SMACNA Figure 1-4, "Transverse (Girth) Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA.
- C. Longitudinal Seams: Select seam types and fabricate according to SMACNA Figure 1-5, "Longitudinal Seams - Rectangular Ducts," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA. Snaplock longitudinal seams (L2) are not acceptable.
- D. Fittings:
1. Select types and fabricate according to SMACNA Chapter 2, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA.
  2. Construct bends and elbows per SMACNA Figure 2-2, "Rectangular Elbows", Type RE1 with radius of not less than 1-1/2 times width of duct on centerline. Where not possible or where indicated on construction documents, construct Type RE2 rectangular elbows with welded-in-place double wall airfoil turning vanes (whether specifically shown on drawings or not), or short radius type RE1 radius elbows.
  3. Construct tees per SMACNA Figure 2-5, "Divided Flow Branches", Type 2, Type 3, Type 4A or 4.
  4. Construct branch connections per SMACNA Figure 2-6, "Branch Connection". Use 45 degree entry, 45 degree lead in, conical or bellmouth connections only.
  5. Unless indicated on construction document details, transform duct sizes gradually, not exceeding 15 degrees divergence and 30 degrees convergence. Divergence upstream of equipment shall not exceed 30 degrees. Convergence downstream of equipment shall not exceed 45 degrees.
  6. Bullhead tees are not permitted.

#### 2.5 ROUND DUCTS AND FITTINGS GENERAL REQUIREMENTS

- A. General Fabrication Requirements: Comply with SMACNA Chapter 3, "Round, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated. In no case shall the ductwork be less than 26 gage.
- B. Transverse Joints: Select joint types and fabricate according to SMACNA Figure 3-2, "Transverse Joints - Round Duct," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA. Use flanged joints for ducts larger than 48 inches in diameter.

- C. Longitudinal Seams: Select seam types and fabricate according to SMACNA Figure 3-1, "Seams - Round Duct and Fittings," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA. Utilize spiral seam or butt weld seams only. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.
- D. Fittings:
1. Fittings shall have a wall thickness not less than that specified for longitudinal-seam straight duct or 26 gage, whichever is more stringent.
  2. Tees and Laterals: Select types and fabricate according to SMACNA Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA. Utilize 90 degree tee with oval to round tap, 45 degree lateral tap, or conical fitting only. Wye fittings may be utilized where specifically indicated on drawings and details.
  3. Elbows: Construct elbows with radius of not less than 1-1/2 times width of duct on centerline. Provide minimum 5 gore elbows on all 90 deg elbows, 3 gore elbows on 45 degree elbows. Continuously welded stamped long radius elbows may be utilized on ductwork up to and including 12-inches in diameter.
  4. Bullhead tees are not permitted.

## 2.6 INSULATED FLEXIBLE DUCTWORK

- A. Use for connection to diffusers, grilles and terminal boxes as indicated in specifications and details.
- B. Construct the inner liner of coated steel helix and a PE or CPE liner substantially bonded together to prevent the duct from collapsing or kinking in short radius bends. Provide fiberglass insulation providing minimum R-4.2 thermal conductance and 3 pound minimum density around inner jacket consisting of fiberglass reinforcement and aluminum foil vapor barrier outer jacket. Use duct rated at minimum working pressure of 10 inches of water positive and 1 inches of water maximum negative pressure (4-12 in I.D.), and 6 inches of water positive and 1/2 inch of water maximum negative pressure (14- 16 I.D.),. Provide duct listed by U.L. at flame spread rate of not over 25 and smoke developed rate of not over 50, and complying with NFPA Standard 90A and 90B. The entire assembly shall be listed by Underwriters Laboratories under U.L. Standard 181 as a Class I flexible air duct. Supplier shall submit laboratory test results indicating acoustical performance comparable to that of "Flexmaster Type 1M-Insulated".

## 2.7 FLUE VENT

- A. Provide for all gas fired equipment. Provide all accessories such as flue caps, support plates, ventilated roof thimble, storm collar, etc. by the same manufacturer.
- B. Type AL 29-4C Double Wall Flue. Provide UL listed pressure rated, double pipe with Type AL 29-4C stainless steel inner liner, 1-inches of space (air gap), and Type 430 stainless steel outer jacket, similar to Heat-Fab Saf T-Vent CI..
- C. Type IPS Double Wall Flue. Provide UL listed pressure rated, double pipe with Type 304 stainless steel inner liner, 2 inches of fiber insulation, and Type 304 stainless steel outer jacket, similar to Metalbestos Model IPS. The vent system shall be UL tested and listed to 50"W.G and 1000°F continuous operating conditions.

## 2.8 DOUBLE-WALL DUCT AND FITTING (HVAC DUCTWORK)

- A. Ducts: Fabricate double-wall (insulated) ducts with an outer shell and an inner duct. Dimensions indicated are for inside clear free area. An R-6 Insulation liner shall be located in between walls.
- B. Outer Shell: Base metal thickness on outer-shell dimensions. Fabricate outer-shell lengths 2 inches longer than inner duct and insulation and in metal thickness specified for single-wall duct. Ductwork shall be fabricated using a spiral lockseam. Outer surface shall be paintable galvanized steel.
- C. Insulation: 2-inch thick fibrous glass. Terminate insulation where double-wall duct connects to single-wall duct or uninsulated components, and reduce outer shell diameter to inner duct diameter. Thermal Conductivity (k-Value): 0.26 at 75°F mean temperature. Ductwork shall be tested in accordance with UL-181 for impact and erosion resistance at an internal airflow velocity of 10,000 feet per minute.
- D. Perforated Inner Ducts: Fabricate with 0.028-inch thick sheet metal having 3/32-inch diameter perforations, with overall open area of 23 percent.
- E. Maintain concentricity of inner duct to outer shell by mechanical means. Prevent dislocation of insulation by mechanical means. Where spiral duct grilles are indicated, provide a sleeve between the inner and outer wall of the ducts that corresponds to the opening size required by the grille.
- F. Flexible connector:
  - 1. Provide flex connectors as shown in details on the Drawings and Part 3. Flex connectors shall be flanged, constructed of materials of similar chemical resistance as duct system, and provided by the ductwork Vendor.
- G. Hangers and Supports:
  - 1. Support FRP ductwork using details and methods described in the SMACNA Industrial Duct Construction Manual.
  - 2. Protect the duct from clamping force of strap hangers with a 1/8-inch-thick layer of neoprene pad.
  - 3. Maximum spacing of supports shall not exceed 10 feet for sizes 8 inches and under or 15 feet for ducts over 20 inches.
  - 4. Provide supports which are independent of equipment and walls.

## PART 3 - EXECUTION

### 3.1 GENERAL INSTALLATION

- A. Construction Standards. Use construction methods which follow the requirements outlined SMACNA publications, as well as SMACNA Balancing and Adjusting publications, unless indicated otherwise in these specifications or accompanying drawings.
- B. Reinforcement. Reinforce ducts having one side equal to 25 inches or more in accordance with recommended construction practice of SMACNA.
- C. Plenum Construction. Construct plenum chambers of not less than No. 20 U.S. gage metal reinforced with galvanized structural angles.

- D. Cross Breaking or Beading. Cross break or bead sheet metal for rigidity, except ducts which are 12 inches or less in the longest dimension.
  - E. Wall and Floor Penetrations.
    - 1. Install fire, smoke and combination fire smoke dampers in floor penetrations and in one and two-hour rated walls where indicated in drawings and in accordance with code requirements.
    - 2. Where ducts pass through walls in exposed areas, install suitable escutcheons made of galvanized sheet metal angles as closers.
    - 3. At all locations where ductwork passes through floors, provide watertight sleeves projecting 3 inches above finished floor and flush with bottom of floor slab. Fabricate sleeves of 1/8 inch thick steel, galvanized after fabrication. Anchor into adjacent floor slab as required.
    - 4. Sleeves are required inside as well as outside chases.
    - 5. Provide 24 gage sheet metal sleeves for insulated and non-insulated ducts penetrating gyp board and CMU walls. Seal openings between ducts and sleeves with fireproofing sealants.
  - F. Interior Painting. Interior painting of metal ductwork exposed to view through grilles, registers, and other openings is specified in the Section on painting. Do not install grilles, registers, or similar items until painting is complete.
  - G. Ductwork Openings. Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pilot tube openings where required for testing of systems, complete with metal cap with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.
  - H. Ductwork Location. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities, including access to electrical and control panels.
  - I. Instrument Test Hole Fitting. Provide Duro Dyne Model TH-1 instrument test ports with heavy-duty zinc-plated heavy-gage cap, instant-release wing nut, neoprene expansion plug, flat neoprene mounting bracket and mounting holes. Provide fittings to air balance contractor.
  - J. Provide transitions at equipment and air device connections as per SMACNA standards. Where equipment requires an oval inlet and a round flex duct is routed to the equipment, provide insulated round to oval transition.
  - K. Install duct mounted heating water coils with necessary duct transitions for proper air flow through the coils.
  - L. Refer to mechanical details for information on diffuser connections, etc.
- 3.2 SEAM AND JOINT SEALING
- A. All duct systems (except welded exhaust ductwork and double wall flue) shall be sealed. Duct shall be thoroughly cleaned prior to application of sealant. All transverse joints, longitudinal seams and duct wall penetrations shall be sealed. All ductwork shall be sealed as per seal Class A of SMACNA Standards irrespective of the duct pressure classifications.

### 3.3 HANGER AND SUPPORT INSTALLATION

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Hangers and Supports." Unless indicated otherwise in specifications.
- B. Hanger Spacing. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1, "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing. Install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection. Do not use wire to support ductwork.
- C. Horizontal Ducts Up to 40 Inches. Support horizontal ducts up to and including 40 inches in their greater dimension by means of No. 20 U.S. gage band iron hangers attached to the ducts by means of screws, rivets or clamps, and fastened to inserts with toggle bolts, beam clamps or other approved means. Use clamps to fasten hangers to reinforcing on sealed ducts.
- D. Horizontal Ducts Larger Than 40 Inches. Support horizontal ducts larger than 40 inches in their greatest dimension by means of hanger rods bolted to angle iron (or equivalent unistrut) trapeze hangers. Place supports on at least 8'-0" centers according to the following:

<b>Angle Length</b>	<b>Angle</b>	<b>Rod Diameter</b>
4'-0"	1-1/2" x 1-1/2" x 1/8"	1/4"
6'-0"	1-1/2" x 1-1/2" x 1/8"	1/4"
8'-0"	2" x 2" x 1/8"	5/16"
10'-0"	3" x 3" x 1/8"	3/8"

The trapeze is to be placed on the exterior of non-compressible insulation between hanger and ductwork.

- E. Vertical Ducts. Support ducts to ensure rigid installation. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Fig. 4-7, Fig 4-8, Fig 4-9 "Riser Supports – From Floor". Support vertical ducts where they pass through the floor lines with 1-1/2 inches x 1-1/2 inches x 1/4 inch angles for ducts up to 60 inches. Above 60 inches, the angles must be increased in strength and sized on an individual basis considering space requirements. Support vertical duct drops more than 6 feet in length with angle iron frames attached to ducts.
- F. Refer to drawings for additional hanger details and requirements. Note that not all hangers are shown on the drawings are in the BIM model. The Contractor shall coordinate all hangers with the structure and other trades.

### 3.4 FLEXIBLE DUCTWORK

- A. Low Pressure Flexible Ductwork
  1. Do not exceed 6 feet in length with any flexible duct.
  2. Flexible duct shall be limited to a maximum of a single 90 degree change indirection between the duct and the neck of the air device. This does not include the final turn into the neck of the air device.
  3. Support ductwork independently of lights, ceiling and piping. Provide harness at connection to ceiling diffuser as indicated on details.

4. Provide two stainless steel work clamps on inner core and seal connection with duct sealant. The insulation and outer jacket shall be slipped over inner core connection to point where insulation abuts insulation on duct or diffuser. The insulation connections shall be sealed by embedding scrim tap and sealant to form a vapor barrier.
5. .

### 3.5 DOUBLE-WALL DUCT (HVAC) AND FITTING

- A. Paint exterior of ductwork as indicated in Division 9.
- B. Provide double wall ductwork in the following locations:
  1. Areas specifically indicated on drawings.
- C. Contractor to coordinate opening locations and sizes in the ductwork for the spiral duct grilles.

### 3.6 FLUE VENTS

- A. General. Install ductwork in accordance with manufacturer's recommendations and International Building Code and Mechanical Code requirements. Maintain minimum clearances from combustible materials. Provide ventilated wall thimble, storm collar, flashing and cap. Maintain necessary clearances from vertical walls, outside air intakes and roofs per Code Requirements.
- B. Type AL 29-4C Flues. Contractor shall install manufacturer provided drain at bottom of stack. Drain shall be routed to nearest floor drain. Seal all ductwork as recommended by manufacturer.

### 3.7 FLASHING

- A. Where ducts pass through exterior walls, provide suitable flashing to prevent rain or air currents from entering the building. Provide flashing not less than No. 26 gage 316L stainless steel or 16 ounce copper.

### 3.8 DUCT LINING

- A. Fiberglass acoustical lining is not permitted to be installed on this project except as indicated between walls of double wall spiral ducts.
- B. Install per manufacturer's recommendations.

### 3.9 TESTS

- A. Allowable Leakage. Test ductwork for leaks in accordance with SMACNA before concealing or insulating as indicated below. Arrange for the Owner's Representative to witness the test.
  1. Low pressure ductwork. Test low pressure ductwork at +2 inches W.G. Maximum allowable leakage (Lmax) per 100 ft<sup>2</sup> of ductwork shall be equal to  $C_L \times P^{0.65}$ , where  $C_L = 6$  for rectangular ducts and round flexible ducts,  $C_L = 3$  for round/flat oval ducts, and  $P = 2$ " for low pressure ducts.
  2. Test the following ductwork:
    - a. Low pressure ductwork:
      - 1) All ductwork served by roof-top units and air handling units..



b. Other

1) Do not test Double Wall Flue Piping or Dryer Exhaust Ductwork.

B. Equipment. Provide equipment necessary for performing tests, including rotary blower, orifice section and U-tube gage board complete with cocks and rubber tubing.

3.10 CLEANING

A. Protect all ductwork and equipment from dirt during storage, installation and prior to grille, diffuser installation with protective covering at each end. Ductwork exposed to dirt and dust due to inadequate protection will have to be removed, cleaned and reinstalled.

B. Do not operate any air handling units or fan coil units during construction without filters.

C. Provide temporary filters on return air ductwork during construction to protect ductwork from dust.

D. Provide temporary filters on exhaust grilles during construction to protect ductwork from dust.

END OF SECTION 23 31 00

## SECTION 23 33 00 - AIR DUCT ACCESSORIES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including "Uniform General Conditions and Supplementary General Conditions For The State Of Texas Building Construction Contracts" and Division 01 Specification Sections, apply to the work of this Section.
1. Where the term "Owner's Designated Representative" is used, it shall mean a member of the project's capital team.

#### 1.2 SUMMARY

- A. Section Includes:
1. Fire dampers.
  2. Combination fire and smoke dampers.
  3. Smoke dampers.
  4. Volume control dampers.
  5. Duct access doors.
  6. Conical spin-in fittings and taps
  7. Duct accessory hardware.
  8. Flexible Connection
  9. Portable Roof Duct Supports
  10. Laboratory exhaust accessories

#### 1.3 RELATED WORK

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Specification 23 31 00, Ductwork

#### 1.4 SUBMITTALS

- A. Product Data: Submit product data for each product. Refer to Section 23 00 00.
- B. Fire and Combination Fire/Smoke Damper. Include manufacturer's literature to include performance data and installation requirements. Include any wiring diagrams.
- C. Access Doors. Include type of material, installation guidelines, leakage rates and maximum pressure data.
- D. Volume Control Dampers. Include type of material, installation guidelines, pressure drop and maximum pressure data.
- E. Shop Drawings: For duct accessories. Include plans, elevations, sections, details and attachments to other work.
1. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances; and method of field assembly into duct systems and other construction. Include the following:
    - a. Special fittings.

- b. Manual volume damper installations.
- c. Control damper installations.
- d. Fire-damper and smoke-damper installations, including sleeves; and duct-mounted access doors.
- e. Wiring Diagrams: For power, signal, and control wiring.

#### 1.5 OPERATION AND MAINTENANCE DATA

- A. Submit operation and maintenance data under provisions of Section 23 00 10.
- B. Fire dampers, smoke dampers and combination fire/smoke dampers.
  - 1. Include operation and maintenance information, including recommended testing requirements.
  - 2. Assign identification numbers (FD – Fire Damper, FSD – Fire/smoke Damper, SD – Smoke Damper) for each damper. Include table in O&M manual that indicates identification number, room location, duct system and size.

#### 1.6 QUALITY ASSURANCE

- A. All materials, installation and workmanship shall comply with the applicable requirements and standards addressed within the following references
  - 1. NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."
  - 2. AMCA 500-D, "Laboratory Method of Testing Dampers for Rating"
  - 3. NFPA 101 - Life Safety Code.
  - 4. SMACNA - HVAC Duct Construction Standards Metal and Flexible – Second Edition
  - 5. UL 555 – Standard for Fire Dampers.
  - 6. UL 555C – Standard for Ceiling Radiation Dampers.
  - 7. UL 555S – Standard for Smoke Dampers

### PART 2 - PRODUCTS

#### 2.1 ACCEPTABLE MANUFACTURERS

- A. Fire, Smoke and Fire/Smoke Dampers. Greenheck, Pottorff, Ruskin, Nailor.
- B. Flexible Connections. Ductmate, Ventfabrics Ventglass.
- C. Duct Access Doors. Ductmate, DuraSystems, Flexmaster, Greenheck, Ruskin, United McGill.
- D. Roof Duct Supports. Portable Pipe Hangers, MAPA Products.
- E. Conical Spin-in Fittings. Flexmaster, Buckley
- F. Volume Control Dampers. Flexmaster, Greenheck, Prefco, Ruskin.

#### 2.2 MATERIALS

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated.
- B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: **G60**.
  2. Exposed-Surface Finish: Mill phosphatized.
- C. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304 or 316L, and having a No. 2 finish for concealed ducts and finish for exposed ducts.
- D. Aluminum Sheets: Comply with **ASTM B 209**, Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.
- E. Extruded Aluminum: Comply with **ASTM B 221**, Alloy 6063, Temper T6.
- 2.3 FIRE DAMPERS (FD)
- A. Quality Standards. Furnish and construct fire dampers according to NFPA 90A and UL 555 (Dynamic). Dampers must bear UL label and suitable for dynamic application. Dampers shall possess a 1-1/2 hour or 3 hour (as appropriate for the construction shown in the architectural Drawings) protection rating 165 degrees F fusible link.
- B. Construct fire dampers such that damper frame material and curtain material are galvanized.
- C. Use Curtain Type Fire Dampers for fire dampers where possible. Use Multiple Blade Fire Dampers for fire damper sizes that exceed manufacturer's allowable Curtain Type Fire Damper sizes, or where velocities or pressures exceed Curtain Type Fire Dampers.
- D. Curtain Type Fire Dampers (Type B)
1. Damper shall be classified for dynamic closure to 2000 fpm and 4 inches w.g. static pressure.
  2. Damper shall have 5" frame constructed from minimum 20 gage galvanized steel.
  3. Blades shall be minimum 24 gage galvanized steel.
  4. Closure springs shall be Type 301 stainless steel, constant force or spring clip type.
  5. Provide Grille, Grille Access Type or Out of Wall Type of frame where indicated on drawings.
- E. Multiple Blade Fire Damper
1. Dampers shall be suitable for dynamic closure to 3000 fpm and 6 inches w.g. static pressure at 90"x64" for vertical installation and 60"x48" for horizontal installation.
  2. Damper shall have 5" frame constructed from minimum 16 gage galvanized steel channel and reinforced at the corners.
  3. Blades shall be 6" wide airfoil type and constructed from minimum 14 gage galvanized steel.
  4. Bearings shall be self-lubricating stainless steel sleeve, turning in extruded hole in frame.
  5. Blade seals shall be galvanized steel for flame seal to 1,900 degrees F and mechanically attached to blade edge.
  6. Linkage shall be concealed in frame.
  7. Provide 1/2-inch diameter plated steel hex shaped axle attached to blade.
  8. Pressure drop shall be a maximum of 0.07 inches w.g. at 1,500 feet per minute through 24 x 24 inch damper.

## 2.4 COMBINATION FIRE AND SMOKE DAMPERS (FSD)

- A. Quality Standards. Furnish and construct combination fire/smoke dampers according to NFPA 90A and UL 555 (Dynamic). Dampers must bear UL label and suitable for dynamic application and a Leakage Class 1 Smoke Rating in accordance with UL 555S. Dampers shall possess a 1-1/2 hour or 3 hour (as appropriate for the construction shown in the architectural Drawings) protection rating 165 degrees F. Dampers shall have a minimum 5 year warranty.
1. Dampers shall be suitable for dynamic closure to 3000 fpm and 6 inches w.g. static pressure at 120"x96" for vertical installation and 144"x96" for horizontal installation.
  2. Damper shall have 5" frame constructed from minimum 16 gage galvanized steel channel and reinforced at the corners.
  3. Blades shall be 6" wide airfoil type and constructed from minimum 14 gage (equivalent) galvanized steel.
  4. Bearings shall be self-lubricating stainless steel sleeve, turning in extruded hole in frame.
  5. Blade seals shall be inflatable silicone fiberglass material, rated for maintaining smoke leakage at a minimum of 450°F and galvanized steel for flame seal to 1,900 degrees F. Seals shall be mechanically attached to blade edge. Provide stainless steel flexible metal compression jamb.
  6. Linkage shall be concealed in frame.
  7. Provide 1/2-inch diameter plated steel hex shaped axle attached to blade.
  8. Temperature Release Device. Close in a controlled manner and lock damper during test, smoke detection, power failure, or fire conditions through actuator closure spring. At no time shall actuator disengage from damper blades. Allow damper to be automatically and remotely reset after test or power failure conditions. After exposure to high temperature or fire, inspect damper before reset to ensure proper operation. Controlled closing and locking of damper in 7 to 15 seconds to allow duct pressure to equalize. Instantaneous closure is not acceptable.
  9. Actuator. Provide electric 120V [24V], 60 Hz, two-position, fail close actuator. Operators shall be UL listed and labeled.
  10. Pressure drop shall be a maximum of 0.07 inches w.g. at 2,000 feet per minute through 24 x 24 inch damper.

## 2.5 SMOKE DAMPERS (SD)

- A. Quality Standards. Furnish and construct smoke dampers according to NFPA 90A and UL 555 (Dynamic). Dampers must bear UL label and suitable for dynamic application and a Leakage Class 1 Smoke Rating in accordance with UL 555S. Dampers shall possess a 1-1/2 hour or 3 hour (as appropriate for the construction shown in the architectural Drawings) protection rating 165 degrees F. Dampers shall have a minimum 5 year warranty.
1. Dampers shall be suitable for dynamic closure to 3000 fpm and 6 inches w.g. static pressure at 120"x96" for vertical installation and 144"x96" for horizontal installation.
  2. Damper shall have 5" frame constructed from minimum 16 gage galvanized steel channel and reinforced at the corners.
  3. Blades shall be 6" wide airfoil type and constructed from minimum 14 gage (equivalent) galvanized steel.
  4. Bearings shall be self-lubricating stainless steel sleeve, turning in extruded hole in frame.
  5. Blade seals shall be inflatable silicone fiberglass material, rated for maintaining smoke leakage at a minimum of 450°F. Seals shall be mechanically attached to blade edge. Provide stainless steel flexible metal compression jamb.

6. Linkage shall be concealed in frame.
7. Provide ½-inch diameter plated steel hex shaped axle attached to blade.
8. Actuator. Provide electric 120V [24V], 60 Hz, two-position, fail close actuator. Operators shall be UL listed and labeled.
9. Pressure drop shall be a maximum of 0.07 inches w.g. at 2,000 feet per minute through 24 x 24 inch damper.

## 2.6 VOLUME CONTROL DAMPERS

- A. Provide volume dampers in round and rectangular ductwork where indicated on drawings.
- B. General Fabrication Requirements:
  1. Comply with SMACNA Chapter 2, "Volume Dampers" unless more stringent requirements are indicated. Provide single blade dampers on round dampers and for rectangular dampers not exceeding 36-inches in width or 12-inches in height. Provide multiblade rectangular dampers for dampers exceeding 36-inches in width or 12-inches in height or where required due to velocity or pressure requirements.
  2. Refer to Specification 23 31 13 Ductwork for application table that defines Low and Medium Pressure ductwork.
  3. Provide a locking hand quadrant on all dampers. Mount quadrant regulators on stand-off mounting brackets, bases, or adapters on insulated ducts.
  4. For stainless steel ductwork, provide stainless steel finish to match ductwork material.
  5. Shop fabricated dampers are not acceptable.
- C. Round Dampers.
  1. Low Pressure. Provide single blade damper with minimum 20 gage galvanized steel frame, minimum 20 gage galvanized steel blade, continuous 3/8" square plated steel axle mechanically attached to blade, and bronze or oilite bearings. Dampers shall be suitable for 1500 feet per minute velocity and a maximum pressure of 2"W.G. when closed, and a maximum pressure drop of 0.03"W.G. at 1500 feet per minute through a 20-inch damper when tested in accordance with AMCA Fig. 5.3.
- D. Rectangular Dampers.
  1. Low Pressure Single Blade Damper (Fans systems with less than 1"W.G. Static Pressure). Provide single blade damper with minimum 3-inch x 20 gage galvanized steel frame, minimum 20 gage galvanized steel blade on dampers up to 18-inches wide, 16 gage on dampers over 18-inches wide. Provide a continuous 3/8" square plated steel axle mechanically attached to blade, and synthetic flanged sleeve type bearing. Dampers shall be suitable for 1500 feet per minute velocity and a maximum pressure of 1"W.G. when closed.
  2. Low Pressure Multi-Blade Damper. Provide opposed multi-blade damper with minimum 5-inch x 16 gage galvanized steel frame, minimum 16 gage triple V galvanized steel blade. Provide a continuous 1/2" square plated steel axle mechanically attached to blade and external (out of airstream) blade-to-blade linkage. Provide bronze or oilite bearings. Dampers shall be suitable for 1500 feet per minute velocity and a maximum pressure of 3"W.G. for up to a 24-inch wide damper when closed. Damper shall have a maximum pressure drop of 0.1"W.G. at 1500 feet per minute through a 24-inch x 24-inch damper.

3. Low Pressure Drop Medium Pressure Damper. Provide opposed multi-blade damper with minimum 4-inch x 1-inch 0.125-inch thick aluminum channel frame. Blades shall be extruded aluminum airfoil type, minimum 0.125-inch thick. Provide a continuous 1/2" square plated steel axle mechanically attached to blade and linkage concealed in jamb. Provide bronze or oilite bearings. Dampers shall be suitable for 5000 feet per minute velocity and a maximum pressure of 5"W.G. for up to a 24-inch wide damper when closed. Damper shall have a maximum pressure drop of 0.1"W.G. at 2000 feet per minute through a 24-inch x 24-inch damper when tested in accordance with AMCA Fig. 5.3.

- E. Splitter Dampers. Fabricate splitter dampers of minimum 16 gauge thickness sheet metal to streamline shape. Secure blade with continuous hinge or rod. Operate with minimum 1/4" diameter rod in self-aligning, universal joint action flanged bushing with set screw. Control splitter with locking quadrants on exposed externally insulated ductwork.

## 2.7 DUCT ACCESS DOORS

### A. Square Frame Access Doors

#### 1. Low Pressure Ductwork

- a. Construct outer frame of minimum 22 gage roll formed galvanized steel with installation tabs. Door shall be removable double wall door constructed of 24 gage galvanized steel and insulated with 1-inch of insulation (R-4). Provide minimum 2 manually operated cam locks on access doors 16-inches and under, 4 cam locks for doors greater than 16-inches. Provide foam gasket seal between door and frame and between frame and duct.
- b. Performance. 24"x24" access door shall be suitable for up to 2"W.G. and have a maximum leakage of 0.15 CFM/sq.ft. at 1"W.G. pressure.

### B. Round "Spin" Access Doors

1. Construct outer frame of minimum 22 gage roll formed, double hemmed galvanized steel. Door shall be removable double wall door constructed of 24 gage galvanized steel and insulated with 1-inch of insulation (R-4). Provide minimum 3 manually operated cam locks on access door. Provide continuous foam gasket between door and frame.

- C. For stainless steel ductwork, provide stainless steel finish to match ductwork material.

- D. Where duct size permits, access door size shall be 18-inches in diameter or 18" x 16" for rectangular doors. For duct sizes under 20-inches, provide access door 2-inches smaller than duct size. For ducts 12-inches wide, provide minimum 10" x 12".

## 2.8 CONICAL SPIN-IN FITTINGS AND TAPS

- A. General Construction. For stainless steel ductwork, provide stainless steel finish to match ductwork material.

- B. Furnish conical spin-in fittings with quadrant dampers at all round runout ducts serving diffusers and grilles. Fabricate conical fitting of 26-gage galvanized sheet metal with 2-inch build out, continuous 3/8" square shaft, air tight nylon bushings and locking quadrant handle. Connect damper plate to shaft with a minimum 2 u-bolts on dampers 12-inches and greater.

## 2.9 DUCT ACCESSORY HARDWARE

- A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.
- B. Drill temporary test holes for balancing in ducts as required. Cap with neoprene plugs, threaded plugs, or threaded or twist-on metal caps. Provide neat patch on external duct insulation and label as "Test Plug".
- C. Provide permanent test holes in ductwork upstream and downstream of all coils, fans, and locations as indicated on drawings. Test holes shall be factory fabricated, airtight flanged fittings with screw cap. Provide extended neck fittings to clear insulation.

## 2.10 FLEXIBLE CONNECTIONS

- A. Provide air-tight flexible connections where ductwork connects to fans, air handling units and fan coil units with fabric as specified below:

<b>Application</b>	<b>Fabric</b>	<b>Coating</b>	<b>Gauge</b>
HVAC (Indoor)	Fiberglass	Neoprene	28
HVAC (Outdoor & Lab)	Fiberglass	Hypalon	28

- B. The fabric shall be UL listed, fire retardant, waterproof and mildew resistant, crimped into metal edging strip.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.
- B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.
- C. Install backdraft dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.
- D. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.
  - 1. Install steel volume dampers in steel ducts.
  - 2. Install aluminum volume dampers in aluminum ducts.
- E. Set dampers to fully open position before testing, adjusting, and balancing.



- F. Install test holes at fan inlets and outlets and elsewhere as indicated.

### 3.2 ACCESS DOORS

- A. Install duct access doors on sides or bottom of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:
  1. Upstream and downstream of duct mounted duct coils.
  2. Downstream from manual volume dampers (not spin-in fittings).
  3. Downstream of control dampers.
  4. Upstream of airflow measuring stations.
  5. Adjacent to and close enough to fire, smoke and combination fire/smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors; and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
  6. At duct mounted smoke detectors.
  7. Upstream or Downstream of turning vanes.
  8. In internally lined ductwork, provide access doors for duct liner inspection at 50 foot intervals and downstream of each elbow or branch fitting. Access doors are not required in return air boots.
  9. Elsewhere as indicated on drawings, details or specifications.
- B. Label access doors according to Section 23 05 53 - Identification for HVAC Piping and Equipment to indicate the purpose of access door.

### 3.3 FIRE, SMOKE AND COMBINATION FIRE/SMOKE DAMPERS

- A. Install dampers at locations indicated on the drawings and in accordance with manufacturer's UL approved installation instructions.
- B. Install dampers square and free from racking with blades running horizontally.
- C. Do not compress or stretch damper frame into duct or opening.
- D. Handle damper using sleeve or frame. Do not lift damper using blades, actuator, or jackshaft.
- E. Install bracing for multiple section assemblies to support assembly weight and to hold against system pressure. Install bracing as needed.
- F. Provide access doors for all fire, smoke and combination fire/smoke dampers. Refer to details for additional requirements.

### 3.4 CONICAL SPIN-IN FITTINGS AND TAPS

- A. Install conical spin-in fittings with quadrant dampers to serve diffusers as indicated on drawings.
- B. After installation of spin-in fitting, seal all around connection to meet leakage class indicated in Specification 23 31 13.

### 3.5 VOLUME CONTROL DAMPER

- A. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.
- B. Set dampers to fully open position before testing, adjusting, and balancing

### 3.6 FLEXIBLE CONNECTIONS

- A. Install at connections between ductwork and motor driven equipment as shown. Provide a minimum of 1 inch slack in the connections, and a minimum of 2-1/2 inches distance between the edges of the ducts and equipment. Also provide a minimum of 1 inch slack for each inch of static pressure on the fan system. Securely fasten flexible connections to equipment and to adjacent ductwork by means of sealant with sheet metal screws. Where flex ductwork is connected to oval collars in diffusers and plenums, provide a metal transition fitting from oval to round.

### 3.7 FIELD QUALITY CONTROL

- A. Tests and Inspections:
  - 1. Operate all volume dampers to verify full range of movement.
  - 2. Inspect locations of access doors and verify that purpose of access door can be performed.
  - 3. Operate fire, smoke and combination fire/smoke dampers to verify full range of movement per NFPA and verify that proper heat-response device is installed.

END OF SECTION 23 33 00

## SECTION 26 00 00 - BASIC ELECTRICAL REQUIREMENTS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including "Uniform General Conditions and Supplementary General Conditions For The State Of Texas Building Construction Contracts" and Division 01 Specification Sections, apply to the work of this Section.
  - 1. Where the term "Owner's Designated Representative" is used, it shall mean a member of the project's capital team as defined by Lamar State College, Facilities Design and Construction,

#### 1.2 WORK INCLUDED

- A. General Requirements specifically applicable to Division 26.
- B. The Contractor shall be responsible for:
  - 1. The work included consists of furnishing all materials, supplies, equipment and tools, and performing all labor and services necessary for installation of a completely functional power, lighting, fire alarm and signaling systems. Complete systems in accordance with the intent of Contract Documents.
  - 2. Coordinating the details of facility equipment and construction for all Specification Divisions, which affect the work covered under this Division.
  - 3. Furnishing and installing all incidental items not actually shown or specified, but which are required by good practice to provide complete functional systems.
  - 4. Temporary power service and lighting for construction. Coordinating all shutdown dates and schedules with Owner's Representative and obtain all work-permits required by Owner.
- C. Intent of Drawings:
  - 1. The Drawings are necessarily diagrammatic by their nature and are not intended to show every connection in detail or every device or raceway in its exact location, unless specifically dimensioned. The Contractor shall carefully investigate structural and finish conditions and shall coordinate the work in order to avoid interference between the various phases of work. The Contractor shall be responsible for the proper routing of raceway, subject to prior review by the Owner and Engineer. Work shall be organized and laid out so that it will be concealed in furred chases and suspended ceilings, etc., in finished portions of the building, unless specifically noted to be exposed. All work shall be installed parallel or perpendicular to the lines of the building unless otherwise noted.
  - 2. The intent of the Drawings is to establish the type of systems and functions, but not to set forth each item essential to the functioning of the system. The drawings and specifications are cooperative, and work or materials called for in one and not mentioned in the other shall be provided. Review pertinent drawings and adjust the work to conditions shown. In case of doubt as to work intended, or here discrepancies occur between drawings, specifications, and actual conditions, immediately notify the Architect/Engineer and the Owner's representative and propose a resolution.

### 1.3 RELATED WORK

- A. This Section shall be used in conjunction with the following other specifications and related Contract Documents to establish the total general requirements for the project electrical systems and equipment.
  - 1. Division 01 Sections included in the project specifications.
  - 2. The contract.

### 1.4 DESIGN CRITERIA

- A. Equipment and devices to be installed outdoors or in enclosures where the temperatures are not controlled shall be capable of continuous operation under such conditions per manufacturer's requirements.
- B. Compliance by the Contractor with the provisions of this Specification does not relieve him of the responsibilities of furnishing equipment and materials of proper design, mechanically and electrically suited to meet operating guarantees at the specified service conditions.
- C. Electrical components shall be UL listed and labeled.

### 1.5 REFERENCE CODES AND STANDARDS, REGULATORY REQUIREMENTS

- A. Standards of the following organizations as well as those listed in Division 01, may be referenced in the specification. Unless noted otherwise, references are to standards or codes current at the time of bidding.
  - 1. Association of Edison Illuminating Companies (AEIC)
  - 2. American National Standards Institute (ANSI)
  - 3. Institute of Electrical and Electronics Engineers (IEEE)
  - 4. Insulated Cable Engineers Association (ICEA)
  - 5. National Electrical Code (NEC)
  - 6. National Electrical Manufacturers Association (NEMA)
  - 7. Electrical Safety in the Workplace
  - 8. National Fire Protection Association (NFPA)
  - 9. Underwriter's Laboratories (UL)
  - 10. ASHRAE/IES 90.1 – Energy Standard for Buildings Except Low-Rise Residential Buildings
- B. Work, materials and equipment must comply with the latest rules and regulations of the following.
  - 1. National Electrical Code (NEC)
  - 2. Electrical Safety in the Workplace
  - 3. Occupational Safety and Health Act (OSHA)
  - 4. American with Disability Act (ADA)
  - 5. American Society for Testing and Materials (ASTM)
  - 6. Applicable state and federal codes, ordinances and regulations
- C. Discrepancies. The drawings and specifications are intended to comply with listed codes, ordinances, regulations and standards. Where discrepancies occur, immediately notify the Owner's representative in writing and ask for an interpretation. Should installed materials or workmanship fail to comply, the Contractor is responsible for correcting the improper installation. Additionally, where sizes, capacities, or other such features are required in excess of minimum code or standards requirements, provide those specified shown.

- D. Contractor shall obtain permits and arrange inspections required by codes applicable to this Section and shall submit written evidence to the Owner and Engineer that the required permits, inspections and code requirements have been secured.

## 1.6 SUBMITTALS

- A. Submit the following in addition to and in accordance with the requirements of Division 01 for submittal requirement.
  - 1. Include inspection and permit certificates and certificates of final inspection and acceptance from the authority having jurisdiction.
  - 2. Manufacturer's standardized schematic diagrams and catalog cuts shall not be acceptable unless applicable portions of it are clearly indicated and non-applicable portions clearly deleted or crossed out.
  - 3. All schematic, connection and/or interconnection diagrams in accordance with the latest edition of NEMA.
  - 4. Provide submittals as required by individual specification Section.
- B. Provide the following with each submittal:
  - 1. Catalog cuts with manufacturer's name clearly indicated. Applicable portions shall be circled, and non-applicable portions shall be crossed out.
  - 2. Line-by-line specification review by equipment manufacturer and contractor with any exceptions explicitly defined.
- C. Equipment Layout Drawing: 1/8-inch scale minimum drawings indicating electrical equipment locations. Dimensions for housekeeping pads should be indicated on these drawings. Indicate routing of conduit 2 inches and over on these drawings.
- D. Within the specified time window after award of contract, submit list of equipment and materials to be furnished.
  - 1. Itemize equipment and material by specification Section number; include manufacturer and identifying model or catalog numbers.
  - 2. Replace rejected items with an acceptable item within 2 weeks after notification of rejection.
  - 3. If a satisfactory replacement is not submitted within a two-week period, owner will notify contractor as to equipment manufacturer or type and make or material to be furnished. Provide designated items at no additional cost to owner.
- E. As-Built Record Drawings: The Contractor shall maintain a master set of As-Built Record Drawings that show changes and any other deviations from the drawings. The markups must be made as the changes are done. At the conclusion of the job, these As-Built Record Drawings shall be transferred to AutoCad electronic files, in a format acceptable to the Owner, and shall be complete and delivered to the Owner's Representative prior to final acceptance. Refer to 01210 Project Administration for other requirements.

## 1.7 OPERATIONS AND MAINTENANCE MANUALS

- A. Submit for approval copies of operations and maintenance manuals as specified in Division 01 and the other Division 26, 27 and 28 sections. Each copy of the manuals shall be marked to indicate the specific models, sizes, types and options of the systems and equipment that were provided. Manuals not so marked will be rejected.

## 1.8 SAFETY

- A. The Contractor shall follow the safety procedures in addition to, and in accordance with, the requirements of Project Safety Manual (PSM).
  - 1. The Contractors shall be responsible for training all personnel under their employ in areas concerning safe work habits and construction safety. The Contractor shall continually inform personnel on hazards particular to this project and update the information as the project progresses.
  - 2. The Contractor shall secure all electrical rooms, to limit access, prior to energizing any high voltage (2.4KV or higher) switchgear and shall control access during the project after energization. The Contractor shall post and maintain warning and caution signage in areas where work is ongoing near energized equipment. The Contractor shall cover all energized live parts when work is not being done in the equipment. This includes lunch and breaks.
  - 3. The Contractor shall strictly enforce OSHA lock out/tag out procedures. Initial infractions shall result in a warning; a second infraction shall result in the removal of the workman and his foreman from the site. Continued infractions shall result in removal of the Contractor from the site.

## 1.9 SHORING AND EQUIPMENT SUPPORTS

- A. The Contractor shall provide all permanent and temporary shoring, anchoring, and bracing required to make all parts absolutely stable and rigid; even when such shoring, anchoring, and bracing are not explicitly called for.
- B. The Contractor shall adequately support all panels, enclosures, and other equipment. This shall include bolting to the floor or solid structural steel to prevent tipping. Install free-standing electrical equipment on 4" thick concrete housekeeping pads that are provided by others. Under no condition shall equipment be fastened to non-rigid building steel (i.e., removable platform steel gratings, handrails, etc.).
- C. The Contractor shall provide racks and supports, independently mounted at structure, to support electrical equipment and systems supplied and installed under this contract. At no time shall the Contractor mount or suspend equipment from other disciplines' supports.

## 1.10 TEMPORARY POWER REQUIREMENTS

- A. Provide power distribution system sufficient to accommodate construction operations requiring power, use of power tools, electrical heating, lighting, and start-up/testing of permanent electric-powered equipment prior to its permanent connection to electrical system. Provide proper overload protection. Ground fault circuit interrupters (GFCI) are to be used on all 120-volt, single-phase, 15 and 20 amp receptacle outlets where portable tools and equipment are used. Ground fault circuit interrupters shall be tested weekly by the Contractor.
- B. Temporary power feeders shall originate from a distribution panel. The conductors shall be multi-conductor cord or cable per NEC for hard and extra-hard service multi-conductor cord.
- C. Branch circuits shall originate in an approved receptacle or panelboard. The conductors shall be multi-conductor cord or cable per NEC for hard and extra-hard service multi-conductor cord. Each branch circuit shall have a separate equipment grounding conductor.

- D. All receptacles shall be of the grounding type and electrically connected to the grounding conductor.
- E. Provide temporary lighting by factory-assembled lighting strings or by manually-assembled units. All lamps for general lighting shall be protected from accidental contact or breakage. Protection shall be provided by installing the lights a minimum of 7 feet from the work surface or by lamp holders with guards. Branch circuits supplying temporary lighting shall not supply any other load. Provide sufficient temporary lighting to ensure proper workmanship by combined use of day lighting, general lighting, and portable plug-in task lighting. Comply with OSHA required foot-candle levels and submit plan for approval by the owner.
- F. For temporary wiring over 600 volts, suitable fencing, barriers, or other effective means shall be provided to prevent access of anyone other than authorized and qualified personnel.
- G. Temporary power cords shall be kept off the ground or floor. The Contractor shall provide temporary supports as required to keep temporary cords off the ground or floor.

1.11 SUBSTITUTION OF MATERIALS AND EQUIPMENT:

- A. Refer to Uniform General Conditions and Supplementary General Conditions for substitution of materials and equipment.
- B. The intent of the Drawings and/or Specifications is neither to limit products to any particular manufacturer nor to discriminate against an "APPROVED EQUAL" product as produced by another manufacturer. Some proprietary products are mentioned to set a definite standard for acceptance and to serve as a reference in comparison with other products. When a manufacturer's name appears in these Specifications, it is not to be construed that the manufacturer is unconditionally acceptable as a provider of equipment for this project. The successful manufacturer or supplier shall meet all of the provisions of the appropriate specification(s).
- C. The specified products have been used in preparing the Drawings and Specifications and thus establish minimum qualities with which substitutes must at least equal to be considered acceptable. The burden of proof of equality rests with the Contractor. The decision of the designer is final.
- D. When requested by the Architect/Engineer, the Contractor shall provide a sample of the proposed substitute item. In some cases, samples of both the specified item and the proposed item shall be provided for comparison purposes.
- E. Timeliness: The burden of timeliness in the complete cycle of submittal data, shop Drawings, and sample processing is on the Contractor. The Contractor shall allow a minimum of six (6) weeks time frame for review of each submission by the office of the design discipline involved after receipt of such submissions by that design discipline. The Contractor is responsible for allowing sufficient time in the construction schedule to cover the aforementioned cycles of data processing, including time for all resubmittal cycles on unacceptable materials, equipment, etc. covered by the data submitted. Construction delays and/or lack of timeliness in the above regard are the responsibility of the Contractor and will not be considered in any request for scheduled construction time extensions and/or additional costs to the Owner.

- F. All equipment installed on this project shall have local representation; local factory authorized service, and a local stock of repair parts.
- G. Acceptance of materials and equipment will be based on manufacturer's published data and will be tentative subject to the submission of complete shop Drawings indicating compliance with the contract documents and that adequate and acceptable clearances for entry, servicing, and maintenance will exist. Acceptance of materials and equipment under this provision shall not be construed as authorizing any deviations from the Specifications, unless the attention of the Architect/Engineer has been directed in writing to the specific deviations. Data submitted shall not contain unrelated information unless all pertinent information is properly identified.
- H. Certification: The Contractor shall carefully examine all data forwarded for approval and shall sign a certificate to the effect that the data has been carefully checked and found to be correct with respect to dimensions and available space and that the equipment complies with all requirements of the Specifications.
- I. Physical Size of Equipment: Space is critical; therefore, equipment of larger sizes than shown, even though of specified manufacturer, will not be acceptable unless it can be demonstrated that ample space exists for proper installation, operation, and maintenance.
- J. Should a substitution be accepted, and should the substitute material prove defective, or otherwise unsatisfactory for the service intended within the guarantee period, this material or equipment shall be replaced with the material or equipment specified at no additional cost to the Owner.

## PART 2 - PRODUCTS

### 2.1 MATERIALS AND EQUIPMENT

- A. Materials and Equipment: Labeled and/or listed as acceptable to the authority having jurisdiction as suitable for the use intended. Materials shall be of a standard industrial quality if no specifications or specific model numbers are given.
- B. Where two or more units of the same class of material are required, provide products of a single manufacturer. Component parts of materials or equipment need not be products of the same manufacturer.
- C. All materials shall be new and unused.
- D. Provide non-metallic material in corrosive areas or as otherwise specified.
- E. All electrical equipment, conduit, and boxes mounted outside shall be supported using corrosion resistant (stainless steel or galvanized) products, e.g. Unistrut, hangers, rods, bolts, nuts, washer, etc.

## PART 3 - EXECUTION

### 3.1 WORKMANSHIP

- A. Install work in compliance with NEC latest edition.



- B. Install material and equipment in accordance with manufacturers' instructions. Provide calibrated torque wrenches and screwdrivers and tighten all terminals, lugs, and bus joints using it.
- C. Comply with startup procedures as defined by Construction Manager and Owner.
- D. Arrange electrical work in a neat, well-organized manner. Do not block future connection points of electrical service. Install all electrical work parallel or perpendicular to building lines unless noted otherwise, properly supported with purpose-designed apparatus, in a neat manner.
- E. Apply, install, connect, erect, use, clean, adjust, and condition materials and equipment as recommended by the manufacturers in their published literature.
- F. Make opening through masonry and concrete by core drilling in acceptable locations. Restore openings to original condition to match remaining surrounding materials.
- G. Support: All piping shall be adequately and properly supported from the building structure as specified in this Division and in accordance with the National Electrical Code.
- H. Receptacle and light switch cover plates shall be labeled with the panel name and circuit number engraved on the front with 3/16" high lettering.

### 3.2 CLEANUP

- A. Remove and legally dispose of demolished items, rubbish and debris from the construction site daily, and at the completion of the work. Failure to do so may result in the cleanup being performed by others and all costs thereof being deducted from the Contractor's final payment.

### 3.3 EQUIPMENT PROTECTION

- A. Protect equipment and materials during shipment, storage and construction against damage and contamination.
- B. Items that become damaged or contaminated shall be restored to a "like new" condition or replaced at the Contractor's expense

### 3.4 FIELD QUALITY CONTROL

- A. Arrange for testing and commissioning of electrical systems, equipment and materials prior to final acceptance of the work. Acceptance tests and commissioning shall be performed as specified in Division 01 and the other Division 26, 27 and 28 sections, and in applicable codes, standards and manufacturers' instructions.
- B. Provide all test equipment, materials and labor necessary to perform the tests, and coordinate with the other trades for necessary services, such as scaffolding and the uncoupling of motors.
- C. Notify the Owner's Representative 3 working days in advance of tests. The Owner shall witness the tests unless the Owner's Representative waives such witnessing in writing.

- D. Notify manufacturers sufficiently in advance of tests for which the manufacturers should be present.
- E. Replace any equipment or materials found to be defective or found to be of lesser quality than that specified or shown on the drawings.
- F. Provide written test reports, signed and dated, for all tests prior to acceptance of the electrical equipment by the Owner.
- G. Provide the training specified in each specification section

### 3.5 SERVICE CONTINUITY

- A. Maintain continuity of electric service to all functioning portions of process or buildings during the hours of normal use. Phase construction work to accommodate Owner's occupancy requirements.
- B. Arrange temporary outages for cutover work with the Owner. Keep the outages to a minimum number and minimum length of time.
- C. All service outages shall be requested in writing a minimum of two weeks prior to the date. Owner reserves the right to postpone shutdowns up to 24 hours prior to the shutdown at no additional cost. Outage requests shall include a schedule of the work to be performed and the time requirements. More than two weeks notice may be required for major outages. Consult project manager/construction manager for assistance planning major outages with Owner well in advance of submitting a formal request.
- D. The Contractor shall obtain all appropriate Owner permits for working in equipment.

### 3.6 HAZARDOUS LOCATIONS

- A. Equipment, wiring, devices, and other components located within hazardous areas to be of appropriate type per NFPA requirements.
- B. Ground exposed non-current carrying parts of entire electrical system in hazardous areas, in accordance with NEC and as instructed by Owner.

### 3.7 SLEEVES AND SEALS

- A. Provide sealing and/or fire stopping where electrical equipment passes through walls, ceilings, and floors. Seals shall be watertight and/or fire rated as applicable.

### 3.8 CONSTRUCTION REVIEW

- A. The Engineer or Owner's representative will review and observe installation work to insure compliance by the Contractor with requirements of the Contract Documents.
- B. Review, observation, assistance, and actions by the Engineer or Owner's representative shall not be construed as undertaking supervisory control of the work or of methods and means employed by the Contractor. The review and observation activities shall not relieve the Contractor from the responsibilities of these Contract Documents.

- C. The fact that the Engineer or Owner's representative do not make early discovery of faulty or omitted work shall not bar the Engineer or Owner's representative from subsequently rejecting this work and insisting that the Contractor make the necessary corrections.
- D. Regardless of when discovery and rejection are made, and regardless of when the Contractor is ordered to correct such work, the Contractor shall have no claim against the Engineer or Owner's representative for an increase in the Contract price, or for any payment on account of increased cost, damage, or loss.

### 3.9 QUALITY ASSURANCE

- A. Electrical work shall be performed by licensed Journeyman or registered Apprentice Electricians. The number of apprentices on a project shall not exceed the number of Journeymen. Electricians shall carry a copy of their license or registration while working on the Owner's projects.
- B. Contact the Owner's Code Inspection Department before starting the project to arrange for periodic inspections. Normal inspections will be performed at no cost to the Contractor, but the costs for repeat re-inspections of rejected work may be deducted from the Contractor's final payment.

### 3.10 SHIPPING HANDLING AND STORAGE

- A. For deliveries of equipment to the Owner, notify the Owner's Representative of the deliveries 3 working days in advance. Deliveries that arrive without adequate notice may be rejected.
- B. Provide unloading and storage for Owner furnished equipment that is shipped to the project site.
- C. Pick up, transport and unload at the project site Owner furnished equipment that is stored in the Owner's warehouses.
- D. Provide packaging Waste management in accordance with Division 1.

### 3.11 WARRANTY

- A. Provide warranties in accordance with the requirements of Uniform General and Supplementary Conditions (UGC).
- B. Guarantee work for a period of one year from the date of the Owner's final acceptance of the project (Substantial Completion). A manufacturer's warranty beginning upon equipment receipt or startup shall be extended to one year from final project acceptance. A manufacturer's warranty in excess of one year shall remain in effect for its entire time period.

### 3.12 CLEANUP

- A. Remove and legally dispose of demolished items, rubbish and debris from the construction site daily, and at the completion of the work. Failure to do so may result in the cleanup being performed by others and all costs thereof being deducted from the Contractor's final payment.

3.13 EQUIPMENT PROTECTION

- A. Protect equipment and materials during shipment, storage and construction against damage and contamination.
- B. Items that become damaged or contaminated shall be restored to a "like new" condition or replaced at the Contractor's expense.

3.14 FIELD QUALITY CONTROL

- A. Arrange for testing and commissioning of electrical systems, equipment and materials prior to final acceptance of the work. Acceptance tests and commissioning shall be performed as specified in Division 01 and the other Division 26, 27 and 28 sections, and in applicable codes, standards and manufacturers' instructions.
- B. Provide all test equipment, materials and labor necessary to perform the tests, and coordinate with the other trades for necessary services, such as scaffolding and the uncoupling of motors.
- C. Notify the Owner's Representative 3 working days in advance of tests. The Owner shall witness the tests unless the Owner's Representative waives such witnessing in writing.
- D. Notify Manufacturers sufficiently in advance of tests for which the manufacturers should be present.
- E. Replace any equipment or materials found to be defective or found to be of lesser quality than that specified or shown on the drawings.
- F. Provide written test reports, signed and dated, for all tests prior to acceptance of the electrical equipment by the owner.
- G. Provide the training specified in each specification section.

END OF SECTION 26 00 00

## SECTION 26 00 00 .01- ELECTRICAL DEMOLITION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including "Uniform General Conditions and Supplementary General Conditions For The State Of Texas Building Construction Contracts" and Division 01 Specification Sections, apply to the work of this Section.
  - 1. Where the term "Owner's Designated Representative" is used, it shall mean a member of the project's capital team.

#### 1.2 WORK INCLUDED

- A. Electrical demolition for remodeling.
- B. Electrical/control portion of HVAC work covered by Division 23 pertaining electrical demolition shall follow the requirement set forth by this specification.

#### 1.3 RELATED WORK

- A. This Section shall be used in conjunction with the following other specifications and related Contract Documents to establish the total requirements for minor electrical demolition for remodeling.
  - 1. Section 26 00 00 - Basic Electrical Requirements.
- B. In the event of conflict regarding minor electrical demolition requirements between this Section and any other Section, the provisions of this Section shall govern.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS AND EQUIPMENT

- A. Materials and equipment for patching and extending work: as specified in individual Sections.
- B. Provide all materials necessary for work.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. All demolitions or modifications to existing systems shall be coordinated through Owner's Representative. Demolition drawings are based on casual field observation and existing record documentations. Therefore the accuracy or exactness of the drawings is not guaranteed. The Contractor shall verify that field measurements and circuiting arrangements are as shown on Drawings and abandoned wiring and equipment serve only abandoned facilities. The Contractor shall be responsible for reporting discrepancies to Engineer before disturbing existing installation.
- B. Beginning of demolition means Contractor accepts existing conditions.

### 3.2 PREPARATION

- A. Coordinate demolition with all phases of construction. Failure to coordinate resulting in re-work of demolished systems will be at no cost to the owner.
- B. Disconnect electrical systems in walls, floors, and ceilings scheduled for removal. Provide temporary wiring and connections to maintain remaining systems in service during demolition and/or modification. Owner reserve the right up to 24 hours prior to any scheduled event to delay or suspend shutdowns or outages to more convenient times at no additional cost.
- C. Existing Electrical Service: Maintain existing system in service until new system is complete and ready for service. No work shall begin without proper permits and authorizations. Disable system only to make switchovers and connections. Obtain permission from Owner at least (2) weeks before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area.
- D. Existing Fire Alarm System: Maintain existing system in service until new system is accepted. Disable system only to make switchovers and connections. Notify Owner at least (2) weeks before partially or completely disabling system. Minimize outage duration. Provisions for manual fire watch shall be provided in areas where services are interrupted. Make temporary connections to maintain service in areas adjacent to work area.
- E. Existing Telephone System: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Notify Owner at least (2) weeks before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area.

### 3.3 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

- A. Remove, relocate, and extend existing installations to accommodate new plan drawings.
- B. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes full length from source to device. Cut embedded or concealed conduit flush with walls and floors, and patch surfaces.
- C. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets that are not removed.
- D. Disconnect and remove abandoned panelboards and distribution equipment.
- E. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.
- F. Disconnect and remove abandoned luminaires. Remove brackets, stems, hangers, and other accessories.
- G. Repair adjacent construction and finishes damaged during demolition and extension work.
- H. Maintain access to existing electrical installations that remain active. Modify installation or provide access panel as appropriate.

- I. Extend existing installations using materials and methods compatible with existing electrical installation or as specified.
- J. The level of completion shall be demonstrated to Owner's Representative.
- K. Where equipment is indicated to be demolished and returned to Owner, the Contractor shall include the delivery of this equipment to the Owner's site storage area. Remove with care all equipment to be relocated. Repair or replace of newly damaged equipment is the responsibility of the Contractor.

### 3.4 CLEANING AND REPAIR

- A. The Contractor shall follow Owner's clean work policy and shall include the removal of trash and demolished material from the building or work area at the end of the each day and removal from the site once a week.
- B. The Contractor shall be responsible for repairing adjacent construction and finishes damaged during demolition and/or modification. The Contractor shall be responsible for the removal of ceiling tiles required in the demolition work. The Contractor shall be responsible for the replacement of damaged tiles and reinstallation of the ceiling prior to final acceptance.
- C. Panelboards: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide typed circuit directory showing revised circuiting arrangement.
- D. Luminaires: Remove existing luminaires for cleaning. Use mild detergent to clean all exterior and interior surfaces; rinse with clean water and wipe dry. Replace lamps, ballasts, and broken electrical parts.

### 3.5 DISPOSITION OF MATERIAL AND EQUIPMENT

- A. Review with the Owner materials that have been removed and are no longer required, to determine any which the Owner may desire to keep. Deliver those materials that the Owner desires to the Owner's specified location.
- B. For those materials not required by the Owner, dispose of them in accordance with applicable regulations.

### 3.6 DEMOLITION

- A. Protect adjacent building services and materials indicated to remain. Install and maintain barriers to keep dirt, dust and noise from being transmitted to adjacent areas. Remove protection and barriers after demolition is completed.
- B. Remove all equipment and materials designated for demolition as follows:
  - 1. Power wiring – remove back to the source or to the first junction box where the circuit continues on to remaining loads.
  - 2. Telecommunications wiring – remove from conduits and J-hooks back to cable trays or to the outer walls of the building entrance (BE) room or telecommunications rooms (TRs).

- a. Cut and label wire ends "Abandoned" when abandoning sections of wires in cable trays and at BE and TR outer walls. Do not remove telecommunications wiring from cable trays, the BE or the TRs.
- b. Coordinate for the Telecommunications Installation Contractor to remove abandoned wiring from cable trays and inside the BE and TRs.
3. Conduits and boxes in walls and above permanent ceilings – abandon in place. Install blank cover plates on boxes.
4. Conduits through floors and walls, and boxes in floors – remove completely. Patch and pain penetrations to match existing.
5. Exposed and accessible conduits, wireways and boxes – remove completely. Patch and pain surface to match existing, and plug unused panel and junction box holes.
6. Lighting fixtures and electrical equipment – remove and dispose of completely (unless designated for relocation).

### 3.7 LAMP AND BALLAST RECYCLING

- A. Recycle tubular fluorescent, compact fluorescent, HID, LED, induction and cold cathode lamps removed during demolition or replaced during construction. These six types of lamps shall not be disposed of as solid waste.
  1. Package unbroken tubular fluorescent lamps in their original cardboard boxes, or contact OSEH Hazardous Materials Management at (734) 647-1142 and arrange to pick up U-lamp, 60 lamp, 100 lamp or 250 lamp boxes at the North Campus Transfer Facility located at 1655 Dean Road. Package unbroken compact fluorescent, HID, LED, induction and cold cathode lamps in appropriately sized corrugated cardboard boxes.
    - a. Use separate boxes for each type and physical size of lamp. Do not mix lamp types or sizes in the same box.
    - b. Fill the boxes as completely as possible.
  2. Obtain Universal Waste Labels from OSEH. Fill out and attach one label to each box.
    - a. Enter the building name, quantity of lamps, and the accumulation start date (date the box started to be filled).
    - b. Mark the appropriate check box to indicate the type and length of lamps.
  3. Tape the boxes closed on all sides.
  4. Sweep up any broken lamps and seal them in a heavy plastic bag. Place the plastic bag in a corrugated cardboard box and tape the box closed on all sides. Label the box to indicate the type and quantity of broken lamps inside. Notify OSEH of the broken lamps.
  5. Contact the OSEH Hazardous Materials Management at and arrange to deliver the sealed. Take care to avoid breaking the lamps. Position the boxes on their sides during transport. Do not stack anything on top of the boxes.
  6. If lamps inside a box become broken, seal the entire box in a heavy plastic bag. Copy the Universal Waste Label information onto a new label and attach the new label to the outside of the plastic bag.
  7. Place the boxes into the designated storage area. Position the boxes on their sides so that the labels are forward and visible. Do not stack the boxes more than three high (two high for 250 lamp boxes). OSEH will recycle the lamps at no cost to the Contractor.
- B. Recycle fluorescent, HID and cold cathode lighting ballasts removed during demolition. Recycle LED and induction lighting drivers removed during demolition. Lighting ballasts and drivers shall not be disposed of as solid waste.



1. Contact OSEH Hazardous Materials Management at (734) 763-4568 and arrange to pick up DOT approved 30 gallon steel drums and 5 gallon pails at the North Campus Transfer Facility located at 1655 Dean Road.
2. Place the drums in an accessible location and on a hard surface so that OSEH can use a drum cart to pick them up later. Lawns, dirt piles, gravel drives, muddy areas and basements without elevators are not considered accessible locations.
3. Wearing rubber gloves, deposit any leaking ballasts into the 5 gallon pails for separate handling. When finished, deposit the rubber gloves into the 5 gallon pails.
4. Deposit the non-leaking ballasts and drivers into the 30 gallon drums. Leave enough space at the top of the drums for installation of lids.
5. Obtain Universal Waste Labels from OSEH. Fill out and attach one label to each 5 gallon pail and each 30 gallon drum. Enter the building name, quantity of ballasts and drivers, and the accumulation start date (date the pail or drum started to be filled).
6. Contact OSEH at least 3 working days in advance to request pick-up of the pails and drums. OSEH will pick up and recycle the ballasts and drivers at no cost to the Contractor.
7. Do not deposit ballasts from other projects or any other refuse in the drums. All costs for disposing of foreign items found in the drums will be deducted from the Contractor's final payment.

### 3.8 RELOCATION

- A. Carefully remove, clean and restore items designated for relocation to a "like new" condition, and store them for reuse.

### 3.9 SALVAGE

- A. Equipment and materials removed during demolition, unless noted otherwise, shall become the property of the contractor with due consideration for all such removed equipment included in the bid price.

END OF SECTION 26 00 00.01

## SECTION 26 05 26 – GROUNDING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including "Uniform General Conditions and Supplementary General Conditions For The State Of Texas Building Construction Contracts" and Division 01 Specification Sections, apply to the work of this Section.
  - 1. Where the term "Owner's Designated Representative" is used, it shall mean a member of the project's capital team.

#### 1.2 REFERENCES

- A. NFPA 70 – National Electrical Code.
- B. NECA 1-2000 – Standard Practices for Good Workmanship in Electrical Contracting.
- C. NFPA 99 – Standard for Health Care Facilities.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS AND EQUIPMENT

- A. Ground Electrode Conductors: Stranded, tinned, annealed copper cable.
- B. Equipment Grounding Conductors: As specified by Section 16120, green insulation, sized in accordance with NFPA 70Code, Table 250.122.
- C. Grounding Clips: Steel City Type G, or equal.
- D. Ground Rods: Copper-encased steel, 3/4" diameter, minimum length 10 feet.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Install ground system as indicated, in accordance with the applicable requirements of the NFPA 70 and NECA 1-2000.
- B. Install #6 AWG grounding electrode conductors or larger in conduit, bonded at each end.
- C. Install grounding conductors continuous, without splice.
- D. Provide a separate, insulated equipment grounding conductor in all feeder and branch circuit conduits. Terminate each end on a listed grounding lug, bus, or bushing.
- E. Bond grounding electrode conductors to metal water pipe using suitable ground clamp. Make connections to flanged piping at street side of flange. Provide bonding jumper around water meter.
- F. Bond all building steel to grounding electrode system

- G. Install Exothermic Welded ground connectors where they are concealed or inaccessible. Exothermic welding shall be used on all connections to rod, plate and building steel grounding electrodes
- H. Electrical Service: Bond main switchboard ground bus to grounding electrode system.
- I. Bond all equipment cabinets, junction boxes, outlet boxes, motors, controllers, raceways, conduit, fittings, switchgear and other metallic equipment and enclosures with an equipment grounding conductor. Unless some separate grounding provision is specified or indicated, equipment and enclosures will be considered to be grounded by the continuous grounded metallic conduit or raceway system; however, bonding jumpers shall be provided wherever necessary to insure the electrical continuity. Equipment grounding conductor shall be bonded to enclosure at all junction boxes where feeder/branch circuit splices/taps are made, as well as all distribution and utilization equipment.
- J. Transformers:
  - 1. Transformers with Secondary Neutrals: Transformer secondary neutral shall be grounded to the grounding electrode system using a separate grounding electrode conductor. Use of the transformer primary feeder equipment grounding conductor as the grounding electrode conductor is prohibited. This contractor shall provide a suitable grounding electrode.
  - 2. Main bonding jumpers shall be located at the first disconnecting means
  - 3. System bonding jumpers shall be located at the source of a separately derived system.
- K. Conduit Grounding Bushings: Install grounding bushings on all Conduits terminating in equipment that has a ground bus. Ground each conduit by means of a bonding jumper securely and permanently attached to the grounding bushing and to the ground bus in the equipment. Bonding jumper size shall be same or larger than the equipment ground in the raceway it is bonding. Multiple conduits shall be permitted to be bonded with a single jumper, provided it is sized for the largest circuit OCPD it is bonding. Alternately, the equipment ground in each conduit can be looped, stripped and terminated (without cutting/splicing) in its conduit's bushing and continued to the ground bus of the equipment.

### 3.2 GROUND RESISTANCE MEASUREMENTS

- A. Method: The Fall Of Potential method accurate within plus or minus two (2) per cent.
- B. Instrument: Biddle Digital Resistance Tester Catalog Number 250200.
- C. Maximum Acceptable Resistance: Two (2) OHMS.
- D. Documentation:
  - 1. Method and equipment used for measurement.
  - 2. Calibration date of equipment used.
  - 3. Plot plan outlining measurement points.
  - 4. Name of person(s) performing measurement.
  - 5. Date of test.
- E. Testing shall be performed by a third party NETA certified testing agency

- F. Reference Grounding Point:  
1. Provide in branch circuit or distribution panelboard.

- G. Electrical Apparatus Grounding:  
1. Electrical Apparatus Grounding.

<u>Equipment</u>	<u>Method</u>
Permanently installed equipment	With a separate #10 THWN green insulated, continuous grounding conductor not more than 15 feet long to the closest ground bus. Run in its own separate conduit.
Ground terminal of 120V power receptacles	Same as above.
Metal switch and receptacles plates	By means of mounting screw connections to the device mounting yokes.
Metal Raceways	Install a grounding bushing on each conduit entering the Panelboard. Connect each bushing to the panelboard ground bus with a separate #12 green continuous, insulated, copper grounding conductor.

2. Non-Electrical Conductive - Surface Grounding:

<u>Equipment</u>	<u>Method</u>
	Connected to grounding system by means of cords and grounding jacks. Cords of #10 copper, neoprene jacketed, extra flexible, 600V, heavy duty type equipped with approved lug for bolting to device and approved plug at opposite end.
	With a separate #10, green, insulated, continuous grounding conductor not more than 15 feet long to the closest ground bus.
	With a separate #10, green, insulated, continuous grounding Conductor not more than 15 feet long connected to the nearest ground bus.

## SECTION 26 05 29 SECURING AND SUPPORTING METHODS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including "Uniform General Conditions and Supplementary General Conditions For The State Of Texas Building Construction Contracts" and Division 01 Specification Sections, apply to the work of this Section.
  - 1. Where the term "Owner's Designated Representative" is used, it shall mean a member of the project's capital team.

#### 1.2 WORK INCLUDED

- A. Raceway, cable tray, and equipment supports
- B. Fastening hardware
- C. Coordinate location of concrete equipment pads

#### 1.3 QUALITY ASSURANCE

- A. Support systems shall be adequate for weight of equipment and conduit, including wiring, which they carry. Support systems shall be sized adequately to support an additional 25% for future loads

#### 1.4 COORDINATION

- A. Coordinate with other trades where conduit and cable tray supports are in the same location as piping, ductwork, and work of other trades and where supports are furnished and installed under other Divisions. Supporting from the work or supports of other Contractors shall not be allowed except by express, written permission of the Owner.

#### 1.5 SUBMITTALS

- A. Provide submittals in accordance with and in additional to Section 26 00 00 Basic Electrical Requirements, and Division 01 for submittal requirement.

### PART 2 - PRODUCTS

#### 2.1 MATERIAL

- A. Support Channel:
  - 1. All non-corrosive locations: Hot-dip galvanized steel.
  - 2. Corrosive locations: Nonmetallic fiberglass.
  - 3. Outdoors or in spaces subject to outside air, including Air Handling Units: 316 Stainless Steel.
- B. Hardware:
  - 1. All non-corrosive locations: Hot-dip galvanized steel.

2. Corrosive locations: Fiberglass threaded rod, attachments and fasteners shall be used with fiberglass supports.
3. Outdoors or in spaces subject to outside air, including Air Handling Units: 316 Stainless Steel.

C. Threaded Rod: used for rack support from structure above; 3/8-inch minimum diameter.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Fasten hanger rods, conduit clamps, and outlet and junction boxes to building structure using precast insert system, expansion anchors, or beam clamps. Do not use spring steel clips and clamps. Provide necessary calculations to select proper support materials for electrical equipment, raceway, and cable tray supports.
- B. Fixture whips shall be supported with "batwings" or tie wire, no more than one support per wire to avoid lifting the ceiling grid.
- C. Install hangers, anchors, sleeves and seals as indicated, in accordance with manufacturer's written instructions and with recognized industry practices to insure supporting devices comply with requirements. Comply with requirements of NEC for installation of supporting devices. Install supports with spacing in compliance with NEC requirements.
- D. Use toggle bolts or hollow wall fasteners in hollow masonry, plaster, or gypsum board partitions and walls; expansion anchors in solid masonry walls; or concrete surfaces; sheet metal screws in sheet metal studs; and wood screws in wood construction.
- E. Do not fasten supports to piping, ductwork, mechanical equipment, or conduit.
- F. Do not use powder actuated anchors without written permission from the Engineer.
- G. Do not drill structural steel members without written permission from the Structural Engineer.
- H. Fabricate supports from structural steel or steel channel, rigidly welded or bolted to present a neat appearance. Use hexagon head bolts with spring lock washers under all nuts.
- I. Bridge studs top and bottom with channels to support recessed mounted cabinets and panelboards in stud walls.
- J. Install surface mounted cabinets and panelboards with a minimum of four anchors. Provide strut channel supports to stand cabinet 1-5/8 inches off wall. Utilize "Post Bases" and support channel to attach to structural floor. Extend vertical channel a minimum of 12" above panel to accept horizontal conduit support channel
- K. Provide extra care in supporting PVC conduit to protect it from potential damage.
- L. Use fiberglass for nonmetallic raceway systems supports in areas subject to corrosives.
- M. All supports in contact with floor using stanchion type support shall be solidly bolted to the permanent structural floor.

- N. Conduit supports shall have at a minimum, the bottom support member constructed of double strut. This horizontal member shall be double-nutted, and the supporting all-thread rod shall be trimmed to one inch below lowest nut.
- O. Coordinate with other electrical work, including raceway and wiring work, as necessary to interface installation of supporting devices with other work.
- P.
- Q. Do not anchor supports to columns. Where panelboards, cables, or conduits are routed on the face of a column provide "column hugging" channel supports.

### 3.2 TOUCH-UP

- A. Touch-up all scratches on securing and supporting system, and paint the ends of channel after cutting with an approved zinc chromate or 90 percent zinc paint.

END OF SECTION 26 05 29

## SECTION 26 05 33 - RACEWAYS, CONDUITS AND BOXES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including "Uniform General Conditions and Supplementary General Conditions For The State Of Texas Building Construction Contracts" and Division 01 Specification Sections, apply to the work of this Section.

#### 1.2 WORK INCLUDED

- A. Raceways:
  - 1. Surface metal raceways.
  - 2. Multi-outlet assemblies.
  - 3. Wireways.
  - 4. Indoor service poles.
- B. Conduit:
  - 1. Rigid metal conduit and fittings. (RGS)
  - 2. Electrical metallic tubing and fittings. (EMT)
  - 3. Flexible metal conduit and fittings.
  - 4. Liquid-tight flexible metal conduit and fittings.
  - 5. Non-metallic conduit and fittings. (underground use only)
- C. Boxes:
  - 1. Wall and ceiling outlet boxes.
  - 2. Pull and junction boxes.
- D. Electrical/control portion of HVAC work covered by Division 23 pertaining raceway, conduit and boxes shall follow the requirement set forth by this specification.

#### 1.3 REFERENCES

- A. NFPA 70 – National Electrical Code, latest edition
- B. ANSI C80.1 - Rigid Steel Conduit, Zinc-Coated
- C. ANSI C80.3 - Electrical Metallic Tubing, Zinc-Coated
- D. ANSI/NEMA FB 1 - Fittings and Supports for Conduit and Cable Assembling.
- E. ANSI/NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers and Box Supports
- F. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum)
- G. ANSI/NEMA TC 2 – Electrical Plastic Tubing (EPT) and Conduit (EPC-40 and EPC-80)
- H. ANSI/UL 1 – Flexible Metal Conduit



- I. ANSI/UL 5 – Surface Metal Raceways and Fittings
  - J. ANSI/UL 360 – Liquid-tight Flexible Steel Conduit
  - K. ANSI/UL 467 – Electrical Grounding and Bonding Equipment
  - L. ANSI/UL 651 – Schedule 40 and 80 Rigid PVC Conduit (underground use only)
  - M. ANSI/UL 797 – Electrical Metal Tubing
  - N. ANSI/UL 870 – Wireways, Auxiliary Gutters and Fittings
  - O. NEMA RN 1 – Polyvinyl Chloride (PVC) Externally Coated galvanized Rigid Steel Conduit and Intermediate Metal Conduit
  - P. UL 6 – Rigid Metal Conduit
  - Q. ANSI/UL 5C – Surface Raceways and Fittings for Use with Data, Signal, and Control Circuits
  - R. ANSI/UL 498 – Attachment Plugs and Receptacles
  - S. ANSI/UL 943 – Ground Fault Circuit Interrupters
- 1.4 SUBMITTALS
- A. Refer to Division 01. Submit manufacturer's product data for conduit, boxes, wireways, raceways, in-ground pull boxes and manholes. Provide submittals in accordance with and in addition to Section 26 00 00.UT, Basic Electrical Requirements, and Section 01330, Submittal Procedures.
  - B. Shop drawings consisting of a complete list of equipment and materials, which will be used for the project, including manufacturer's descriptive and technical literature, catalog cuts and installation instructions. Shop drawings to include conduit routing for large racks and feeders through two hour fire rated. Conduit routing shown on construction documents to be confirmed by contractor and included on submitted shop drawings.
  - C. Sealing/fire stopping materials and details.
  - D. Conduit used in 2hr. circuit Protective Systems shall be submitted under a separate section.
- 1.5 STORAGE AND HANDLING
- A. Handle materials carefully to avoid damage, breaking, denting and scoring. Damaged equipment or materials shall not be installed.
  - B. Store materials in a clean dry space and protected from the weather.

## PART 2 - PRODUCTS

### 2.1 SURFACE METAL RACEWAY

- A. Surface metal raceway shall be factory pre-assembled galvanized steel complete including bases, removable covers, receptacles, end plates, elbows, connectors and fittings, to exact length to match the length of the cabinets, casework, utility chases, and shelving as indicated on laboratory and furniture shop drawings, and work bench details, as applicable.
- B. Size shall be as shown on the Drawings. The length shown on electrical drawings is diagrammatic only and is not accurate for fabrication of raceway Sections. Refer to shop drawings, architectural plans, elevations, and details.
- C. Finish shall be ANSI-61 gray enamel .
- D. Covers shall be field removable by use of a standard screwdriver, without marring the extrusion or cover finish. Raceway with two covers must allow each cover to be removed separately without access into the compartment(s) enclosed by the other cover.
- E. Provide a permanent, integral, grounded metallic dividing barrier to isolate the wiring compartments in the multi-outlet raceway system per drawing as applicable. Provide divider with fittings that maintain the separation of the raceway wiring compartments.
- F. Provide device brackets for mounting standard single-gang or two-gang devices within the raceway system. Devices shall have the capacity of mounting flush or in conjunction with device faceplates.
- G. Provide receptacles for the respective power systems as indicated on the drawings. Refer to Section 26 27 26 Wiring Devices for device specifications.

### 2.2 MULTI-OUTLET ASSEMBLY

- A. Multi-outlet assembly shall be two-piece sheet metal channel with fitted, removable cover suitable for use as a multi-outlet assembly.
- B. Size shall be as indicated on the Drawings.
- C. Provide receptacles mounted as shown on Drawings.
- D. Finish shall be ANSI-61 gray enamel.
- E. Provide couplings, elbows, outlet and device boxes, and connectors designed for use with multi-outlet system.

### 2.3 WIREWAYS

- A. Wireways shall be of steel construction general purpose for indoor spaces and rain tight for outdoor applications with knockouts.
- B. Size shall be as indicated on Drawings.



1. Minimum size: 3/4 inch unless otherwise specified. Minimum size for communication shall be 3/4". Flexible conduit connections to lighting fixtures may be 3/8 inch not to exceed 72 inches in length.
  2. General: Use RMC for all applications except as noted below. Use thread lubricant equal to Crouse Hinds STL on all threaded joints.
  3. Underground Installations:
    - a. Use thick wall schedule 40 nonmetallic conduit.
    - b. Minimum Size: 3/4" inch.
    - c. Before turning to above grade, transition to RMC. All elbows and 90 degree fittings shall be RMC. Where conduits exit concrete slabs, use rigid conduit through slab a minimum of three inches above finished slab. Wrap rigid steel conduits with two layers of vinyl PVC wrap, extended a minimum of two inches above and below slab.
  4. Dry Locations:
    - a. Concealed: Use electrical metallic tubing (EMT) for 4" and smaller.
    - b. Exposed: Use electrical metallic tubing (EMT) above 8' AFF measured vertically. Use (RMC) below 8' AFF measured vertically.
    - c. Unconditioned spaces, indoors locations exposed to outside air, inside air handling units or spaces subjected to steam or dampness: Use Rigid Metal Conduit (RMC)
  5. Motor Connections: Use liquid tight flexible metal conduit.
  6. Dry Type Transformer Connections; Use flexible metallic galvanized steel conduit not exceeding 72" in length.
  7. Telecommunications Conduit system : Provide conduits, outlet boxes, and pull boxes as indicated and specified. Use same grade as specified above, minimum one (3/4") inch unless indicated otherwise. Terminate conduit in the Telephone room within eight (8) feet of the floor grade.
- D. RMC: Hot dip galvanized including threads, as manufactured by Pittsburgh Standard, Triangle or Allied.
1. Rigid metal conduit shall be hot-dipped galvanized indoors where subject to physical damage i.e. mechanical room, loading dock, etc. EMT in all other locations specified above except when in direct contact with earth/concrete and when near cooling towers.
  2. Fittings shall be threaded type. "No-thread" fittings are not acceptable.
- E. Nonmetallic conduits;
1. Schedule 40 PVC in underground locations as manufactured by Carlon, or Pittsburgh Standard.
  2. Fiberglass for above ground locations where nonmetallic conduits are required.
- F. EMT: Pittsburgh Standard, Triangle or Allied.
- G. Flexible Metal Conduit: International, AFC, or Alflex.
- H. Liquid Tight Flexible Conduit: Presheathed galvanized steel Anaconda Type UA, electric-Flex Type LA, Appleton, or AFC.
- 2.5 CONDUIT FITTINGS
- A. Rigid Steel Conduit: ANSI/NEMA FB1.

- B. EMT: Steel rain tight compression type in mechanical spaces, laboratories and bio-containment facilities. Set-screw in other dry locations only.
- C. Die cast fittings are not acceptable.
- D. Flexible Metal Conduit: ANSI/NEMA FB1
- E. Liquid Tight Flexible Metal Conduit: ANSI/NEMA FB1.
- F. Nonmetallic conduit: NEMA TC 3.
- G. Miscellaneous Fittings:
  - 1. Conduit Bodies: Malleable iron. Form 7. "Mogul" size conduit bodies for conduits larger than 1-inch. Do not exceed listed conductor capacity of conduit bodies, upsize conduit body if necessary.
  - 2. Grounding Bushings:
    - a. Threaded Rigid Conduit: Appleton Type "GIB", Crouse-Hinds Type "GLL" or Thomas & Betts 3800 series threaded, grounding type insulated metallic bushing, in combination with one exterior and one interior locknut.
    - b. EMT: O.Z. Gedney Type BLG.
  - 3. Expansion Fittings: O.Z. Gedney Type "AX" or "EX" with bonding jumper.
  - 4. Sealing Fittings: Standard conduit bodies with sealing materials or compound as recommended by Manufacturer, Killark EY or EYS.
  - 5. Hubs: Appleton "HUB" or "HUB-U" Series or Thomas & Betts "370" Series.
  - 6. Unions: Appleton Type "EC" or Thomas & Betts "Erickson coupling".
  - 7. Plastic Bushings:
    - a. Threaded: Equal to Thomas & Betts 222 series.
    - b. Threadless: Equal to Thomas & Betts TRIB series.

## 2.6 CONDUIT ACCESSORIES

- A. Conduit Straps: one-hole straps, unistrut straps or other Owner approved methods made of the following materials:
  - 1. Indoors conditioned spaces and plenums – Zinc Plated steel
  - 2. Unconditioned spaces indoors – Hot-dipped galvanized or stainless steel
  - 3. Outdoors, indoors locations exposed to outside air, inside air handling units and fans – Stainless Steel.
- B. Pull Lines: Jet line #232 for metal conduit. 1/2" minimum polyester mule rope for PVC conduit.
- C. Sleeve Penetration Sealant: Refer to Division 07.
- D. Underground Warning Tape: 6" wide with metal backing, red with black letters, and continuous message: "Caution – Buried Electrical Line".

## 2.7 SURFACE METAL RACEWAY

- A. Manufacturers: Wire-mold.
- B. Description: Sheet metal channel with fitted cover, suitable for use as surface metal raceway.

- C. Size: As shown on Drawings.
- D. Finish: As specified by Architect.
- E. Fittings, Boxes, and Extension Rings: Furnish manufacturer's standard accessories. Provide corner fittings which accommodate the minimum bending radius requirements of EIA/TIA 568A.
- F. Receptacles: As recommended by receptacle manufacturer.
- G. Multioutlet Assembly:
  - 1. Sheet metal channel with fitted cover, with pre-wired receptacles, suitable for use as multioutlet assembly.
  - 2. Size: As indicated on Drawings.
  - 3. Receptacles: NEMA WD 6, Type 5-15R, single receptacle.
  - 4. Receptacles Spacing: 12 inches on center.
  - 5. Receptacle Color: White.
  - 6. Channel Finish: White.
  - 7. Fittings: Furnish manufacturer's standard couplings, elbows, outlet and device boxes, and connectors.

## 2.8 WIREWAY

- A. Manufacturers: Square D, Hoffman, or Wiegmann.
- B. Description: General purpose or rain-tight type wire way.
- C. Knockouts: No pre-punched knockouts, all knockouts field drilled for clean installation.
- D. Minimum Size: 6 x 6 inch x length shown, or sizes as indicated on the drawings for each application.
- E. Cover: Hinged cover.
- F. Connector: Slip in.
- G. Finish: Rust inhibiting primer coating with gray enamel finish.

## 2.9 BOXES

- A. Manufacturers: Raco, Steel City, or Appleton.
- B. Application:
  - 1. Indoors – NEMA 1
  - 2. Indoors in pump rooms – NEMA 3R
  - 3. Outdoors, corrosive locations, inside air handlers and fans enclosures and indoor locations exposed to outside air – NEMA 4X 316 Stainless
- C. Pull Boxes: Galvanized steel, sized in accordance with the National Electrical Code. Use standard outlet boxes for junction and pull boxes 45 cubic inches in size and smaller. Use cabinets, as specified below, for pull boxes larger than 45 cubic inches.

- D. Outlet Boxes;
1. Galvanized steel, at least 1-1/2 inches deep, and of sufficient size to accommodate wiring devices.
  2. Handy boxes and single gang switch boxes will not be accepted.
  3. Use switch cut-in boxes only where sheetrock exists on both sides of an existing wall, for remodel only.
  4. Size in accordance with NEC.
  5. Where 1" conduit terminates in outlet box, provide minimum 4-11/16" square deep box.
  6. Furnish plaster rings, sized for finished wall depth including cabinets, backsplash or other wall covering, where required. Box extenders will not be permitted on construction where wall covering has been removed.
  7. Extension boxes are not allowed.
- E. Outlet Boxes for Wall Brackets and Overhead Lighs: 4" square or octagon galvanized boxes, 1-1/2" deep or 2-1/8" deep, depending upon the number of conductors. Provide 3/8" fixture studs through back of box where required for mounting fixtures. Furnish plaster rings for where required.
- F. Outlet Boxes in Masonry Walls: Sheet steel outlet boxes made specifically for masonry walls, in one to five gang widths, Raco Cat. No. 696 through 699. Single gang switch boxes and handy boxes will not be accepted.
- G. Cabinets:
1. Construction: NEMA 250, Type 1, 3R, or 4X (4X 316 stainless) steel enclosure as indicated.
  2. Covers: Secured by screws.
  3. Enclosure Finish: Manufacturer's standard gray baked enamel or stainless steel.
- 2.10 MANHOLES AND IN-GROUND PULLBOXES
- A. Manufacturers: Brooks Products, Dalworth.
- B. General: Precast, constructed of 4500 psi reinforced red concrete, complete with precast neck (where required), manhole frame, cover, and all required hardware. Use pull boxes in lieu of hand holes.
- C. Covers: Screw type, fully gasketed, hot-dipped galvanized checkered steel plate suitable for pedestrian or vehicular traffic duty as applicable. Use flush beveled stainless steel screws.
- D. Minimum Size:
1. Manholes terminating five (5) ducts or more: 6'w x 12'l x 7'h.
  2. Pullboxes terminating four (4) ducts or less: 4'w x 5'l x 4'h.
- E. Design Loads: Accommodate of dead load, live load, impact, loads due to water table, and other loads which may be imposed upon the structure.
- F. Reinforcing Steel: Hot dipped galvanized.
- G. Pulling Eyes: 7/8" diameter, set in the manhole opposite each duct entrance.

- H. Cable Racks: Provide each communication manhole with four (4) hot-dipped galvanized cable racks, two per long side, each equipped with two adjustable hooks sized to adequately support the hardware.
- I. For manholes that cannot be drained practically, provide a "dry" sump 12" diameter 18" deep in one corner with floor sloped to sump.
- J. Provide a steel skid-resistant ladder, with hooked ends, in each manhole with headroom greater than five (5') feet. Provide ladder bracket support in the collar.
- K. Provide manhole bonding ribbon of annealed, tinned, copper and bonding ribbon clamps.

## 2.11 CABLE TRAY AND FITTINGS

- A. Ladder type cable trays
  1. Tray: NEMA VE 1, Class 12C or as indicated on the drawings.
  2. Material and Finish of Tray, Fittings, and Accessories: 6063-T6 aluminum extrusion or hot-dip galvanized after fabrication steel (ASTM A123) as indicated on Drawings.
  3. Inside width: 12 inches minimum or as indicated on Drawings.
  4. Inside depth: 4 inches minimum or as indicated on Drawings
  5. Straight Section rung spacing: 12 inches on center.
  6. Inside radii of fittings: as indicated on Drawings
  7. Accessories and Fittings: Manufacturer's standard clamps, hangers, brackets, splice plates, reducer plates, blind ends, barrier strips, connectors, and grounding straps.
  8. Provide covers on tray where exiting the top of control cabinets, communication/data cabinets, distribution panelboards and switchboards which covers vertical Sections of tray and 90 degree bend.
- B. Perforated bottom cable trays
  1. Tray: NEMA VE 1, Class 12C.
  2. Material and Finish of Tray, Fittings, and Accessories: 6063-T6 aluminum extrusion or hot-dip galvanized steel (ASTM A123).
  3. Inside Width: 12 inches minimum or as indicated on Drawings.
  4. Inside depth: 4 inches or as indicated on Drawings.
  5. Inside radii of fittings: 12 inches.
  6. Accessories and Fittings: Manufacturer's standard clamps, hangers, brackets, splice plates, reducer plates, blind ends, barrier strips, connectors, and grounding straps.
  7. Utilization: Data cables, control cables, telephone cables, fiber optics. Do not use for vertical sections. Vertical cables shall be installed vertical floor mounted racks.
  8. Covers: Ventilated covers where indicated on the drawings.
- C. Fiberglass cable trays
  1. Tray: NEMA FG1
  2. Material and finish of tray, fittings, and accessories: Glass fiber reinforced polyester.
  3. Inside width: 12 inches minimum or as indicated on Drawings.
  4. Inside depth: 4 inches minimum or as indicated on Drawings
  5. Inside Radii of Fittings: 12 inches or as indicated on Drawings.
  6. Accessories and Fittings: Manufacturer's standard clamps hangers, brackets, splice plates, reducer plates, blind ends, barrier strips, and connectors.
  7. Covers: Solid covers where indicated on the drawings.
- D. Warning signs for cable trays



1. 1/2-inch high black letters on yellow plastic with the following wording: WARNING!  
DO NOT USE CABLE TRAY AS WALKWAY, LADDER, OR SUPPORT. USE  
ONLY AS MECHANICAL SUPPORT FOR CABLES AND TUBING!

### PART 3 - EXECUTION

#### 3.1 PREPARATION

- A. Locate all proposed underground utilities in accordance with Division 02.
- B. Perform all excavation, trenching and backfill in accordance with Division 02.

#### 3.2 CONDUIT INSTALLATION

- A. Concealed: Run conduit concealed in all areas unless otherwise indicated or specified. Concealed conduits are those hidden from sight as in hung ceilings, walls, chases, furred spaces or trenches.
- B. Exposed: Run conduit exposed, parallel or perpendicular with building lines, in all mechanical rooms and chases and where indicated on the drawings.
- C. Joints: Cut all joints square, ream smooth, and draw up tight.
- D. Run concealed conduit direct and with as long bends as possible. Run concealed and exposed conduit parallel with, or at right angles to, the lines of the building. Make all bends with standard conduit elbows or bend conduit to not less than equivalent radius. All bends shall be free from dents or flattening. Use no more than the equivalent of four quarter bends in any run between terminals and cabinets, or between outlets and junction or pull boxes.
- E. Use approved condulets in lieu of conduit elbows where installation conditions and appearance warrant their use. Make conduit joints with approved couplings and unions.
- F. Installation of all new conduits must be minimum 12 inches from ceiling grid except where approved in writing by Owner, appropriate justification must be provided.
- G. Run conduits continuous from outlet to outlet, and from outlets to cabinets, junction or pull boxes. Secure conduits to all boxes in such manner that each system is electrically continuous throughout.
- H. Use of running threads is prohibited.
- I. No raceway shall be run horizontally inside of walls or partitions. Exceptions: building perimeter walls under windows, clerestory panel walls, and where structural conditions do not allow vertical access to tops of walls. The contractor shall obtain written approval from the Owner for exceptions prior to installation.
- J. Multiple Conduit Installation:

1. Install all conduits parallel to or at 90 degrees to the structure. Multiple conduits shall not be installed using a single rod support. Multiple conduits running the same direction with spacing 48 inches apart or less shall be installed on the same trapeze. Conduits shall be installed on metal framing constructed trapeze hangers that have minimum 24-inch width. Trapeze hangers shall be supported on minimum 3/8-inch diameter all-thread rod attached to the structure with coupling nuts and expansion bolts or beam clamps. Conduit straps or other devices specifically designed for the purpose shall be used to secure conduits to the metal framing. Wire ties and hanger wires are not permitted. Conduits shall only be installed on the top surface of the metal framing, with multiple layered trapeze supports if required. Hanger rods shall not extend more than 1 inch past the lower double nut. Use double nuts and/or lock washers for all-thread rods.
  2. Where parallel conduits are strapped, fastened or anchored, the devices used shall be of the same type and installed on the same plane whether vertical or horizontal.
- K. Single Conduit Installation:
1. Install single conduits parallel to or at 90 degrees to the structure and suspended from the structure on all thread rods (1/4-inch minimum) or clamped and/or clipped to the structure with manufactured clamps/clips. When single conduits are suspended from all thread rods, conduit clamps with bolts and nuts shall be used. Through partition wall penetration shall not be construed as a means of conduit support. Wire ties and hanger wires are not permitted. No powder actuated, compressed air, propane or similar powered "shot" anchor systems shall be installed under any circumstance. Wire ties and hanger wires are not permitted. Single conduits may be secured as follows:
    - a. Wood screws on wood.
    - b. Toggle bolts on hollow masonry.
    - c. Bolts and expansion anchors in concrete or brick.
    - d. Machine screws, threaded rods and clamps on steel.
    - e. Conduit clips on steel joists.
    - f. Plastic anchors are not allowed.
- L. Support all conduits at a maximum spacing of 10 feet. Other spacing intervals that do not violate the NEC and approved by the engineer prior to installation.
- M. Support all conduits and J-boxes above ceilings from the building structure. All J-boxes being installed above suspended ceilings must have a minimum of 12-inch working clearance between the bottom of J-boxes and the top of the ceiling grid except where approved by the Owner in writing prior to installation.
- N. Provide pull boxes for telephone and low voltage (example - Fire Alarm) conduit systems after four right angle bends and at intervals not exceeding 70 feet. Locate boxes in accessible locations.
- O. Do not use pull boxes at 90° bends on conduits 1.25" and larger.
- P. Install each complete conduit system prior to cover-up and before any conductors are drawn in.
- Q. Install meyers hubs at panel top entries in all wet and damp locations.
- R. No raceways, metallic or non-metallic, flexible or rigid, shall be installed in any floor slab elevated above slab on grade.

- S. Ground and bond all conduits in accordance with section 26 05 26. Conduit and wireway systems shall not serve as branch circuit grounding conductors.
  - T. Avoid moisture traps where possible; where unavoidable, provide junction box with drain fitting at conduit low point.
  - U. Use suitable conduit caps to protect installed conduit against entrance of dirt and moisture.
  - V. Cap ends of spare conduits and extend into space above accessible ceiling a minimum of 18 inches. Label conduit as spare.
  - W. Do not daisy chain conduit installations in or on walls, provide a single conduit wall drop per device. Deviations to be approved in writing by owner, appropriate justification must be provided.
  - X. The support means for conduit installation, whether threaded rods, trapeze or other system, shall not be shared with non-electrical system. Any deviation from this standard due to space constrain shall be submitted to the Owner. Owner's review does not necessarily guarantee an approval; therefore the Contractor is advised not to start installation prior to final approval.
  - Y. Identify all conduits in accordance with section 26 05 53.
  - Z. Seal the interior of all conduits where passing from outside to inside, conditioned to unconditioned spaces, and spaces with temperature differentials of 20 degrees F. The seal shall be made within 10' of the transition point and shall comply with NEC 300.7. The material used shall be re-enterable.
- 3.3 CLEANING AND PULL LINES
- A. Clean and swab conduit runs to remove foreign matter and moisture prior to pulling in wire and cable. Clean boxes of concrete, mortar, and other foreign matter.
  - B. Provide pull lines in all active and empty conduits.
- 3.4 INSTALLATION - SURFACE METAL RACEWAY AND MULTI-OUTLET
- A. Install Products in accordance with manufacturer's instructions.
  - B. Use flathead screws to fasten channel to surfaces. Mount plumb and level.
  - C. Use suitable insulating bushings and inserts at connections to outlets and corner fittings on multi-outlet assembly.
  - D. Maintain grounding continuity between raceway components to provide a continuous grounding path in accordance with the requirement of NEC and under provisions of Section 26 05 26.
- 3.5 INSTALLATION - WIREWAYS
- A. Bolt wireways to steel channels fastened to the wall or in self-supporting structure. Install level.

- B. Gasket each joint in oil-tight wireway.
- C. Mount rain tight wireway for exterior installation in horizontal position only.
- D. Support wireways in accordance with section 26 00 00.
- E. Close ends of wireway and unused conduit openings.

### 3.6 INSTALLATION - BOXES

- A. Provide electrical boxes as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections, and code compliance.
- B. Provide outlet box accessories as required for each installation, including mounting brackets, wallboard hangers, extension rings, fixture studs, cable clamps and metal straps for supporting outlet boxes, compatible with outlet boxes being used and meeting requirements of individual situations.
- C. Electrical box locations shown on Contract Drawings are approximate unless dimensioned. Verify location of outlets prior to rough-in.
- D. Locate and install boxes to allow access, minimum 12 inches above ceiling except where space dimensions do not allow.
- E. Do not install boxes back-to-back in walls. Provide minimum 6-inch separation. Provide minimum 24-inch separation in acoustic-rated walls. If boxes are connected together, install flexible connection between the two and pack openings with fiberglass.
- F. Secure boxes rigidly to the substrate upon which they are being mounted, or solidly imbed boxes in concrete or masonry. Do not support junction boxes from the raceway systems. Boxes shall not be permitted to move laterally. Boxes shall be secured between two studs. Boxes connected to one stud are not permitted.
- G. Provide knockout plugs for unused openings.
- H. Use multiple-gang boxes where more than one device is mounted together. Do not use sectional boxes. Provide barriers to separate wiring of different voltage systems.
- I. Install boxes in walls without damaging wall insulation.
- J. Outlet boxes in plaster partitions shall be "shallow-type" set flush in wall so there is at least 5/8 inch plaster covering back of box.
- K. Outlet boxes for switch shall not be used as junction boxes.
- L. Coordinate mounting heights and locations of outlets mounted above counters, benches and backsplashes.
- M. In inaccessible ceiling areas, position outlets and junction boxes within 6 inches of recessed luminaire, to be accessible through luminaire ceiling opening.

- N. Outlet boxes supporting fixtures shall be securely anchored in place in an approved manner. Support outlet boxes and fixtures in acoustic ceiling areas from building structures, not from acoustic ceilings. Lighting fixture outlets shall be coordinated with mechanical and architectural equipment and elements to eliminate conflicts and provide a workable neat installation.
- O. Set floor boxes level and flush with finish flooring material.

### 3.7 INSTALLATION – CABLE TRAY

- A. Installation: In conformance with NEC and NEMA requirements and in accordance with manufacturer's instructions. Arrange cable tray to maintain headroom and present neat appearance. Cables shall be arranged in cable trays in a neat, workmanlike manner.
- B. Support cable tray at each connection point, at the end of each run, and at other points to maintain spacing between supports of 10 feet maximum. Trays shall be level with respect to grade plus or minus 1/8-inch per 10 feet or 1/2-inch cumulative. Unless otherwise noted cable trays shall be supported by rigid steel brackets or trapeze type hangers. Hanger materials, including threaded hanger rods, all brackets, and other structural support items shall be per 16190, Supporting Methods and shall have sufficient strength to support the load with a safety factor of at least 3 when all trays are filled to design capacity. Where multiple tiers of cable tray are installed, a minimum of 100-lbs./foot fill for each cable tray shall be used to establish support requirements if limiting factor is the supporting material. In fabricating or installing cable tray supports, holes shall be drilled and cuts made with a saw. Hanger rods shall be of 1/2-inch or larger diameter, shall be double-nutted at the lowest cable tray support and the hanger rod shall be cut off one (1) inch below the bottom nut. Cable tray support spacing shall not exceed 10 feet for ladder type trays. Hanger rods shall be unspliced. Cable trays installed on trapeze type hangers shall be braced laterally at intervals not exceeding 50 feet. Refer to Section 26 05 29 for cable tray support methods.
- C. Where it is necessary to make field changes in the tray system, cuts shall be made with hacksaw or power saw. All sharp edges and burrs shall be removed.
- D. Install warning signs at 50 foot centers along route of cable tray, in locations visible from the floor.
- E. Where new cable trays are installed above, below or in-line with existing cable trays, the new cable tray shall be supported independently from the existing cable tray with new supports and framing unless approved by the Owner and the Structural Engineer. Maintain twelve-inch clearance between cable tray and surfaces with temperatures exceeding 104 degrees F, such as flues, steam pipes, and heating appliances. Maintain at least 6-inch clearance between cable tray and piping, ductwork or other interference. Any deviation from this must be approved by the Owner. It shall be the Contractor's responsibility to protect existing cable tray in the area of construction against damage throughout the construction period. Any damaged cable tray shall be replaced by the Contractor at no additional cost prior to final acceptance by the Owner.
- F. All power cable trays shall have a continuous; No. 4/0 insulated copper, (for aluminum tray) and bare copper (for galvanized steel tray) grounding conductor run inside the tray. Bond No. 4/0 to each section of tray and fitting with an OZ Gedney type CTGC ground clamp. All communication cable trays shall have a continuous, No. 6, green insulated copper grounding conductor run inside the tray. Connect to tray at each fitting or tray section per the Drawings.

- G. Maintain electrical continuity between sections of cable tray and bond cable trays at the both ends to building ground plates to provide a continuous grounding path. Install copper braided bonding jumpers around expansion joints and hinged adjustable splice plates where electrical discontinuity occurs.
- H. Cable tray in designated "Corrosive" areas shall be fiberglass.

### 3.8 INSTALLATION - INDOOR SERVICE POLES

- A. Verify that installation of ceiling suspension system and other work above finished ceiling is complete.
- B. Neatly cut openings in ceiling panels.
- C. Attach foot and top clamp in accordance with manufacturer's instructions.
- D. Install trim plate to enclose ceiling panel opening.
- E. Install poles plumb. Install grounding.

### 3.9 WALL AND FLOOR PENETRATIONS:

- A. Core drilling shall be approved in writing by the Structural Engineer prior to execution. Avoid anchor bolt on structural column by installing "column hugging" type of unistrut support for electrical installation. PVC shall not be used for wall and floor penetration. All floor penetrations shall be waterproof.
- B. Wall penetrations for cable tray or under floor raceway shall be sealed in accordance with Specification Section 07840, Fire-stopping and Section 07900, Joint Sealers.
- C. Provide a 3 1/2 inch curb around block outs through concrete floors. Fire-stop per Architectural specification.
- D. Route conduit through roof openings for piping and ductwork where possible; otherwise, route through roof jack with pitch pocket. Coordinate roof penetrations with the roofing contractor.

### 3.10 UNDERGROUND CONDUIT- FEEDERS

- A. Conduit for underground feeders over 100 amps and/or more than 277v to ground are to be concrete encased per Section 3.6. Conduit for underground feeders/branch circuits that do not fall into this category shall be ran in Sch. 80 PVC w/ a minimum coverage of 30" from the top of the pipe to finished grade. Provide underground warning tape per section 26 05 53.

END OF SECTION 26 05 33

## SECTION 26 05 53 - ELECTRICAL IDENTIFICATION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including "Uniform General Conditions and Supplementary General Conditions For The State Of Texas Building Construction Contracts" and Division 01 Specification Sections, apply to the work of this Section.
  - 1. Where the term "Owner's Designated Representative" is used, it shall mean a member of the project's capital team.

#### 1.2 WORK INCLUDED

- A. Nameplates and tape labels
- B. Wire and cable markers
- C. Conduit color coding and labeling

#### 1.3 REFERENCES

- A. NFPA 70 – National Electrical Code (latest edition)

#### 1.4 SUBMITTALS

- A. Provide submittals in accordance with and in addition to Section 26 00 00 Basic Electrical Requirements, and Division 01 for submittal requirement.
  - 1. Furnish nameplate identification schedules listing equipment type and nameplate data with letter sizes and nameplate material.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. Equipment Nameplates:
  - 1. For electrical panel equipment, provide engraved three-layer laminated plastic nameplates, engraved white letters on a black background.
  - 2. For fire alarm system provide engraved three-layer laminated plastic nameplates with white letters on a yellow background.
  - 3. For security and CCTV system panels, provide engraved three-layer laminated plastic nameplates with white letters on a blue background.
- B. Underground Warning Tape
  - 1. Manufactured polyethylene material and unaffected by acids and alkalines.
  - 2. 3.5 mils thick and 6 inches wide.
  - 3. Tensile strength of 1,750 psi lengthwise.
  - 4. Printing on tape shall include an identification note BURIED ELECTRIC LINE, and a caution note CAUTION. Repeat identification and caution notes over full length of tape. Provide with black letters on a red background.

- C. Conductor Color Tape and Heat Shrink:
  - 1. Colored vinyl electrical tape shall be applied perpendicular to the long dimension of the cable or conductor.
  - 2. In applications utilizing heat shrinkable tubing shall be used to obtain the proper color coding for the length of the conductor in the cabinet or enclosure. Variations to the cable color coding due to standard types of wire or cables are not acceptable.
  
- D. Warning labels: Provide warning labels with black lettering on red background with a minimum of 1/2" lettering.
  
- E. Tape Labels: Embossed adhesive tape, with minimum 1/4-inch letters for labeling, exposed conduit, control device stations, exposed junction and pull boxes and manual motor starter units, etc.
  - 1. White letters on black background for normal power.
  - 2. White letters on red background for emergency/standby power.
  
- F. Concealed J-Box and Cover plate Voltage Labels: Black permanent marker indicating voltage, panel name with circuit designations, system identification for other systems (BAS, Data, Etc.)

## 2.2 EQUIPMENT IDENTIFICATION AND LABELING

- A. Externally mark all equipment, devices, conduits for feeders, branch circuits and similar devices using the same circuit designations as indicated on construction drawings and final Record Documents. Conduit marks shall be made at the point of origin and destination of the conduits, using permanent marker.
  
- B. Nameplates shall be black laminated rigid phenolic with white core. Nameplate minimum size shall be 1 inch high by 3 inches long with 3/16 inch high engraved white letters. Supply blank nameplates for spare units and spaces.
  
- C. Nameplate Fasteners: Fasten nameplates to the front of equipment only by means of stainless steel self-tapping screws. Nameplates installed on dead-front assemblies shall be installed with the dead-front or cover open or removed from the equipment so as not to drill into the interior components of equipment. Screws shall be of length so as not to protrude into the interior of the equipment more than 1/8". Stick-ons or adhesives are not acceptable unless the NEMA enclosure rating is compromised, then only epoxy adhesive shall be used to attach nameplates.
  
- D. Nameplate Information: The general naming convention shall consist of the following segments:
  - 1. Building number (M-XXX) where equipment is located;
  - 2. Building floor where electrical equipment is located;
  - 3. System voltage: M (medium voltage), H (277/480V) or L (120/208V);
  - 4. Individual equipment identification: A, B, C, etc.
  
- E. In general, provide the following information for the types of electrical equipment as listed:



1. Switchgears, Switchboards, Distribution Panels and Motor Control Centers: On mains, identify the piece of equipment, the source and room number, voltage characteristics (i.e., 480/277V 3PH 4W). For each branch circuit protective device, identify the load served (Asset ID shall not be used for breaker identification). See example on wall.
2. Transformers, Individual Starters, Contactors, Disconnect Switches, Transfer Switches and Similar Equipment: Identify the device designation, voltage characteristics, source and load served with room numbers.
3. Panelboards: Identify panelboard designation, voltage characteristics, and source designation and source room number.
  
4. Panelboards: Prepare a neatly typed circuit directory printed on 80 weight paper. This directory shall be installed behind clear heat-resistant plastic in a metal frame tack welded to the inside of the door for each panelboard. Identify circuits by equipment served and by building room numbers where room numbers exist. Indicate all spares and spaces. Adhesive mounted directory pocket is not acceptable. Removing and attaching panel schedules from the Drawings is not acceptable. Circuits shall not be identified as "existing". Where changes are made to a schedule, all existing information shall be incorporated into a new and complete schedule.
5. Panelboards, Pull, Junction and Outlet Boxes:
  - a. With  $\frac{1}{2}$  inch high permanent lettering, identify conduits connected to panelboards, pull, junction and outlet boxes with the complete circuit number of the conductors contained therein. Neutral conductors shall be identified by wire marker tags in the panelboards, pull, junction and outlet boxes. Identify the circuit conductors with permanent tags which indicate circuit designation.
  - b. Emergency circuit junction boxes and their covers shall be painted red. Circuit identification shall be marked on the junction box cover.
  - c. Fire alarm circuits (only) shall be marked with yellow covers and "Fire Alarm" marked on the face.
6. Equipment and raceways over 600 Volts: Provide "WARNING - HIGH VOLTAGE - KEEP OUT" signs on all equipment. With 2 inch-high lettering, mark all exposed raceways containing conductors operating in excess of 600 volts every 100 feet and at each wall or floor penetration with the words "WARNING - HIGH VOLTAGE".
7. Dedicated outlets: Dedicated is understood to be specific equipment listed by equipment number in the panel schedules or identified on the Drawings. Dedicated also includes computer outlets.
8. Remote Ballasts: For remote ballasts not within five (5) feet of their associated lighting fixture, provide appropriate permanent lettering on both the ballasts and the light fixture to identify which are mated to the other.
9. Wires - Circuit number and voltage
10. Warning Labels – Apply warning labels per NEC 110 as applicable.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Degrease and clean surfaces to receive nameplates or tape labels.
- B. Install nameplates parallel to equipment lines.
- C. Secure plastic nameplates to equipment fronts using screws or rivets. Use of adhesives shall be per Owner's approval. Secure nameplate to outside face of flush mounted panelboard doors in finished locations.
- D. Do not drill into live panelboards. Remove dead front or cover when drilling into panels to prevent damaging interior components during installation.

3.2 WIRE IDENTIFICATION

- A. Provide wire markers on each conductor in panelboards, gutters, pull boxes, outlet and junction boxes, and at load connection. Identify with branch circuit or feeder number for power and lighting circuits. Label control wire with number as indicated on schematic and interconnection diagrams or equipment manufacturer's shop drawings for control wiring.
- B. Conductors for power circuits to be identified per the following schedule.

NOTE TO SPEC WRITER: EDIT THE FOLLOWING DESCRIPTIVE SPECIFICATIONS FOR ANY CONFLICTS WITH THE EXISTING COLOR CODING.

Conductor	System Voltage			
	480/277V	208/120V	240/120V High Leg	Medium Voltage
Phase A	Brown	Black	Black	One White Band
Phase B	Purple	Red	Orange (High-Leg)	Two White Bands
Phase C	Yellow	Blue	Blue	Three White Bands
Neutral	Gray with tracer	White with tracer	White with tracer	N/A
Grounding IG	Green N/A	Green Green w/Yellow	Green Green w/Yellow	Green N/A

- C. The above colors shall be used unless requirements of code require different colors. When connecting to existing circuits, existing color coding shall be utilized. The neutral tracer color shall match the phase conductor color that it is associated with. For connection to existing circuits only, lighting circuits with shared grounded (neutral) conductor are not required to have tracer colors on the wire.
- D. Secondary conductors from isolation transformers shall be: Conductor 1-orange and conductor 2-brown.

### 3.3 NAMEPLATE ENGRAVING SCHEDULE

- A. Provide nameplates of minimum letter height as scheduled below. Nameplates shall be same as equipment names indicated on the Drawings.
- B. Individual Circuit Breakers in Distribution Panelboards, Disconnect Switches, Motor Starters, and Contactors: 1/4-inch; identify source to device and the load it serves, including location.
- C. Dry Type Transformers Not in Substations: 3/8-inch; identify equipment designation. 1/4-inch; identify primary and secondary voltages, primary source, and secondary load and location.
- D. Panelboards: 3/8-inch; identify equipment designation. 1/4 -inch; identify source, voltage and bus ampere rating.

END OF SECTION 26 05 53

## SECTION 26 12 16 DRY TYPE TRANSFORMERS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including "Uniform General Conditions and Supplementary General Conditions For The State Of Texas Building Construction Contracts" and Division 01 Specification Sections, apply to the work of this Section.

#### 1.2 WORK INCLUDED

- A. This Section specifies the furnishing and installation of 3-phase dry-type transformers with medium voltage primary . All transformers shall meet DOE 2016 energy efficiency standards.

#### 1.3 REFERENCE STANDARDS

- A. IEEE C57.12.91 – Test Code for Dry-Type Distribution and Power transformers.
- B. NEMA ST 20- Dry-Type Transformers for General Application.
- C. UL 1561 – Dry-Type General Purpose and Power Transformers

#### 1.4 APPLICABLE PROVISION

- A. Refer to Section 26 00 00, Electrical General Provisions.

#### 1.5 SHOP DRAWINGS

- A. Brochures. Submit brochures on the transformer.
- B. Dimensional Drawings. Submit dimensional drawings of the transformer, including top and bottom views showing entry and exit space for conduits.

### PART 2 - PRODUCTS

#### 2.1 RATINGS

- A. Required KVA, voltages, phases and winding configurations are indicated on the drawings. Transformers must be rated for 60 hertz operation.

#### 2.2 COILS

- A. Windings. Use copper wire (bar stock) for coil windings.
- B. The completed coils shall be preheated, vacuum-impregnated with non-hydroscopic, thermosetting insulating varnish, and then thoroughly baked. This process shall completely seal the coils against moisture, and eliminate any voids which could create hot spots or cause corona formation.

### 2.3 INSULATION

- A. All transformers shall have a maximum temperature rise of 150°C above a ambient. All insulating materials used, to be in accordance with NEMA ST20 or NEMA TR27 Standards for a 220°C insulation system. The temperature rise shall be designated on the transformer nameplate.

### 2.4 CORES

- A. The transformer cores are to be constructed of high grade, non-aging silicon steel laminations with high magnetic permeability, and low hysteresis and eddy current losses. Magnetic flux densities are to be kept well below the saturation point. The core laminations shall be clamped together with heavy, structural steel bars or angles.

### 2.5 BASIC IMPULSE LEVEL

- A. The basic impulse levels (BIL) shall be a minimum of 10 kV for the transformers less than 300 KVA.

### 2.6 SOUND REQUIREMENTS

- A. Average sound levels must not exceed the following values as measured in accordance with NEMA TR-27.

<u><b>KVA</b></u> 45-150	<u><b>DB</b></u> 50
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### 2.7 CONSTRUCTION

- A. Enclosure. Provide a self-supporting steel enclosure with removable panels for access to the taps and for core and coil inspection. Construct enclosure so that it may be dismantled to reduce size and weight for rigging.
- B. Accessories. Provide jack pads, ground pad, diagrammatic nameplate.

### 2.8 ACCEPTABLE MANUFACTURERS

- A. Acceptable manufacturers are General Electric, Eaton/Cutler-Hammer, Siemens.

## PART 3 - EXECUTION

### 3.1 TAP SETTING

- A. Select the appropriate tap setting on transformer so that the actual secondary voltage is  $\pm 1/2$  of a tap span. Record the transformer serial number, KVA rating, selected tap setting and secondary voltage readings. Submit three copies of the record to the Engineer.

### 3.2 FOUNDATION PAD

- A. Construct a concrete pad in accordance with Section 26 00 00, Electrical General Provisions.

3.3 TOUCH-UP PAINTING

- A. Restore marred surfaces to factory finish.

END OF SECTION 26 12 16

## SECTION 26 24 15 – DISTRIBUTION PANELBOARDS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including "Uniform General Conditions and Supplementary General Conditions For The State Of Texas Building Construction Contracts" and Division 01 Specification Sections, apply to the work of this Section.
  - 1. Where the term "Owner's Designated Representative" is used, it shall mean a member of the project's capital team.

#### 1.2 REFERENCES

- A. NECA 1-2000 – Standard Practices for Good Workmanship in Electrical Contracting.
- B. NEMA AB 1 - Molded Case Circuit Breakers.
- C. NEMA ICS 2 - Industrial Control Devices, Controllers, and Assemblies.
- D. NEMA PB 1 - Panelboards.
- E. NEMA PB 1.1 - Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.
- F. NFPA 70 - National Electrical Code.

#### 1.3 RELATED SECTIONS

- A. Section 26 00 00 – Basic Electrical Requirements.
- B. Section 26 05 26 – Grounding.

#### 1.4 SUBMITTALS

- A. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, integrated short circuit ampere rating, circuit breaker and 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, and installation of Product.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. General Electric.
- B. Eaton - Cutler-Hammer.
- C. Siemens.

## 2.2 DISTRIBUTION PANELBOARDS

- A. Construction: NEMA PB 1, circuit breaker type.
- B. Bus: Tin plated copper, rating as indicated on drawings. Provide copper ground bus in each panelboard.
- C. Future Provisions: Fully equip spaces for future devices with bussing and bus connections, suitably insulated and braced for short circuit currents. Provide continuous current rating as indicated.
- D. Short Circuit Rating: Provide minimum integrated short circuit interrupting capacity unless noted higher on the drawings.
  - 1. 240 Volts and Below: 10,000 amperes rms symmetrical.
  - 2. Above 240 Volts: 14,000 amperes rms symmetrical.
- E. Enclosure: NEMA PB 1, Type 1.
- F. Cabinet Front: Surface type, fastened with concealed trim clamps. Provide hinged "door-in-door" construction with flush lock. Finish in manufacturer's standard gray enamel.

## 2.3 FEEDER DEVICES

- A. Molded Case Circuit Breakers:
  - 1. 400-ampere Frame and Less: Manufacturer's standard industrial construction, bolt-on type, integral inverse time delay thermal and instantaneous magnetic trip.
  - 2. 225-ampere through 400-ampere Frame: Continuously adjustable magnetic pick-ups.
  - 3. 600-ampere frame and Above: NEMA AB 1 with electronic sensing, timing and tripping circuits for adjustable current settings.
    - a. Instantaneous trip.
    - b. Adjustable short time current pickup and short time delay.
    - c. Adjustable long time current pickup and long time delay.
    - d. Include shunt trip, under voltage release, auxiliary contacts, where indicated.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install panelboards in accordance with NEMA PB 1.1 and NECA 1-2000.
- B. Install panelboards plumb. Install recessed panelboards flush with wall finishes.
- C. Ground and bond panelboards under the provisions of section 26 05 26.
- D. Height: 6 ft to top of panelboard; with bottom no less than 4 inches above floor.
- E. Provide filler plates for unused spaces in panelboards.
- F. Provide typed circuit directory, matching the actual circuit breaker arrangement and location, for each branch circuit panelboard under provisions of Section 26 00 00. Revise directory to reflect circuiting changes required to balance phase loads. All panelboards shall be furnished with metal directory holders.



- G. Provide engraved plastic nameplates under the provisions of Section 26 00 00.
- H. Provide spare conduits out of each recessed panelboard to an accessible location above ceiling. Minimum spare conduits: One 3/4 inch empty conduit for every three spare or space circuits. Identify each conduit as SPARE.
- I. Provide compression lugs to accept service feeders.

### 3.2 FIELD QUALITY CONTROL

- A. 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 26 24 15

## SECTION 26 24 16- BRANCH CIRCUIT PANELBOARDS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including "Uniform General Conditions and Supplementary General Conditions For The State Of Texas Building Construction Contracts" and Division 01 Specification Sections, apply to the work of this Section.

#### 1.2 REFERENCES

- A. NECA 1-2000 – Standard Practices for Good Workmanship in Electrical Contracting.
- B. NEMA AB 1 - Molded Case Circuit Breakers.
- C. NEMA ICS 2 - Industrial Control Devices, Controllers, and Assemblies.
- D. NEMA PB 1 - Panelboards.
- E. NEMA PB 1.1 - Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.
- F. NFPA 70 - National Electrical Code.
- G. IEEE C62.41-1991 - IEEE Recommended Practice on Surge Voltage in AC Power Circuits.
- H. ANSI/IEEE C62.45-1987 - IEEE Guide on Surge Testing for Equipment Connected to Low-Voltage AC Power Circuits.
- I. UL 1449 - Standard for Transient Voltage Surge Suppressors.
- J. UL 1283 - Standard for Electromagnetic Interference Filters.

#### 1.3 RELATED SECTIONS

- A. Section 26 00 00 – Basic Electrical Requirements.
- B. Section 26 05 26 – Grounding.

#### 1.4 SUBMITTALS

- A. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, integrated short circuit ampere rating, circuit breaker and 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, and installation of Product.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. General Electric.
- B. Eaton- Cutler-Hammer.
- C. Siemens.

### 2.2 BRANCH CIRCUIT PANELBOARDS

- A. Construction: NEMA PB1, circuit breaker type, NEMA 1 enclosure unless indicated otherwise.
- B. Rating: -As indicated on drawings. Fully rated only
- C. Bus: Tin plated copper, ratings as indicated. Provide copper ground bus in each panelboard. Use 1000 amps per square inch for all busses.
- D. Future Provisions: Fully equip spaces for future devices with bussing and bus connections, suitably insulated and braced for short circuit currents. Provide 20% spare 20A/1P circuit breakers in each panelboard.
- E. Molded Case Circuit Breakers:
  - 1. NEMA AB 1, bolt-on type, thermal magnetic trip circuit breakers, with common trip handle for all poles.
  - 2. Provide circuit breakers UL listed as Type SWD for lighting circuits.
  - 3. Provide circuit breakers UL listed as Type HID for circuits serving high intensity discharge luminaires.
  - 4. Provide UL Class A ground fault interrupter circuit breakers where scheduled.
  - 5. Do not use tandem circuit breakers.
  - 6. Breakers feeding 120 volt shunt trip circuits shall be provided with breaker handle locking devices.
  - 7. Provide maximum number of circuit breakers for which the panelboard is configured.
- F. Cabinet Front: Surface cabinet front with concealed trim clamps, concealed hinge, "door-in-door" construction with flush lock. Key all locks alike.
- G. Finish: ANSI 61 gray enamel.

### 2.3 ELECTRONIC GRADE PANELBOARDS

- A. Description: NEMA PB1, circuit breaker type panelboard with integral transient voltage surge suppression unit, NEMA 1 enclosure.
- B. Rating: As indicated on drawings.
- C. Bus: Tin plated copper; use 1000 amps per square inch.

- D. Future Provisions: Fully equip spaces for future devices with bussing and bus connections, suitably insulated and braced for short circuit currents. Provide continuous current rating as indicated.
- E. Neutral Bus: Rated 200% of phase bus capacity; use 1000 amps per square inch.
- F. Ground Bus: Provide one safety ground bus and one insulated ground bus, both with connection points equal to number of panelboard positions. Use 1000 amps per square inch.
- G. Short Circuit Rating: Provide minimum integrated short circuit interrupting capacity unless noted higher on the drawings.
  - 1. 240 Volts and below: 10,000 amperes rms symmetrical.
  - 2. Above 240 Volts: 14,000 amperes rms symmetrical.
- H. Molded Case Circuit Breakers:
  - 1. NEMA AB 1, bolt-on type thermal magnetic trip circuit breakers, with common trip handle for all poles.
  - 2. Provide circuit breakers UL listed as Type SWD for lighting circuits.
  - 3. Provide circuit breakers UL listed as Type HID for circuits serving high intensity discharge luminaires.
  - 4. Provide UL Class A ground fault interrupter circuit breakers where scheduled.
  - 5. Do not use tandem circuit breakers.
  - 6. Breakers feeding 120 volt shunt trip circuits shall be provided with breaker handle locking devices.
  - 7. Provide maximum number of circuit breakers for which the panelboard is configured.
- I. Cabinet Front: Surface cabinet front with concealed trim clamps, concealed hinge, "door-in-door" construction with flush lock. Key all locks alike.
- J. Finish: ANSI 61 gray enamel.

## 2.4 GROUNDING CORD SETS

- A. Each set shall consist of single conductor, extra flexible copper grounding conductor insulated with green neoprene having a grounding plug on one end and grounding terminal on the other, in accordance with applicable documents. Overall resistance on the cord set, measured from the tip of the grounding plug to the connector, shall not exceed 0.03 ohms.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install panelboards in accordance with NEMA PB 1.1.
- B. Install panelboards plumb. Install recessed panelboards flush with wall finishes.
- C. Ground and bond panelboards under the provisions of Section 26 05 26.
- D. Height: 6 ft to top of panelboard; install panelboards taller than 6 feet with bottom no less than 4 inches above floor.
- E. Provide filler plates for unused spaces in panelboards.

- F. Provide typed circuit directory, matching the actual circuit breaker arrangement, for each branch circuit panelboard under provisions of Section 26 00 00. Revise directory to reflect circuiting changes required to balance phase loads. All panelboards shall be furnished with metal directory holders.
- G. Provide engraved plastic nameplates under the provisions of Section 26 00 00.
- H. Provide compression lugs to accept service feeders.
- I. .

### 3.2 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of Division 01.
- B. 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.
- C. 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.

### 3.3 SCHEDULES: REFER TO THE DRAWINGS.

END OF SECTION 26 24 16

## SECTION 26 28 13 - FUSES, 600 VOLT

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including "Uniform General Conditions and Supplementary General Conditions For The State Of Texas Building Construction Contracts" and Division 01 Specification Sections, apply to the work of this Section.
  - 1. Where the term "Owner's Designated Representative" is used, it shall mean a member of the project's capital team.

#### 1.2 WORK INCLUDED

- A. Dual-element, current limiting Class R fuses for loads up to 600 volts, 0-600 Amps.
- B. Time delay, current limiting Class L fuses for loads up to 600 volts, 601-6000 Amps.

#### 1.3 REFERENCES

- A. UL 248-12 - Standard For Safety For Low-Voltage Fuses-Part 12: Class R Fuses
- B. UL 248-10 - Standard For Safety For Low-Voltage Fuses-Part 10: Class L Fuses
- C. Where application of local codes, trade association standard or publications appears to be in conflict with the requirements of this Section, the Architect/Engineer shall be asked for an interpretation.

#### 1.4 SUBMITTALS

- A. Provide submittals in accordance with and in additional to Section 26 00 00 Basic Electrical Requirements, and Division 01 for submittal requirement.

#### 1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Store fuses in a clean and dry space and protected from weather. When necessary to store outdoors, elevate materials well above grade and enclose with durable, waterproof wrapping.

### PART 2 - PRODUCTS

#### 2.1 MATERIAL AND EQUIPMENT

- A. Furnish fuses manufactured by Buss, or equal, in accordance with the following:
  - 1. Motors and Transformers, 0 to 600 Amp:
    - a. 250 volt - Buss LPN-RK, UL Class RK1.
    - b. 600 volt - Buss LPS-RK, UL Class RK1.
  - 2. Lighting Loads, 0 to 600 Amp:
    - a. 250 volt - Buss KTN-R, UL Class RK1.
    - b. 600 volt - Buss KTS-R, UL Class RK1.
  - 3. All Applications, 601 to 6000 Amp:
    - a. 600 volt - Buss KRP-C, UL Class L.

- B. Size fuses serving motor loads as specifically recommended by motor or equipment manufacturer or in the range of 150% to 175% of motor nameplate rating per NEC in accordance to the type of motor.
- C. Interrupting Rating: 300,000 RMS Amps.
- D. Maintenance Stock, Fuses:
  - 1. Furnish the following:
    - a. Three spare fuses of each size and type for a spare set.
    - b. Furnish spare fuse cabinet sized to contain required spare fuse stock.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Install fuses where indicated, in accordance with the manufacturer's written instructions, the applicable requirements of NEC, national and local codes, regulations, and requirements.
- B. Provide quantity of spare fuses and fuse cabinet per the requirement of this Section at the location per drawing or the direction of Owner's Representative, in addition to replace blown or defective fuses during installation, startup, system commissioning and acceptance.

END OF SECTION 26 28 13

## SECTION 26 28 16 - ENCLOSED SAFETY SWITCHES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including "Uniform General Conditions and Supplementary General Conditions For The State Of Texas Building Construction Contracts" and Division 01 Specification Sections, apply to the work of this Section.
  - 1. Where the term "Owner's Designated Representative" is used, it shall mean a member of the project's capital team.

#### 1.2 SUMMARY

- A. This Section specifies the furnishing and installation of enclosed safety switches. All switches shall be fused.

#### 1.3 REFERENCE STANDARDS

- A. ANSI/UL 98 - Enclosed and Dead-Front Switches.
- B. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches.
- C. NFPA 70 - National Electrical Code (NEC).
- D. NFPA 70E - Standard for Electrical Safety in the Workplace.

#### 1.4 RELATED WORK

- A. Section 26 00 00, Electrical General Provisions.
- B. Section 26 28 13, Fuses - 600 Volt and Below.
- C. Section 26 05 73, Overcurrent Protective Device Coordination Study.

#### 1.5 SUBMITTALS

- A. Provide product data on each type and rating of switch.
  - 1. Ratings including voltage, and horsepower or continuous current.
  - 2. Dimensioned outline drawings.
  - 3. Conduit entry/exit locations.
  - 4. Cable terminal sizes.
  - 5. Wiring diagrams.
- B. Provide arc-flash calculations and associated incident energy levels. Refer to Section 26 05 73, Overcurrent Protective Device Coordination Study.



## PART 2 - PRODUCTS

### 2.1 CHARACTERISTICS

- A. Voltage. Provide switches with a voltage rating of 250 volts d-c, 240 volts or 600 volts a-c, as required for the installed system voltage.
- B. Type. Provide switches conforming to NEMA KS 1 standard for Type HD (heavy duty).
- C. Contacts. Provide switches with quick-make, quick-break contacts.
- D. Poles. Unless otherwise shown, provide 3-pole, visible blade switches.

### 2.2 CONSTRUCTION

- A. Enclosure. Provide NEMA 1 enclosures for switches in indoor dry locations. Provide NEMA 3R enclosures for switches located outside the building conditioned envelope. Provide NEMA 4X stainless steel enclosures for switches located in corrosive environments, unless otherwise shown.
- B. Operating Handle. Provide a handle suitable for padlocking in the OFF position with as many as three padlocks of 5/16-inch diameter shank. Use a defeatable, front accessible, coin-proof door interlock to prevent opening the door when the switch is in the ON position and to prevent turning the switch ON when the door is open.
- C. Terminal Shield. Provide incoming line terminals with an insulated shield so that no live parts are exposed when the door is open.
- D. Neutral. Provide each switch with an isolated, fully rated neutral block. Make provisions for bonding the block to the enclosure.
- E. Ground. Provide each switch with a ground lug.
- F. Fuse Holders. Provide switches with rejection-type fuse holders which are suitable for use with fuses specified under Section 26 28 13, Fuses - 600 Volt and Below. All switches shall be fused.
- G. Nameplates. Provide metal nameplates, front cover mounted, which indicate the switch type, catalog number and horsepower rating (with both standard and time delay fuses).

### 2.3 LISTING

- A. UL 98 - Safety Standard for Enclosed Switches.

### 2.4 MANUFACTURER

- A. GE Company.
- B. Siemens
- C. Eaton/Cutler-Hammer.

### PART 3 - EXECUTION

#### 3.1 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products individually wrapped, on pallets or in factory-fabricated fiberboard type containers.
- B. Store products in a clean and dry space, elevated above grade, and protected from weather, sunlight, moisture, corrosion, dirt and damage.
- C. Handle products carefully to avoid damage to material components, enclosure and finish. Damaged products shall be rejected and not be installed on project.
- D. Refer to Paragraph 3.2 of Section 26 00 00, Electrical General Provisions.

#### 3.2 INSTALLATION

- A. Install safety or disconnect switches where indicated, in accordance with the manufacturer's written instructions, and the applicable requirements of NEC. Install safety and disconnect switches in accordance with the directions of the Owner's Representative.
- B. In general, mount switches and disconnects so that operating handle is approximately 60 inches above finished floor. Where grouped, align tops of switches.
- C. For equipment with motors larger than 1/8 hp, provide disconnect switches within sight of the motor.
- D. Mount motor and circuit disconnect enclosures, independent of equipment served, on columns or freestanding on a bolted unistrut-type or galvanized welded angle iron framework anchored to floor. Refer to Section 26 05 29, Metal Framing and Supports.
- E. Switch interiors shall be maintained clean until final acceptance by Owner. Switch exteriors shall be maintained free of mud, spray-on insulation, paint spray and other substances not placed on the exterior surface by the switch manufacturer.

#### 3.3 FUSIBLE DISCONNECT SWITCHES

- A. Provide fusible disconnect switches only. Coordinate with Divisions 14, 21, 22, 23, and equipment supplier for warranty and listing requirements of equipment approved by submittal.
- B. Coordinate fuse selection with the overcurrent protective device coordination study. Refer to Sections 26 05 73 and 26 28 13.
- C. Install fuses in fusible disconnect switches. Provide permanent marking inside switch enclosure for fuse type and size.

END OF SECTION 26 28 16

## SECTION 26 31 00 - FIRE ALARM AND SMOKE DETECTION SYSTEM

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including "Uniform General Conditions and Supplementary General Conditions For The State Of Texas Building Construction Contracts" and Division 01 Specification Sections, apply to the work of this Section.
  - 1. Where the term "Owner's Designated Representative" is used, it shall mean a member of the project's capital team.

#### 1.2 RELATED SECTIONS

- A. Section 08710 - Door Hardware: Door closers, electric locks, and electric releases.
- B. Section 15310 – Fire Protection Systems.
- C. Section 15910 - Ductwork Accessories: (Smoke Dampers and Combination Fire/Smoke Dampers.
- D. Section 16000 - Electrical Section.

#### 1.3 REFERENCES

- A. NFPA 13 – Installation of Sprinkler Systems
- B. NFPA 20 – Installation of Stationary Pumps for Fire Protection
- C. NFPA 70 - National Electrical Code.
- D. NFPA 72 - National Fire Alarm Code.
- E. NFPA 101 - Life Safety Code.
- F. NFPA 90A - Air Conditioning Systems
- G. ASME/ANSI A17.1 - Safety Code for Elevators
- H. ADA - Americans with Disabilities Act.
- I. TAS – Texas Accessibility Standards

#### 1.4 SUMMARY

- A. Once operational, the new fire alarm system will only communicate with Campus Supervising Station and will fully integrate with the Fireworks monitoring station

#### 1.5 FIRE ALARM SYSTEM

- A. Must be a complete & fully functional system (see section 2).

- B. A description/summary of the system shall be provided to owner. The description shall include information on other existing Fire Protection Systems (i.e. suppression, sprinklers). (NOTE: This should include type of wiring used for initiating device circuits, signaling line circuits, notification appliance circuits, type of devices, etc.).
- C. System shall be appropriate based on the type of building and the type of occupancy.
- D. Contractor shall coordinate proper evacuation signaling, including automatic voice announcements, if applicable, with owner.

#### 1.6 BIDDING

- A. All deviations to specifications shall be clarified via addendum prior to bid. This can be achieved via the Architect.
- B. The installing contractor is responsible for providing an accurate bid that meets applicable codes referenced herein.
- C. Where drawings provided by an architect or other entity for bidding purposes that do not meet minimum code requirements, it is the responsibility of the contractor to design and bid a system that is code compliant.
- D. The contractor is responsible for the accuracy of bidding and installing a fully code compliant system.
- E. The contractor is responsible for verifying all existing conditions prior to completing a bid. Any discrepancies shall be submitted via RFI to architect and FSDC.
- F. Contractors bid shall include a list of material for all equipment included in proposal.
- G. The installation should be determined based on NFPA 101 requirements and provide NFPA code compliant detection and notification. Any components to be installed that exceed code requirements shall be indicated on the project drawings. All devices to be installed in excess of code requirements shall be approved.
- H. Contractor bids shall not include disclaimers or exclusions which may result in a life safety system which is not complete, not fully operational, or does not comply with these specifications.

#### 1.7 PROJECT DOCUMENTATION

- A. Shop Drawings & Submittals:  
Refer to Division 01 Specifications. Submit the following information:
  - 1. Submit shop drawings and obtain approval from all authorities prior to installation of any components of the fire alarm system.
  - 2. The Contractor shall purchase no equipment for the system specified herein until the Owner has approved the project submittals in their entirety and has returned them to the contractor. It is the responsibility of the contractor to meet the entire intent and functional performance detailed in these specifications. Approved submittals shall only allow the contractor to proceed with the installation and shall not be construed to mean that the contractor has satisfied the requirements of these specifications, or relinquish the contractor's responsibility to install a code compliant system.

3. Manufacturer's descriptive literature for all panels, modules and peripheral equipment, including size, color, finish, capacity, electrical characteristics, and wiring requirements. Manufacturer's installation sheets shall be provided for all system components. Clearly identify applicable equipment and strike out non-applicable information.
  4. Sequence of operation for the system and interaction with all other systems panels.
  5. An alarm matrix specific to building detailed with all building fire alarm functions.
  6. A block diagram showing expected system components, wire runs, wire counts and wire sizes.
  7. A panel layout diagram showing the location of all modules and the connections between modules.
  8. Calculations justifying battery size, power supply size and wiring sizes where applicable.
  9. Scaled floor plans indicating each device and all device wiring. Assign device numbers and names to all devices. For new installations contractor shall obtain floor plans for the building and complete system drawings shall be provided (as required in above).
  10. A riser diagram identifying quantity of each device type per floor and connection to panel.
- B. As-builts :
1. Scaled floor plans indicating each device with addresses and all device wiring. Where available, contractor shall indicated on the as-built drawings. Final drawings shall show all new devices, wiring and other system components. Each device type and all wiring will be added as a separate layer.
  2. Final as built documents shall be submitted to the owner via Hard Copy and CD-R.
  3. Contractor shall provide fire alarm documentation box at main FACP per NFPA 72
- C. PROJECT RECORD DOCUMENTS
1. Submit under provisions of Division 01 Specifications.
  2. Testing records shall be submitted via hard copy and electronically in a format compatible with Lamar State Colege standard software (e.g. Word, Excel, Access etc.).
  3. An electronic copy of the final panel programming shall be provided to owner, Environmental Health and Safety (EHS) to maintain on-file. The password for the programming shall be provided to EHS, the programming shall not be encrypted and shall be the most current version on the field panel.
- D. OPERATION AND MAINTENANCE DATA
1. Submit under provisions of Division 01 Specifications.
  2. Furnish three copies of the manuals and books listed below in substantial three-ring binders:
  3. OPERATING INSTRUCTIONS - Describe and illustrate all controls and indicators. Provide all codes and passwords necessary to fully operate system.
  4. PARTS BOOKS - Illustrate and list all assemblies and components, except standard fastening hardware (nuts, bolts, washers, etc.). Provide manufacturer's descriptive literature for all panels, modules and peripheral equipment, including size, color, finish, capacity, electrical characteristics, and wiring requirements. Clearly identify applicable equipment and strike out non-applicable information.
  5. PREVENTATIVE MAINTENANCE INSTRUCTIONS - Describe the daily, weekly, monthly, biannual, and annual maintenance requirements.
  6. ROUTINE TEST PROCEDURES - Describe manufacturer's suggested tests and reports.
  7. TROUBLESHOOTING CHART - Describe and list system trouble codes, probable causes, and suggested remedies.

8. RECOMMENDED SPARE PARTS LIST - List all consumables anticipated to be required during routine maintenance and testing WIRING DIAGRAMS, SCHEMATICS AND MANUALS- Show function of all electrical components.
9. PANEL PROGRAM/REPROGRAM/PROGRAM MODIFICATION - An electronic copy of the panel program shall be furnished to the ODR on appropriate portable media device. The program shall include a listing of all devices, addresses, etc. and shall not be password protected.

1.8 SPARE PARTS

- A. The contractor shall provide spare parts according to type and quantity as follows, where the type of device was installed by the contractor:

Description	Quantity to Provide
Fuses	10 of each fuse size and type for projects involving more than 20 devices
Smoke Detectors	For projects using at least 10 smoke detectors the greater of 1 or 5% of the number installed shall be provided as spare.
Duct Smoke Detectors	For projects using at least 3 duct smoke detectors, the
Pull Station	For projects using at least 3 pull stations, the greater of 1 or 5% shall be provided.
Keys	12 of each for each different key.
Speakers	For projects involving at least 10 smoke detectors the greater of 1 or 5% shall be provided. For projects involving at least 10 smoke detectors the greater of 1 or 5% shall be provided. For projects using at least 5 speakers, the greater of 1 or 5% of the number installed shall be provided as spare. For projects involving at least 10 smoke detectors the greater of 1 or 5% shall be provided For projects involving at least 10 smoke detectors the greater of 1 or 5% shall be provided

Strobes

For projects using at least 10 smoke detectors the greater of 1 or 5% 5 strobes, the greater of 1 or 5% of the number installed shall be provided as spare. If the project exceeds 5 strobes and involves multiple candela ratings, at least 1 of every candela rating used shall be provided as spare

Audio/Visuals

For projects using at least 10 smoke detectors the greater of 1 or 5% 5 Audio/Visual devices, the greater of 1 or 5% of the number installed shall be provided as spare. If the project exceeds 5 Audio/Visual devices and involves multiple candela ratings, at least 1 of every candela rating used shall be provided as spare. 10 smoke detectors the greater of 1 or 5% 10 smoke detectors the greater of 1 or 5% shall be provided For projects involving at least 10 smoke detectors the greater of 1 or 5% shall be provided. For projects involving at least 10 smoke detectors the greater of 1 or 5% shall be provided.

Control/Input Modules

For projects using at least 10 smoke detectors the greater of 1 or 5% 5 control/input modules, the greater of 1 or 5% of the number installed shall be provided as spare. If the project exceeds 5 modules

- B. Upon completion of the project, the Fire Alarm System installer shall provide a letter to owner stating that spare parts for this system will be made available for a period of 10 years from date of acceptance by owner.

1.9 QUALIFICATIONS

- A. Manufacturer: Submit a list of the installations where submitted products have been in successful operation for three years.
- B. Installing Contractor: Submit a list of the installations where submitted products have been in successful operation for three years. Shall be authorized by the Fire Alarm System Manufacturer to sell, install and service the manufacturer's equipment. Shall maintain a staff of specialists for technical assistance and system maintenance, and stock the required spare parts to keep the system in operation.
- C. Contractor shall provide written qualifications for the staff member performing any programming of owner's Fire Alarm Systems. Only personnel factory certified in both EST 3 and EST Fire Works will be allowed to modify any fire alarm programming.

- D. For Projects involving Mass Notification additions or changes, the contractor shall provide written qualifications and factory certifications prior to any work starting.
- E. Field supervision personnel shall have NICET level III fire alarm design certification and have 6 years of experience in installing fire alarm in healthcare facilities.
- F. Project Manager shall have NICET level III fire alarm design certification and have 10 years of experience in installing fire alarm in healthcare facilities.
- G. Both project manager and field supervisor shall review specification with FSDC prior to any installation on owner's property.
- H. Show staff licensed in the state of Texas to perform fire alarm installations and maintenance. Copies of licensure shall be made available upon request.

#### 1.10 REGULATORY REQUIREMENTS

- A. Unless otherwise specified in writing by owner, conform to requirements of the most current NFPA 70, NFPA 72, NFPA 101 and any other regulatory requirements.
- B. Furnish products listed and classified by UL testing firm acceptable to authority having jurisdiction as suitable for purpose specified and indicated.
- C. The contractor may not exercise the "Performance Based Option" in the design of alarm systems, as provided for by the NFPA code, unless expressly approved in writing by the owner's representative, and approved by state fire marshal/TDLR/state authorities or the authority having jurisdiction.

#### 1.11 WARRANTY

- A. Warrant the fire alarm system against defects in workmanship and materials, under normal use and service, for a period of two (2) years from the date of acceptance by owner. Repair, replace or adjust free of charge, any equipment shown to be defective during the warranty period. This warranty is for all equipment installed by FA contractor to include but not limited to devices, wiring, batteries, etc.

#### 1.12 MAINTENANCE SERVICE

- A. Make available service, parts (exact replacements fully compatible) and maintenance of fire alarm system for ten years from Date of Substantial Completion. Owner shall be provided with a print out of devices/information from the panel for ten years from Date of Substantial Completion.

### PART 2 - PRODUCTS AND VENDORS

#### 2.1 ACCEPTABLE MANUFACTURERS

- A. Owner requires competitive bids on all products and installations and will not accept Bids, nor award Contracts for proprietary equipment or installation.
- B. Owner requires that all manufacturers have multiple independent contractors who are certified, or otherwise approved, to perform the installation and service of the manufacturer's equipment.



- C. Owner will not accept bids from a single representative contractor that performs its own installation and service.
- D. Owner will not accept bids from a manufacturer that limits installation to a single source fire alarm contractor. All equipment furnished shall be the current standard products of a single manufacturer and shall bear the label of the Underwriters Laboratories for use in fire alarm systems designed in compliance with the requirements of the applicable NFPA Codes. Raceways, wiring and terminations shall be accomplished at a minimum in compliance with the requirements of the National Electric Code, Article 760.
- E. Acceptable Brands
  - 1. Edwards System Technology (EST)
  - 2. Notifier
  - 3. Gamewell
  - 4. Substitutions: Under provisions of Division 01 Specifications as approved, specifically in writing by the FSDC

- F. Acceptable Vendors
  - 1. Ballou Fire Systems

6200 Stillman.

Houston, TX 77007

- 2. Convergent Technologies

1420 N Sam Houston Pkwy E.

Houston, TX 77032

- 3. Wilson Fire

7303 Empire Central Drive

Houston, TX 77040

## 2.2 GENERAL SYSTEM REQUIREMENTS

- A. Control Panel: Shall be capable of 2400 initiation, control, signaling and fireman's telephone communication points, excluding trouble indications. Maintain all system program information in "non-volatile" memory such that system start-up after a complete loss of operating power (both primary and backup) does not require operator intervention or reloading of any element of the program from an external source. Include provisions for program alterations, point additions/deletions, I/O correlations, logical correlations or time based program changes within the fire alarm control panel. Provide and install a basic operations placard at the fire alarm control panel. System shall be capable of bypass necessary functions to perform routine testing and maintenance.
- B. The system shall incorporate self-sensitivity testing and adjustment of smoke detectors. The Control Panel will print out and provide electronic records of self-sensitivity tests to the user for the purposes of compliance with applicable sections of NFPA 72, routine sensitivity testing. All necessary equipment, components and software for the owner to obtain the required records shall be included.
- C. System Supervision: Component or power supply failure places system in trouble mode.

- D. Initiating Device Circuits: Supervised with alarm and trouble indication; occurrence of single ground or open condition places circuit in trouble mode. Notification Appliance Circuits: Supervised signal module, sufficient for ADA compliant signal devices connected to system; programmable for various signal codes, including steady and march time; occurrence of single ground or open condition places circuit in trouble mode; flash rates of visual strobe devices synchronized. System shall provide voice communication across Alarm Speakers in order to effect voice-evacuation. The following alternate method is acceptable: audio and visual appliances may be installed on the same notification appliance circuit if the fire alarm control panel or the new notification appliances or UL Listed to achieve silence of the audible portion of the appliance, while continuing operation of the visible portion of the appliance. (All wiring shall be supervised). Within multi-story buildings, contractor shall arrange audio notification circuitry such that each floor may be selected independently for voice communication (i.e. one addressable amplifier per floor).
- E. Provide TROUBLE ACKNOWLEDGE, DRILL, and ALARM SILENCE switch.
- F. Alarm Reset: System remains in alarm mode until manually reset (i.e. "latching"); system resets only if initiating circuits are out of alarm mode. Note: panel must be programmed such that the fire alarm panel user may by-pass an individual point/device in alarm, if necessary.
- G. Lamp Test: Manual lamp test function causes alarm indication at each zone at fire alarm control panel and at annunciator panel.
- H. All system product lines must be comprised of components capable of producing the following features when appropriate and specified:
  - 1. Floor above/floor below notifications
  - 2. Private alarm notification
  - 3. Occupied/unoccupied notification
  - 4. Voice alarm notification
  - 5. Fireman's communication
  - 6. Elevator capture/recall
  - 7. Elevator power shunt trip
  - 8. Automatic door control
- I. Messaging: FACP shall be installed with features allowing pre-recorded voice capability, to include extended memory features if necessary to automatically transmit messages. Coordinate message verbiage and tones with owner.
- J. Enclosure: Modular construction with flush or surface wall-mounted enclosure as required.
- K. Power Supply: Adequate to serve control panel modules, remote detectors, remote annunciators, load control relays, and alarm signaling devices. Include battery-operated emergency power supply with capacity for operating system in standby mode for 24 hours followed by alarm mode for 5 minutes on non-voice systems and 15 minutes on voice systems. Power supply shall be served by dedicated emergency power circuit where available in the building.
- L. Each battery cabinet shall contain a quick disconnect in the style of a breaker to kill battery power to the panel.

- M. Interface to Existing Campus Supervising Station: All systems shall include all parts necessary (modules, wiring, links etc.) to interface with all campus Fire Alarm Monitoring Systems. All new systems and system components shall be interfaced with this system, to include all necessary parts, connections, and programming. All new panel installations shall be provided with the necessary interfacing electronics at the time of completion and appropriate programming to communicate with the Campus Supervising Station as required. Contractor to perform all programming for reporting functions. See item 1.4.
- N. Detection circuits shall be short circuit protected and once the short circuit condition is cleared restoration shall be automatic and not require component replacement.
- O. Speaker devices shall be of 70v type.
- P. Each zone shall be supervised for opens, short, and grounds. A fault on one circuit shall not impair the operation of any other circuit in the system. A zone trouble shall annunciate at the Central Control Unit and at the RAP as required.
- Q. Mass Notification - For EST brand installations: the audio decoder shall be a UTC Security FVOIP-EX. Network audio decoder shall interface with the local 3-ASU module. Network audio system supervision shall be accomplished by connecting the FVOIP-EX to the 3-ASU, then connecting to a MN-PASM2. The output of the MN-PASM2 shall be connected to a SIGA-CT1 supervisory module. The SIGA-CT1 shall be connected to the BUILDINGS 3-SSDC1 OR 3-SDDC1 Signature Driver Module. Mass notification shall override audible bypass.
- R. All programming must be permanent and non-volatile to reduce outage time due to failure.
- S. FACP's must be capable of providing circuit integrity monitoring of Initiating Device Circuits at a level of Style B (Class B).
- T. All FACP's and all Booster Power Supplies or Amplifiers must provide twenty percent (20%) excess power supply capacity to allow for future expansion.
- U. Listing: System listed by the Underwriters' Laboratories for NFPA 70 system use.
- V. Zoning: each supply air and return air smoke detectors shall be on an individual zone for each air handler - each manual fire alarm station shall be on a separate zone - each water flow switch shall be a separate zone - each tamper switch shall be a separate zone - elevator lobby smoke detectors shall be on a separate zone.

### 2.3 SYSTEM OPERATION:

- A. Activation of any manual fire alarm station, ceiling smoke detector, heat detector, sprinkler flow switch, or a duct smoke detector causes the following operations and indications:
  - 1. Indicate the origin of the alarm by device via an audible alarm and custom message at the Fire Alarm Control Panel, and Fire Works. All messages, voice and text, shall be approved by owner prior to acceptance.
  - 2. Sound the audible/visual alarm signals :
    - a. High-rise :( 7 or more occupiable floors) - Floor of Alarm, Floor Above, Floor below.
    - b. Non high-rise- General Alarm throughout building
  - 3. Deactivate all magnetically held open smoke doors on all floors which the audio visuals are activated allowing self-closing doors to close.

4. Activate any logic sequences as called for by system programming to actuate special control functions.
- B. Activation of elevator detection and control devices:
1. Fire Service Recall: Activation of a smoke detector in an elevator lobby initiates recall of all elevators serving the lobby in alarm to the primary floor. For alarms on the primary floor, the elevator shall recall to the alternate floor.
  2. Elevator power shunt trip: activation of a Heat detector in the elevator shaft and or machine room shall initialize an elevator recall with a time delay to equal to the time for the cab to travel from top of the shaft to the lowest floor before activating the shunt trip.
  3. Hat flash fire service: activation of a smoke detector in an elevator shaft and or machine room shall initiate the proper fire service recall as-well as activate the fireman's hat flash function.
- C. Activation of HVAC detection and control devices:
1. Shut down the HVAC equipment served by the detector in alarm only.
  2. Activate the damper relays to close all smoke dampers/ Fire smoke dampers associated with the shutdown HVAC equipment only.
  3. Activate relay to indicate to the BAS that AHU is shutting down on fire alarm per AHU.
  4. Shut down shall occur during any operational condition of the HVAC equipment (e.g. "Drive", "By-pass" etc.).
- D. Activation of suppression systems water flow and tamper devices:
1. Within 30-45 seconds of activation of any water flow switch, the alarm signal shall be sent to the Fire Alarm Control Panel and Fire Works.
  2. Within 2 rotations of supervised valve assemblies shall initiate a supervisory signal shall be sent to Fire Alarm Control Panel and Fire Works.
- E. System bypassing:
1. Ability to bypass notification circuits
  2. Ability to bypass Air Handler shut-down
  3. Ability to bypass elevator recall function
  4. Ability to bypass delayed egress and other security door functionality
  5. Ability to bypass activation of water flow switch devices
  6. Other by-pass functions as needed for proper operation, routine testing and maintenance of systems whether alarm or integrated function as approved/ requested by the FSDC
- F. System speaker paging:
1. Ability to select each floor to page too.
  2. Ability to select entire building to page too.
- 2.4 FIRE ALARM AND SMOKE DETECTION CONTROL PANEL CONTROL INTERPHASE
- A. Bypass switches shall be yellow with black lettering.
- B. Speaker select switches shall be grey with white lettering.
- C. Spare switches shall be grey with white lettering and labeled spare.

## 2.5 INITIATING DEVICES

- A. Manual Station: Semi-Flush mounted double-action manual station with key operated test/reset. Provide operating instructions in white letters on cover. Provide manufacturer's standard back-box. If located near day care, pediatrics, psychiatric or public areas in healthcare or clinic buildings, install manufacturer's tamper resistant clear plastic cover with local horn. Conform to NFPA 72.
- B. Heat Detector: Combination rate-of-rise and fixed temperature, rated 135 degrees F, and temperature rate of rise of 15 degrees F, or as appropriate for specific applications. Conform to NFPA 72.
- C. Ceiling Mounted Photoelectric Smoke Detector: with adjustable sensitivity, plug-in base, insect screen and visual indication of detector actuation, suitable for mounting on 4-0 octagon outlet box. Conform to NFPA 72.
- D. Duct Smoke Detector: photoelectric type, duct sampling tubes extending width of duct, and visual indication of detector actuation, in duct-mounted housing, Conform to NFPA 72. Access doors or panels shall be provide in accordance with NFPA 90A. Duct detector Address shall be marked on detector housing viewable from the ground
- E. Provide an LED fire alarm indicator for remote installations, where the duct smoke detectors are located in concealed locations. The remote indicator station shall be labeled to indicate the location of the detector in alarm. Conform to NFPA 72.
- F. Water flow Detecting Devices: Wet Pipe Systems - Monitor listed water flow-detecting alarm device with the necessary attachments to give an alarm contact, as furnished and installed by the sprinkler contractor. Dry Pipe Systems - Monitor the listed alarm pressure switch to the dry pipe valve, as installed by the Sprinkler Contractor. The Sprinkler Contractor shall install Paddle-type water flow alarm indicators in wet systems only. Conform to NFPA 72. Fire Alarm contractor to connect wiring to water flow devices and pressure switches
- G. Sprinkler System Supervisory Device: Monitor listed supervisory device with the necessary attachments to give an alarm contact, as furnished and installed by the sprinkler contractor. Fire Alarm contractor to connect wiring to supervisory devices.
- H. Any device exposed to unconditioned air or the elements shall be rated for exterior use.

## 2.6 NOTIFICATION APPLIANCES

- A. Unless otherwise indicated and approved in writing by owner, the contractor shall install "Alarm Speakers" capable of transmitting voice communications for the purposes of fulfilling the requirements of NFPA 72.
- B. All alarm signaling on a given floor of a building must be homogenous. Voice signaling and continuous signaling shall not be mixed on any given floor without owner. Note: a single exception is in high-noise environments such as select machine rooms where speakers cannot effectively produce appropriate notification signals in compliance with NFPA 72 requirements.

- C. Alarm Visual Device: NFPA 72, wall or ceiling mounted xenon strobe lamp and flasher with red lettered "FIRE" on clear lens, 1-2 Hz flash rate. Candela rating shall conform to NFPA 72 and so indicated on submittals. Where combination systems of fire alarm and mass notification are installed fire alarm devices shall have red lettering ALERT in-place of FIRE per NFPA 72.
- D. Audio/Visual Alarm Speakers: Furnish and install audio/visual speakers to NFPA and ADA requirements. The alarm speakers may be programmed to emit a general alarm instead of preprogrammed voice instructions in areas where new notification appliances are appended to an existing system not capable of voice communication but is designated to be retrofitted to voice communication capability.
- E. Alarm Audible Device: NFPA 72, flush type fire alarm speaker. Sound Rating: Minimum 75 dBA, maximum 100 dBA, and a minimum of 15 dBA over ambient noise levels anywhere necessary according to NFPA 72. Comply with NFPA intelligibility requirements.
- F. Audio/Visual public notification devices: Alarm Audible and Alarm Visual devices may be integrated into a single unit to provide both functions.
- G. Any device exposed to unconditioned air or the elements shall be rated for exterior use.

## 2.7 AUXILIARY DEVICES

- A. Magnetic Door Holder: Magnetic door holders shall be powered by 120VAC, with integral diodes to reduce buzzing.
- B. Load Control Relay: Contacts rated for 10 amps NEMA 1 enclosure, surface mounted.

## 2.8 FIRE ALARM WIRE AND CABLE

- A. Building wire as specified in Division 26 Specifications.
- B. Where approved by the Engineer, System Manufacturer and Installing Contractor in writing, the Electrical Contractor may install all conduit and boxes as per NFPA 70. Rough-in by the electrical contractor shall not in any way affect the system manufacturers and installing contractor's full responsibility for the installed fire alarm system.
- C. Color Code: All fire alarm system wiring shall be red color, UL labeled, and NEC approved fire alarm cable. Wiring shall be installed in accordance with NEC, local codes, Article 210 of NFPA Standard 72, and manufacturer's recommendations. All wiring shall be copper.

## 2.9 FIRE ALARM CONTROL PANEL

- A. Furnish and install as required by NFPA to support a fully functional system.
- B. The FACP shall be located the location shown on the drawings.
- C. The FACP shall have an automatic battery charger, which shall monitor and charge the batteries. Any transfer from the primary power 120VAC to battery shall meet the requirements of the spec for Standby and Alarm.
- D. FACP inner door shall be labeled with the primary power AC circuit.

- E. FACP's primary power disconnect shall be red in color and locked in the on position.
- F. Main FACP shall have extended display.
- G. FACP shall be mounted no more than 65 inches above finished floor.

#### 2.10 REMOTE POWER SUPPLY (RPS)

- A. Furnish and install as required by NFPA to support a fully functional system.
- B. The RPS shall be located in a location like the mechanical or electrical room to provide 24vdc power to visual appliances.
- C. The RPS shall have an automatic battery charger, which shall monitor and charge the batteries. The RPS shall supervise the attached Visual notification appliance circuits. Any transfer from the primary power 120VAC to battery shall meet the requirements of the spec for Standby and Alarm.
- D. RPS inner door shall be labeled with the primary power AC circuit.
- E. RPS primary power disconnect shall be red in color and lock in the on position.
- F. RPS shall be mounted no more than 65 inches above finished floor

#### 2.11 REMOTE ANNUNCIATOR PANEL (RAP)

- A. Where required by this specification, install in recessed or semi-recessed wall-mounted enclosure (i.e. shall not exceed ADA requirements; extend more than 4 inches from wall). Messages on annunciator shall include device address and location details. All messages must be approved by owner prior to acceptance. Remote microphone and applicable functionality shall also be incorporated into Remote Annunciator.
- B. Each RAP shall have the capacity to annunciate on the front panel, alarm and trouble for each detection, supervisory, and monitor zone installed in the RAP. LED indicators shall be clearly visible when on. Zone designations shall be protected from alteration or damage by a clear Plexiglas window.
- C. Each RTU shall have the capacity to include operating controls, which shall include reset, signal silence, and trouble silence. The local control panel shall also include common alarm; common trouble, ground fault, battery fault, and lamp fail indicators. Local controls shall be operational only when the RAP is in the "OFF LINE" mode. The RAP shall be U.L. listed as a stand-alone control panel. Each RAP shall have standby batteries and be capable of operating under NFPA 72 as a stand-alone panel.
- D. RAP shall be mounted no more than 65 inches above finished floor.

### PART 3 - EXECUTION

#### 3.1 DESIGN

- A. Responsibilities of Designing Contractor
  1. Designing contractor shall be responsible for the design of a code compliant system.

2. Designing contractor shall coordinate with all inter-phasing trades to ensure a complete design.
3. Designing contractor shall be responsible for any required equipment missed during design phase.

B. Applicable Codes and References:

1. NFPA 101
2. NFPA 72
3. NFPA 70
4. NFPA 90A
5. NFPA 13
6. NFPA 20
7. ANSI A17.1
8. ADA

C. Design Drawings:

1. Indicate all fire alarm devices on drawings.
2. Indicate function of all relays and control devices.
3. Indicate all inter-phasing equipment (dampers, AHUs, elevators, door holders etc.).
4. Indicate specific scope and area of work.

D. Additional Devices Required in Non-Healthcare

1. Not less than one amplifier per floor shall be provided.
2. Not less than one SLC loop shall be provided per floor.

### 3.2 SUBMITTALS

A. Drawings:

1. Indicate exact extent of scope.
2. Include detailed matrix of system showing all functions.
3. Include sequence of operations of system showing all functions.

B. Product data

1. Include data sheets for all equipment to be installed.
2. Indicate specific devices on data sheets that are to be installed.

C. Submittals

1. All fire alarm submittals shall be approved by FSDC.

### 3.3 INSTALLATION

A. Clear Panel Policy

1. Contractor shall inspect fire alarm system to ensure panel is clear prior to working on system.
2. If panel has troubles unrelated to the work being performed, contractor shall notify owner of impairment prior to beginning work.
3. Contractor shall inspect fire panel upon completion of work to ensure panel is still clear.
4. If contractor finds issues cause by them working on the system the issue shall be fixed and the panel shall be clear with in the same working shift

B. WIRE SUPPORT AND INSTALLATION



1. Install products in accordance with manufacturer's instructions and NFPA guidelines. Use manufacturer recommended tools, sizes, types, etc. All installations shall follow NFPA code requirements.
2. Installation of all wiring and wiring supports shall be supervised by a National Institute for Certification in Engineering Technologies (NICET) Level III (or IV) Fire Alarm Engineering Technician.
3. Low voltage wiring shall be installed in conduit or wire mold as approved by owner in all exposed locations and hard ceilings all Fire alarm conduit back boxes and cover plates shall be painted yellow.
4. There shall be no fire alarm pull boxes located above hard ceiling areas unless otherwise proved an 18X18 access hatch labeled solely for fire alarm access
5. Low voltage wiring installed above lift out ceilings may be outside conduit, provided the wiring is "Plenum rated". Wire shall be installed neatly with 1¼" rings independently supported to the building structure every 4 feet. Wire shall be ran at 90 degree angles at any direction change. Wire shall have no sagging points between rings and will be supported no more than 1 foot from deck unless approved by FSDC. Fire alarm cable shall be 100% dressed throughout the entire system (above ceiling and in control panels).
6. All wire shall be dressed appropriately in all panels and junction boxes. Service loops shall be located neatly in all panels and junction boxes with sticky backs and tire wraps extending from where the wire enters the panel to the nearest side, down that side and back up that side then dressed in 90 degree angles to their termination point. There shall be an service loops above ceiling where wire enters any conduit with the exception of pass through sleeves
7. Where AC voltage is required in fire alarm panels or any boxes where both fire alarm cable and AC voltage are present AC voltage shall enter the panel/ box on the left and fire alarm shall enter on the right maintaining a 6 inch separation, if separation is not possible the contractor shall be responsible for getting approval from the owner
8. All panel communication riser and panel audio riser wiring shall be CLASS A. Each leg of the circuit shall be physically separated by minimum 2-hour fire rated construction, as shown on the drawings, and arranged such that severing one of the conduits will not put any portion of the system out of service. Should a 2-hour separation be determined impractical the owner, a physical separation (distance) of not less than 10 foot on a vertical plane and not less than 10 feet on a horizontal plane shall be achieved.
9. Circuits connecting remote annunciation devices with the control panel shall be Class A (Style "7") as described in NFPA 72. The Contractor shall note this within the submittal document
10. Circuits connecting between fire alarm control panels and fire alarm annunciator panels shall be ran 100% in conduit.
11. Fire alarm risers shall be minimum 2 inch EMT. With 24X24 inch termination cabinets.
12. Top of Fire alarm riser cans shall be mounted at 66" from the finished floor.
13. Fire alarm riser shall be installation shall be field coordinated with FSDC.
14. All field wire shall be CLASS B.
15. For systems requiring pathway survivability level 2, Circuit integrity cable shall be installed per NFPA 72 and NFPA 70.
16. Color Code: All fire alarm system wiring shall be red color, UL labeled, and NEC approved fire alarm cable. Wiring shall be installed in accordance with NEC, local codes, Article 210 of NFPA Standard 72, and manufacturer's recommendations. All wiring shall be copper

17. Wire size shall be sufficient to the circuit it is controlling and shall be 14 gauge for strobe circuits, 16 gauge for speaker, 24v, and phone jack circuits, and 18 gauge for data (SLC) circuits.
18. Low voltage wire shall be tape at all points wire was stripped for termination at edge of jacket to prevent ground faults. All cable burned or damaged from installation shall be replaced and not taped. All tape shall be black.
19. All junctions shall be located in a minimum enclosure of 8X8 inches and shall be terminated to an approved termination block.
20. No wire nuts shall be used in new wire installations.
21. No "T"-tap connections will be allowed.

C. DEVICE INSTALLATION

1. Install products in accordance with manufacturer's instructions and NFPA guidelines. Use manufacturer recommended tools, wires sizes, wire types, etc. All installations shall follow NFPA code requirements.
2. Installation of all devices shall be supervised by a National Institute for Certification in Engineering Technologies (NICET) Level III (or IV) Fire Alarm Engineering Technician.
3. Smoke detectors shall not be installed until all other trades are complete and the area has been cleaned per NFPA 72.
4. Units over 2000 CFM Duct detectors shall be installed on supply side duct work prior to any branch offs. If it is not possible to use a single duct detector to accomplish this requirement, additional duct detectors shall be required.
5. Units requiring a duct detector where there is no duct work to mount detector to, the contractor shall furnish enough duct work to mount the required detector.
6. Only units over 15,000 CFM that feed more than one floor shall have duct detectors installed per NFPA 90A.
7. Access panel shall be provided to perform visual inspection of sample tubes at every duct detector location per NFPA 90A.
8. Mount outlet box for electric door holder to withstand 80 pounds pulling force.
9. Address for each water flow shall be written on W/F cover plate and be viewable from the ground. Monitor module for each water flow shall be located not more than 5 feet away and in the 1900 box the flex conduit is connected to coming from the water flow switch.
10. Address for each tamper switch shall be written on tamper cover plate and be viewable from the ground. Monitor module for each water flow shall be located not more than 5 feet away and in the 1900 box the flex conduit is connected to coming from the Tamper switch.
11. Auxiliary Relays: Provide sufficient auxiliary relay contacts for each auxiliary functions specified. Relay shall not be mounted above ceiling unless approved by FSDC. Addressable devices shall be installed within 6 inches of the relay they are controlling.
12. Batteries shall be marked with both date of manufacture and date of installation in MM/YY format and not be manufactured more than 3 months before the installation date.

D. START-UP EQUIPMENT

1. Start-up of all equipment shall be supervised by a National Institute for Certification in Engineering Technologies (NICET) Level III (or IV) Fire Alarm Engineering Technician.

E. PROGRAMMING

1. Installing contractor shall be responsible for all programming including all interfacing of the existing Campus Supervising Station (Fire Works).

2. Programmer shall be factory certified with both programming and Fire Works to perform any programming on owner's property.
3. Fire Works shall be updated by the fire alarm contractor in the same shift the work was completed in.
4. All programming shall be supervised by a National Institute for Certification in Engineering Technologies (NICET) Level III (or IV) Fire Alarm Engineering Technician.
5. Programming shall be accomplished 100% in the field and include all life safety, control, and descriptive programs so that changes to the system programming can be accomplished with minimal down time and cost. Off sight pre-programming will not be accepted.
6. Provide an up-to-date copy of useable, non-password protected electronic program to owner. Owner files all copies of programs and keeps a library of the above. All changes to programming after this submission requires a new version of the program to be supplied to the owner fire alarm programming library. Contractor may obtain the most recent version of the programming for update from owner by request
7. All programming will be tested in a test station prior to installation when non-standard programming is implemented (e.g. custom messaging, custom message routing, all mass notification programming, etc.). Contractor must coordinate all changes with owner.
8. The contractor shall format device messages within the fire alarm programming as approved by the owner.
9. The contractor shall format labels within the fire alarm programming as approved by the owner.
10. Contractor shall follow a campus standard of programming; this includes a standard of label formatting message formatting and rule formatting. It is the contractor's responsibility to obtain owner's example program. Contractor shall not deviate from campus standard without written authorization from owner. Contractor shall be required to submit program to owner for approval two weeks prior to any pre-testing and will be reviewed and approved prior to final acceptance test.
11. Alarm verification shall not be used.
12. All program alterations shall be accomplished "on-site" and shall not require the access to or removal of any electronic components or modules (e.g. electronic keys). On site programming shall include the ability for owner to:
  - a. Add or delete input and output points e.g. Alarm, supervisory, monitor inputs, bell/strobe, speaker, relay outputs, smoke detector zones, elevator status.
  - b. Change the input/output point correlation (Control by event) including adding, deleting, or changing timer functions and time based control functions.

### 3.4 BARCODING FIRE ALARM DEVICES

- A. Devices being installed on new installation and in renovations shall be barcoded in a barcode format approved by owner.
- B. Devices required to be barcoded shall include but not to be limited to smoke detectors, heat detectors, duct detectors, pull stations, input modules, output modules, control modules, relays, door holders, phone jacks, wardens phones, booster panels, batteries, fire alarm control panels, dialer modules, strobes, speaker strobes , horn strobes, chime strobes, speakers, horns and chimes.
- C. A barcode work sheet shall be provided in a format that is viewable in the latest format of excel and shall list barcode number, device type, device part number, device address and device description, a formatted program to load device barcode information approved by EHS shall also be acceptable.

### 3.5 PRE-FUNCTIONAL TESTING

- A. Perform field inspection and testing under provisions of Division 01 Specifications.
- B. Test in accordance with NFPA 72 and local fire department requirements.
- C. Pre-functional testing shall be supervised by a National Institute for Certification in Engineering Technologies (NICET) Level III (or IV) Fire Alarm Engineering Technician.
- D. Perform 100% pretest of all system functionality and provide proof of 100% pretest before scheduling final acceptance test.
- E. Test each device separately.

### 3.6 FUNCTIONAL TESTING

- A. Functional testing shall be conducted in front of owner representative.
- B. Fire alarm contractor project manager shall be present for all final acceptance testing.
- C. Fire Alarm Field supervisor shall be present for all final acceptance testing.
- D. All required documentation on lines F through L shall be provided in advance to final acceptance test.
- E. For acceptance test, provide hard copy prints of alarm diagrams including device addresses and wiring runs for entire floor where work is being performed (from obtained drawings). A minimum of three sets of drawings shall be supplied in advance final acceptance testing. Drawings shall be D in size unless otherwise approved by owner.
- F. Copy of digital drawing in auto cad format on CD-R shall be provided in advance to final acceptance testing.
- G. Updated matrix of building shall be provided in advance to final acceptance test.
- H. Two copies of the certificate of insurance (FML009) shall be provided in advance prior to final acceptance testing: one for EHS records and one to be displayed in the clear file sleeve at panel. If there is no sleeve, installing contractor shall provide one.
- I. The Record of Completion (as outlined in NFPA 72) shall be completed, with the exception of Part 3, in advance to final acceptance testing. Part 3 will be completed at the conclusion of the acceptance test.
- J. One copy of device print out shall be provided in advance to final acceptance testing. More shall be made available upon request on larger projects.
- K. Required spare parts shall be provided in advance to final acceptance testing.
- L. In addition to provision of NFPA 72 it is the responsibility of the contractor to provide:
  - 1. Smoke detector sensitivity report
  - 2. Pressure differential readings for duct detector sample air flow, where appropriate
  - 3. Closed loop resistance and EOL resistance readings for all field wiring
  - 4. Programming volatility test

- M. Fire Alarm contractor shall provide all of the following for all final acceptance testing:
  - 1. Ladders to access all equipment needing to be tested
  - 2. Multi meter
  - 3. Two way radios
  - 4. Decibel meter
  - 5. Smoke testing device
  - 6. Heat testing device
  - 7. Additional personnel required to perform testing
  - 8. Additional testing equipment required to complete acceptance testing

### 3.7 RE-ACCEPTANCE TESTING

- A. Contractor shall provide proof of repair and changes found.
- B. Contractor shall provide proof of 100% re-pretesting.
- C. Repairs and re-pretesting shall be supervised by a National Institute for Certification in Engineering Technologies (NICET) Level III (or IV) Fire Alarm Engineering Technician.
- D. Restart from line 3.6 section D with corrected documentation.

### 3.8 MANUFACTURER'S FIELD SERVICES

- A. Prepare and start systems under provisions of Division 01 Specifications.
- B. Include services of certified technician to supervise installation, adjustments, final connections, and system testing.

### 3.9 DEMONSTRATION

- A. Provide systems demonstration under provisions of Division 01 Specifications.
- B. Demonstrate normal and abnormal modes of operation, and required responses to each.

### 3.10 TRAINING

- A. Provide training designed for a minimum of four persons, to include:
  - 1. Training in the system operation in all possible modes of operation.
  - 2. Training in the testing of the system.
  - 3. Minimum of eight hours of instruction, but sufficient to cover all items specified.
  - 4. Four sets of instruction materials.
- B. For NEW fire alarm system installs only, the contractor shall provide, as part of the contract, training for two owner's personnel. Training shall be equivalent to the training provided for manufacturer's field service technicians. Training shall be provided on premises at owner or additionally at corporate training centers.

END OF SECTION 26 31 00

## SECTION 26 43 13- SURGE PROTECTION DEVICE

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including "Uniform General Conditions and Supplementary General Conditions For The State Of Texas Building Construction Contracts" and Division 01 Specification Sections, apply to the work of this Section.
  - 1. Where the term "Owner's Designated Representative" is used, it shall mean a member of the project's capital team.

#### 1.2 SUMMARY

- A. This Section specifies the furnishing and installing of type 1 Surge Protective Devices (SPDs), used as a component of a facility-wide suppression system implemented in conjunction with type 2 SPDs in branch circuit panelboards. The specified unit installed in the facility-wide suppression system shall provide effective high-energy transient voltage suppression, surge current diversion, and line control in high-exposure ANSI/IEEE C62.41-1991 environments on the load side of the facility main overcurrent protective device (OCPD). Units installed in the facility-wide suppression system are indicated by the designation SPD (Surge Protection Device) on Drawings.

#### 1.3 STANDARDS

- A. The specified units installed in the facility-wide suppression system shall be designed, manufactured, tested, and installed in compliance with the following standards:
- B. American National Standards Institute and Institute of Electrical and Electronic Engineers:
  - 1. ANSI/IEEE C62.41.1, Recommended Practice for Surge Voltages in Low-Voltage AC power Circuits.
  - 2. ANSI/IEEE C62.45, Guide for Surge Testing for Equipment Connected to Low-Voltage AC Power Circuits.
- C. IEEE Standard 1100-1999 (Emerald Book): Powering and Grounding Sensitive Electronic Equipment.
- D. Federal Information Processing Standards Publication 94 (FIPS PUB 94).
- E. Military Standards (MIL-STD 220A).
- F. National Electrical Manufacturers Association (NEMA LS1-1992/R2000).
- G. National Fire Protection Association (NFPA):
  - 1. NFPA 75, Protection of Information Technology Equipment.
  - 2. NFPA 70, National Electrical Code (NEC), Article 285.
- H. Underwriters Laboratories (UL):
  - 1. UL 248, Low Voltage Fuses.
  - 2. UL 489, Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures.
  - 3. UL 1449 Fourth Edition, Surge Protection Devices.

#### 1.4 RELATED WORK

- A. Section 26 24 16, Panelboards – Distribution and Branch Circuit.
- B. Section 26 43 13, Surge Protection Device.
- C. Section 26 05 73, Overcurrent Protective Device Coordination and Arc Flash Study.

#### 1.5 SUBMITTALS

- A. Factory Tests: Furnish certified documentation for the following tests:
  - 1. Package must include shop drawings complete with all technical information unit dimensions, detailed installation instructions, maintenance manual, recommended replacement parts list and wiring configuration.
  - 2. Copies of Manufacturer's catalog data, technical information and specifications on equipment proposed for use.
  - 3. Copies of documentation stating that the Surge Protection Device is listed from a Nationally Recognized Testing Laboratory (NRTL) (UL, ETL, etc) and are tested and multi-listed to UL 1449 4th Edition and UL 1283.
  - 4. Copies of actual let through voltage data in the form of oscilloscope results for both ANSI/IEEE C62.41 Category C3 (combination wave) and B3 (Ring wave) tested in accordance with ANSI/IEEE C6245.
  - 5. Copies of Noise Rejection testing as outlined in NEMA LS1-1992 (R2000) Section 3.11. Noise rejection is to be measured between 50 kHz and 100 MHz verifying the devices noise attenuation. Must show multiple attenuation levels over a range of frequencies.
  - 6. Copies of test reports from a recognized independent testing laboratory, capable of producing 200kA surge current waveforms, verifying the suppressor components can survive published surge current rating on a per mode basis using the ANSI/IEEE C62.41 impulse waveform C3 (8 x 20 microsecond, 20 kV/10kA). Test data on an individual module is not acceptable.
  - 7. Copies of test reports from a recognized independent testing laboratory indicating the results of nominal discharge current test at values 20 kA/mode. The nominal discharge current test must be conducted per UL 1449 4th Edition.
  - 8. Copy of warranty statement clearly establishing the terms and conditions to the building/facility owner/operator.
- B. Product Data: Submit complete product data and catalog cutsheets describing each unit provided. Make submittals in accordance with the requirements of Division 01 and Section 26 05 00, Electrical General Provisions.
- C. Field Testing: Submit written procedures and forms to be used for field testing to demonstrate compliance with these specifications, as required under Part 3 of this Section. Testing procedures and forms shall include range of permissible values for each recorded parameter. Include list of test instruments and materials to be used for field testing, to include manufacturer, model, accuracy, and applicable steps of field testing procedures.
- D. Submittals after fabrication:
  - 1. Instruction manual describing each unit provided. Manual shall conform to the requirements of Operations and Maintenance (O&M) manuals per Section 26 05 00, Electrical General Provisions.

2. Spare Parts: A list of customer-replaceable spare parts for each unit installed in the facility-wide suppression system shall be included in the unit installation, operation and maintenance instructions. Spare parts shall be quickly and easily field-replaceable.
  3. Field Testing: Submit to the Owner's Representative and to the Architect/Engineer documentation of field testing performed in accordance with Part 3 of this Section, demonstrating compliance with the requirements of this Section. Where not specified otherwise, provide three copies to the Architect/Engineer and one copy to the Owner's Representative.
- E. Panelboards: Refer to Section 26 24 16, Panelboards – Distribution and Branch Circuit, for submittal requirements for distribution and branch circuit panelboards as indicated in Construction Drawings.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURER

- A. Square D
- B. GE
- C. Current Technology
- D. Eaton.

### 2.2 SPD RATINGS

- A. Refer to drawings for operating voltage, configuration.
- B. Declared Maximum Continuous Operating Voltage (MCOV) shall be greater than 115 percent of the nominal system operating voltage and in compliance with test and evaluation procedures outlined in the nominal discharge surge current test of UL1449 4th Edition, section 37.7.3. MCOV values claimed based on the component's value or on the 30-minute 115% operational voltage test, section 38 in UL1449 will not be accepted.
- C. Unit shall have not more than 10% deterioration or degradation of the UL1449 4th Edition Voltage Protection Rating (VPR) due to repeated surges. Unit shall have a monitoring option available to be able to test and determine the percentage of protection available at all times.
- D. Protection Modes of UL1449 4th Edition Voltage Protection Rating (VPR) (6kV, 3kA) for grounded WYE/delta and with voltages of (480Y/277). 3-Phase, 4 wire circuits.
- E. Provide equipment with an integral disconnect with the following ratings:



System Voltage	Mode	MCOV	B3 Ringwave	C3 Comb. Wave	UL 1449 Fourth Edition VPR Rating
120/208	L-G	150	400	650	700
	N-G	0	350	500	900
	L-L	300	400	950	900
277/480	L-N	320	550	1125	900
	L-G	320	850	1075	1200
	N-G	0	700	900	1200
	L-L	550	650	1950	1800

- F. If SPDs are submitted with integral disconnect ratings must be adjusted to comply with UL 1449 4th Edition.
- G. Provide SPDs with nominal discharge current rating of 20kA/mode.
- H. Surge Rating – Provide service entrance SPDs with a minimum surge rating of 200kA per mode at the main switchboards/switchgear in each building. Provide branch circuit and distribution panel SPDs with a minimum surge rating of 80kA per mode.
- I. Electrical Noise Filter- each unit shall include a high performance EMI/RFI noise rejection filter. Noise attenuation for electric noise shall be as follows using the MIL-STD-220A insertion loss test method.
  - 1. 100 kHz at 41 db.
  - 2. All other frequencies should be 31 db or better.
- J. Each Unit shall provide the following features:
  - 1. Phase Indicator lights, Form C dry contacts, counter and audible alarm.
  - 2. Field testable while installed.
- K. Suppression/Filter System: UL 1283 minimum insertion loss obtained utilizing MIL-STD-E220A 50 ohm insertion loss methodology. (100 kHz - 1 MHz): 34 dB (50:1).

### 2.3 FUSING

- A. Fuse Components Identification and Surge Rating: The surge rating (8 x 20 µsec) of the fuse shall be greater than the combined surge current rating of downstream connected suppression elements.
- B. Suppression Components Identification and Surge Rating: The suppression elements connected in series with fuse elements shall provide the suppression elements published 8 x 20 µsec surge current rating. The rating of the suppression elements shall be less than the rating of upstream fusing elements.
- C. Surge Performance: Fusing shall be required to meet the single pulse surge current testing requirements described above.
- D. Isolation: The unit shall have each MOV fused and designed to operate only in the event of a MOV failure within the unit.
- E. UL Rating: Fusing shall be 200kAIC UL248 Recognized.

## 2.4 BUSSING

- A. Transient Conduction Path: Full magnitude transient currents shall be conducted on low-impedance solid copper bussing. Printed circuit boards traces shall not be used to conduct or shunt transient voltage surge currents.

## 2.5 MONITORING

- A. Visual: Monitoring shall include one set of status monitoring lights that will provide visual indication of voltage present to the SPD for each phase of protection. The lights shall also indicate when suppressor protection has degraded to a value of less than 50%.
- B. Alarm: The unit shall include an audible alarm with battery backup, sized for a minimum of 30 minutes, a current-sensing surge counter, and two sets of Form C contacts for remote monitoring.

## 2.6 ENCLOSURE

- A. Provide a SPD assembly that is UL listed.
- B. If required to maintain a UL listing of both the SPD and the associated distribution equipment, then provide the SPD in a separate NEMA Type 12 enclosure sized per the SPD manufacturer's recommendations. Install the SPD per manufacturer recommendations. Install the externally mounted SPD so that the conductor length is a maximum of 5'-0".
- C. SPDs interior to the gear they are protecting will not be permitted.
- D. Finish: Exterior and interior steel surfaces shall be cleaned and finished with electrostatically applied "powder coat" thermoset enamel baked over a rust-inhibiting phosphatized coating. Exterior finish color shall be manufacturer's standard gray, ANSI 49 or ANSI 61, to match finish of associated panelboard.

## 2.7 LISTING

- A. Units shall be UL 1449, Fourth Edition, listed and labeled as a Type 1 Surge Protection Device.

## PART 3 - EXECUTION

### 3.1 DELIVERY, STORAGE, AND HANDLING

- A. Deliver surge protection devices, components and accessories individually wrapped, on pallets or in factory-fabricated fiberboard type containers, and protected from weather and damage.
- B. Store surge protection devices, components and accessories in a clean and dry space, elevated above grade, and protected from weather, sunlight, moisture, dirt, and corrosion.
- C. Surge protection devices, components, and accessories shall not be used as work tables, scaffolds, or ladders.

- D. Handle surge protection devices, components, and accessories carefully to avoid damage to material components, enclosure and finish. Use only lifting eyes and brackets provided for that purpose. Damaged products shall be rejected and not be installed on project.
- E. Refer to Section 26 00 00, Electrical General Provisions.

### 3.2 INSTALLATION

- A. General: Install surge protection device (SPD) internal to the electrical distribution equipment in accordance with manufacturer's wiring diagrams and written instructions and the applicable requirements of the NEC, NEMA, ANSI, local codes, and Owner requirements.
- B. Install the SPD enclosure external to the gear enclosure. Extend phase conductors from SPD to disconnecting means in the electrical equipment, as indicated on Drawings. Extend neutral and ground conductors from SPD to lugs at the neutral and ground busses, in accordance with manufacturer instructions. Connection leads shall not exceed 18 inches from the SPD to the circuit breakers:
  - 1. Where not otherwise indicated or specified, terminate SPD phase conductors to three single-pole circuit breakers in the panelboard connected by a handle tie.
  - 2. Where manufacturer instructions and UL-listing require a 3-pole circuit breaker as disconnecting means and overcurrent protection for the surge protection device, provide a 3-pole circuit breaker as the disconnecting means between the SPD and main bus.
  - 3. Provide overcurrent device for SPD connection to panelboard main bus, sized in accordance with manufacturer recommendations. Refer to Section 26 24 16, Panelboards – Distribution and Branch Circuit.
- C. Wire Size: Manufacturer's recommended wire size for unit supplied. Where wire size is not indicated by manufacturer, provide conductors of same size as grounding conductor connected to the ground bus of the panelboard, #2 AWG minimum per phase, neutral, and ground. Use stranded copper conductor with THWN insulation, unless otherwise noted.
- D. Equipment interiors shall be maintained clean until final Owner acceptance. Equipment exteriors shall be maintained free of mud, spray-on insulation, paint spray and other substances not placed on the exterior surface by the equipment manufacturer.
- E. Inspection: Thoroughly inspect surge protection device and panelboard for items such as loose connections and presence of foreign materials and remedy prior to energizing the panelboard. Bolted connections shall be torqued to the manufacturer's recommendations.

### 3.3 SYSTEM TESTING

- A. Upon completion of installation, provide the start-up and testing services of a factory-authorized and factory-trained local service representative. The tests shall include:
  - 1. Off-Line testing: Impulse injection to verify the system tolerances as well as verification of proper facility neutral-to-ground bond. Compare field test results to factory benchmark test parameters supplied with each individual unit.
  - 2. On-Line testing: Verification that suppression and filtering paths are operating with 100% protection as well as verification of proper facility neutral-to-ground bond by measuring neutral-to-ground current and voltage and by visual inspection.
  - 3. Voltage measurements from Line-to-Ground (L-G), Line-to-Neutral (L-N), Line-to-Line (L-L), and Neutral-to-Ground (N-G), taken at the time of the testing procedure.

### 3.4 DOCUMENTATION AND REPORTING

- A. Record results of field testing and compare to factory benchmark test parameters supplied with each individual surge protection device. Indicate that the integrity of neutral-to-grounds bonds was verified through testing and visual inspection, and that grounding bonds were observed to be in place.
- B. Submit to the Owner's Representative and to the Architect/Engineer copies of the startup test results and the factory benchmark testing results for confirmation of proper suppression filter system function, as required by paragraph 1.5D.3, this Section. Provide number of copies as required by Division One and Section 26 00 00, Electrical General Provisions; and three copies where not otherwise specified.

### 3.5 SYSTEM WARRANTY

- A. The SPD system shall be warranted against defective materials and workmanship for a period of ten years.
- B. Warranties shall conform to the requirements of Division 01 and Section 26 05 00, Electrical General Provisions.

END OF SECTION 26 43 13

## SECTION 26 76 26 – WIRING DEVICES AND FLOOR BOXES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including "Uniform General Conditions and Supplementary General Conditions For The State Of Texas Building Construction Contracts" and Division 01 Specification Sections, apply to the work of this Section.
  - 1. Where the term "Owner's Designated Representative" is used, it shall mean a member of the project's capital team.

#### 1.2 SECTION INCLUDES

- A. Wall switches.
- B. Receptacles.
- C. Incandescent wall dimmers.
- D. Floor boxes and outlets.
- E. Poke-through service fittings.
- F. Plates.
- G. Weatherproof covers.
- H. Exposed work covers.
- I. Special purpose outlets.
- J. Wiring devices in special walls.

#### 1.3 RELATED SECTIONS

- A. Section 26 05 19 – Conduits, Raceway, Boxes.
- B. Section 26 05 26 – Grounding.

#### 1.4 REFERENCES

- A. NEMA WD 1 – General-Purpose Wiring Devices.
- B. NEMA WD 2 – Semiconductor Dimmers for Incandescent Lamps.
- C. NEMA WD 5 – Specific-Purpose Wiring Devices.
- D. Americans with Disabilities Act (ADA).
- E. ANSI/UL 20 – General Use Snap Switches.

F. ANSI/UL 498 – Attachment Plugs and Receptacles.

G. ANSI/UL 943 – Ground Fault Circuit Interrupters.

## 1.5 SUBMITTALS

A. Refer to Division 01. Submit manufacturer's product data for wiring devices and floor boxes.

## PART 2 - PRODUCTS

### 2.1 WALL SWITCHES

A. Manufacturers:

1. Hubbell.
2. Arrow-Hart.
3. Leviton.
4. Pass & Seymour.

B. Switches:

1. Single Pole: 20 ampere, Hubbell 1221.
2. Three Way: 20 ampere, Hubbell 1223.
3. Four Way: 20 ampere, Hubbell 1224.
4. Two Pole: 20 ampere, Hubbell 1222.

### 2.2 RECEPTACLES

A. Manufacturers:

1. Hubbell.
2. Arrow-Hart.
3. Leviton.
4. Pass & Seymour.

B. Receptacles:

1. Duplex: 20A, 125V, 2P, 3W, Grounding, NEMA Configuration 5-20R, Hubbell 5262.
2. Single: 20A, 125/250V, 3P, 4W Grounding, NEMA Configuration 14-20R, Hubbell 8410.
3. Single: 30A, 125/250V, 3P, 4W Grounding, NEMA Configuration 14-30R, Hubbell 9430A.
4. Single: 50A, 125/250V, 3P, 4W Grounding, NEMA Configuration 14-50R, Hubbell 9450A.
5. Ground Fault Interrupting: 15A, 125V, 2P, 3W, Grounding, Hubbell GF5262.

C. All receptacles within six (6) feet of a water source shall be GFCI type. Feed through to non-GFCI receptacles is not permitted.

### 2.3 INCANDESCENT WALL DIMMERS

A. Manufacturers:

1. Lutron.
2. Leviton.
3. Lithonia.

- B. Linear slide type equal to Lutron Nova Series, 600 watts minimum. For loads greater than 600W, provide dimmers of sufficient rating.

## 2.4 FLOOR BOXES AND OUTLETS

- A. Manufacturers:
  - 1. Hubbell.
  - 2. Walker.
  - 3. Thomas & Betts.
- B. Boxes: Shallow, semi-adjustable cast iron boxes, Hubbell B-2524.
- C. 120V Outlets: Brass cover, Hubbell S2930, and single short strap 15A-125V-2P-3W grounding receptacle, Hubbell 5284. Provide adaptors, carpet flanges and fittings as required.
- D. Telephone Outlets: Brass cover, Hubbell S2530. Provide adaptors, carpet flanges and fittings as required.

## 2.5 POKE-THROUGH SERVICE FITTINGS

- A. Manufacturers:
  - 1. Wiremold/RCI.
  - 2. Thomas & Betts.
- B. Description: Assembly comprising service fitting, poke-through component, fire stops and smoke barriers, and junction box for conduit termination.
- C. Fire Rating: 3 hours.
- D. Service Fitting:
  - 1. Type: Flush.
  - 2. Housing: Satin aluminum.
  - 3. Device Plate: Stainless steel.
  - 4. Configuration: As noted on drawings.

## 2.6 PLATES

- A. Manufactures:
  - 1. Hubbell.
  - 2. Arrow-Hart.
  - 3. Leviton.
  - 4. Pass & Seymour.
- B. General: Furnish plates suitable for the device.
- C. Finished Areas: Type 302/304 stainless steel 18% chrome, 8% nickel as follows:
  - 1. Switch Plates: Hubbell Type S1.
  - 2. Duplex Receptacles: Hubbell Type S8.
  - 3. GFCI: Hubbell Type S26.
  - 4. Blank: Hubbell Type S14.
  - 5. Other: Hubbell Type S as appropriate for device.

6. Use ganged plates for adjacent devices.

D. Label plate in accordance with section 260553.

## 2.7 WEATHERPROOF COVERS

A. Manufacturers:

1. Hubbell.
2. Arrow-Hart.
3. Leviton.
4. Pass & Seymour.

B. Description: Cast aluminum. Nonmetallic covers are not acceptable except in corrosive locations.

1. Vertical Duplex: Hubbell WP8M.
2. Vertical GFCI: Hubbell WP26M.
3. Horizontal Duplex: Hubbell WP8MH.
4. Horizontal GFCI: Hubbell WP26MH.

## 2.8 EXPOSED WORK COVERS

A. Manufacturers:

1. Steel City.
2. Crouse-Hinds.
3. Appleton.

B. Description: Stamped steel with edges flush against sides of box, suitable for indicated device, Steel City Type RS.

## 2.9 SPECIAL PURPOSE OUTLETS

A. As noted on the plans.

## 2.10 WIRING DEVICES COLORS

A. Coordinate color of devices with architect and owner's representative

B. Receptacles automatically controlled to comply with the applicable energy code shall be green and permanently marked as required by NEC 406.3.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Verify conditions under provisions of Division 01.

B. Verify outlet boxes are installed at proper height.

C. Verify wall openings are neatly cut and will be completely covered by wall plates.

D. Verify floor boxes are adjusted properly.



- E. Verify branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

### 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 products in accordance with manufacturer's instructions.
- B. Install devices plumb and level.
- C. Install switches with OFF position down.
- D. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.
- E. Do not share neutral conductor on load side of dimmers.
- F. Install receptacles with grounding pole on top.
- G. Connect wiring device grounding terminal to outlet box with bonding jumper and branch circuit equipment grounding conductor. Delete bonding jumper for isolated ground receptacles.
- H. Connect wiring devices by wrapping conductor around screw terminal for solid wire. Use listed fork terminals for stranded wire. Back wiring acceptable for stranded wire with devices listed for that purpose.
- I. Use jumbo size plates for outlets installed in masonry walls.
- J. Install no more than eight receptacles on a single circuit or as indicated on the drawings. Do not combine corridor receptacles with circuits serving other rooms. Patient room receptacle outlets shall be on circuits dedicated to that room.
- K. Identify receptacles in accordance with section 26 05 53.

### 3.4 FIELD QUALITY CONTROL

- A. Verify permanent labeling is installed for each device prior to circuit verification.
- 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.

3.5 ADJUSTING

- A. Adjust devices and wall plates to be flush and level.

END OF SECTION 26 76 26

## **SECTION 31 23 00 - SITE DRAINAGE SYSTEM**

### **PART 1 - GENERAL**

#### **1.01 RELATED DOCUMENTS**

Drawings, Technical Specifications, TSUS construction specifications Division 1, TSUS uniform general conditions for construction contract, safety requirements of OSHA and prevailing building codes & city, state and county.

#### **1.02 DESCRIPTION OF WORK**

Drainage System includes all site drainage structures including, but not limited to:

- A. Excavation and trenching
- B. Leveling fill course
- C. Backfilling
- D. Drainage pipe system including risers and grates

#### **1.03 QUALITY ASSURANCE**

- A. Perform excavation work in compliance with governing authorities having jurisdiction.
- B. Employ, at contractor's expense, a testing laboratory acceptable to Engineer to perform in-place density test of compacted fill.
- C. Re-testing of rejected materials and installed work to be done at contractors' expense.

#### **1.04 SUBMITTALS**

- A. Submit manufacturer's product data with installation instruction for all piping and drainage system materials.

### **PART 2 - PRODUCTS**

#### **2.01 PRODUCTS**

- A. Backfill material: provide mixture of sand and clay containing a minimum of 60% sand by volume and plasticity index of 12 maximum.
- B. Leveling course material: Course aggregate max. 3/4":

#### **2.02 DRAINAGE SYSTEM MATERIALS**

- A. Nyoplast ADS, Advanced Drainage Systems  
3130 Verona Avenue  
Buford, GA 30418
- B. N-12 WT Watertight Pipe
- C. Ductile iron grates and PVC bodies, 18" standard H-25 and 30" standard H-25 locking flange design.

### **PART 3 - EXECUTION**

#### **3.01 EXCAVATION AND BACKFILL**

- A. Excavate trenches to required depths as required to accomplish drainage design.

- B. Install coarse aggregate at bottom of trench to provide pipe support and achieve desired slope.
- C. Lay pipe and PVC risers in trench and stabilize.
- D. Backfill with approved materials with minimum 12" fill above pipe.

**END OF SECTION 31 23 00**

## **SECTION 31 25 13 - EARTHWORK**

### **PART 1 - GENERAL**

#### **1.01 RELATED DOCUMENTS**

Drawings, Technical Specifications, TSUS construction specifications Division 1, TSUS uniform general conditions for construction contract, safety requirements of OSHA and prevailing building codes & city, state and county.

#### **1.02 DESCRIPTION OF WORK**

The extent of earthwork is as follows, but not limited to:

- A. Preparation of subgrade for buildings, walks, and drives.
- B. Fill course for support of building slab.
- C. Back filling.

#### **1.03 QUALITY ASSURANCE**

- A. Perform excavation work in compliance with requirements of governing authorities having jurisdiction.
- B. Provide services of a laboratory for soil testing to determine compliance for earthwork operations.
- C. Retesting of rejected materials or installed work will be at Contractor's expense.

#### **1.04 SUBMITTALS**

Submit the following reports directly to the Owner with copy to the Contractor.

- A. Compaction test of existing sub-grade.
- B. Compaction test of earth fill.
- C. Analysis of earth fill.
- D. Atterberg limits of earth fill.

#### **1.05 JOB CONDITIONS**

- A. Data on subsurface conditions shown are not intended as warranties of accuracy or continuity between borings.
- B. It is expressly understood that the Owner is not responsible for interpretations or conclusions drawn from boring logs by the Contractor.
- C. Additional test borings and other exploratory operations may be made by the Contractor at no cost to the Owner.
- D. Provide adequate protection for existing underground utilities during earthwork operations.
- E. Unknown Utilities:
  - 1. If encountered, notify the Owner and wait for his instructions.
  - 2. If ascertained by the Owner that lines are abandoned, cap at a depth of 12" below finish grade of property line and record location.
  - 3. If encountered and work is continued without contacting the owner for instructions, repair to the lines will be done at the Contractor's expense and to the satisfaction of the utility company involved.

## **PART 2 – PRODUCTS**

### **2.01 SOIL MATERIALS**

- A. Building Fill and Backfill Material: Mixture of sand and clay containing a minimum of 60% sand by volume and plasticity index of 12 maximum.
- B. Yard Fill Material: Stockpiled topsoil from site clearing operation and/or off-site topsoil.
- C. Leveling Course Material: Bank-run sand.

### **2.02 VAPOR BARRIER**

- A. Six (6) mil polyethylene sheeting.
- B. Approved polyethylene tape.

## **PART 3 - EXECUTION**

### **3.01 EXCAVATION**

- A. Consists of removal and disposal of material encountered when establishing required finish grade elevations.
- B. Includes removal and disposal of pavements and other obstructions visible on ground surface, underground structures and utilities.
- C. Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations or dimensions without specific direction of the Owner. This excavation and remedial work directed by the Owner is at the Contractor's expense.
- D. When excavation has reached indicated elevations, notify the Owner to review conditions.
- E. Slope sides of excavation to maintain safe condition until backfilling.
- F. Material Storage:
  - 1. Stockpile satisfactory excavated materials where directed.
  - 2. Place, grade, and shape stored material for proper drainage.
- G. Excavation for Structures:
  - 1. Strip entire area of all vegetation, topsoil, and miscellaneous fill and excavate all soft spots.
  - 2. Excavate to depth to provide a minimum of 24" of inactive fill.
  - 3. Compact inactive subgrade a minimum of 95% of the maximum standard proctor density per ASTM D-695..
  - 4. Conform to elevations and dimensions shown within a tolerance of 1/2".
  - 5. Extend excavation sufficient distance from footings and foundation to permit placing and removal of forms.
  - 6. In excavating for footings and foundations, do not disturb bottom of excavation.
- H. Excavation for Pavement:
  - 1. Strip area under drives and parking of all vegetation.
  - 2. Stabilize the subgrade to a minimum depth of 10" with 8% by dry weight of hydrated lime in accordance with the general provisions of Texas Highway Department 1962 Standard Specification Item 260.
  - 3. Compact stabilized subgrade a minimum of 95% of the maximum standard Proctor density.
  - 4. Cut surface under pavement to comply with cross-sections, elevations and grades shown.

- I. Excavation for Trenches:
  1. Excavate trenches to depths to establish indicated flow lines and invert elevations.
  2. Notch under pipe bells to provide solid bearing the entire length of pipe.
  3. See Sections of Division 15.

### **3.02 COMPACTION**

- A. General: Control soil compaction providing minimum percentage of density specified for each area classification.
- B. Percentage of Maximum Density Requirements: Compact top 8" of subgrade and each layer of backfill or fill material to 95% Proctor Density at optimum moisture content.
- C. Moisture Control:
  1. Uniformly apply water to subgrade or layer of soil material where it must be moisture conditioned before compaction.
  2. Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to scheduled density.
  3. Soil material that has been removed because of too much moisture may be stockpiled and reused when moisture content has been reduced to level to permit satisfactory compaction.

### **3.03 BACKFILL AND FILL**

- A. General: Place acceptable soil material in layers to required subgrade elevations for each classification listed below:
  1. In excavations, use satisfactory excavated or borrow material.
  2. Under grassed area, use satisfactory excavated or borrow material.
  3. Under building slabs, use building fill material.
  4. Under walks and drives, use building fill material.
- B. Backfill excavations as promptly as possible, but not until completion of the following:
  1. Acceptance of work below grade.
  2. Inspection, testing, and recording locations of underground utilities.
  3. Removal of shoring and bracing.
  4. Removal of debris
- C. Ground Surface Preparations:
  1. Remove vegetation, debris, unsatisfactory soil materials, and obstructions for a minimum depth of 6" prior to placement of fill.
  2. Plow, strip, or break-up sloped surfaces steeper than 1 to 4 so that fill material will bond with existing surface.
- D. Placement and Compaction:
  1. Place backfill and fill material in layers not more than 6" loose depth.
  2. Before compaction, moisten or aerate each layer to provide optimum moisture content.
  3. Compact each layer to required percentage of maximum density.
  4. Do not place backfill or fill on surfaces that are muddy or contain frost.
  5. Place backfill and fill materials evenly adjacent to structures to required elevations.

### **3.04 GRADING**

- A. General
  1. Uniformly grade area of entire site including areas between property line

2. Land curb.
  3. Smooth finished surfaces within specified tolerances and compact with uniform levels or slopes between points where elevations are shown or between such points and existing elevations.
- B. Grading Outside Building Lines:
1. Grade areas adjacent to buildings to drain away from structure and to prevent ponding.
  2. Lawn Areas:
    - a) Finish areas to receive topsoil to within 0.10' required subgrade elevation.
    - b) Finish to grade with 3" topsoil, stockpiles of present topsoil may be reused.
  3. Under Walks and Drives:
    - a) Shape surfaces to line grade and cross-section to within 1/2" of required subgrade elevation.
    - b) Use leveling-course material for uniform level surface.
- C. Grading Under Building:
1. Grade smooth, even, free of voids, compacted as specified and to required elevations.
  2. Provide grades within 1/2" when tested with a 10' straight edge.
  3. Use leveling-course material for uniform level surface.
- D. Compaction: After grading, compact subgrade surfaces to the depth and percentage of maximum density for each area classification.

### **3.05 FIELD QUALITY CONTROL**

- A. Compaction test required.
1. Subgrade under building or paved area: One (1) for each 2000 square feet, but not less than three (3) tests.
  2. Each fill layer under building or paved area: One (1) for each 2000 square feet, but not less than three (3) tests.
- B. Provide at no additional cost to the Owner, any additional tests required for reason of poor compaction work.
- C. Any other tests required will be at the Owner's expense.

### **3.06 MAINTENANCE**

Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface reshape and compact to required density.

### **3.07 VAPOR BARRIER PLACEMENT**

- A. Cover entire fill area under building slab with vapor barrier.
- B. Lap side and end joints a minimum of six (6) inches.
- C. Tape all joints, all pipe, conduit, etc., penetrations.
- D. Notify termite control subcontractor, if specified, prior to placement of vapor barrier.

**END OF SECTION 31 25 14**



## **SECTION 31 25 14 - PORTLAND CEMENT CONCRETE PAVEMENT**

### **PART 1 - GENERAL**

#### **1.01 RELATED DOCUMENTS**

Drawings, Technical Specifications, TSUS construction specifications Division 1, TSUS uniform general conditions for construction contract, safety requirements of OSHA and prevailing building codes & city, state and county.

#### **1.02 DESCRIPTION OF WORK**

- A. Extent of concrete paving is shown on drawings including, curbs, gutters, walks and drives.
- B. Prepared sub-base is specified in Division 31.
- C. Concrete and related materials are specified in Division 3.
- D. Joint fillers and sealers are specified in Division 7.

#### **1.03 SUBMITTALS**

Furnish samples, test reports and material certificates as required in referenced sections for concrete and joint fillers and sealers.

#### **1.04 JOB CONDITIONS**

- A. Maintain access for vehicular and pedestrian traffic as required for other construction activities.
- B. Utilize barricades, warning signs and warning lights required.

### **PART 2 - PRODUCTS**

#### **2.01 MATERIALS**

- A. Forms:
  - 1. Use steel, wood or other suitable material of size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal.
  - 2. Use forms that are straight and free of distortions.
  - 3. Use flexible spring steel forms or laminated boards to form radius bends as required.
- B. Form Release Agent: Use a non-staining agent that will not discolor or deface surface of concrete.
- C. Reinforcing: As shown on drawings or these minimums:
  - 1. Welded Wire Mesh: Welded plain cold-drawn steel wire fabric, ASTM A185 6 x 6 x 4 ga.
  - 2. Reinforcing Bars: Welded or clip-assembled steel bar or rod mats, ASTM A184, No. 3 rods at 15" o.c. each way.
- D. Joint Dowel Bars:
  - 1. Plain steel bars, ASTM A615, Grade 40.
  - 2. Cut bars true to length with ends square and free of burrs.
- E. Expansion Caps:
  - 1. Furnish for one end of each dowel bar in expansion joint.

2. Design caps with one end closed and a minimum length of 3" to allow bars movement of not less than 1".
- F. Concrete Materials: Comply with requirements of applicable Division 3 sections for concrete materials, admixtures, bonding materials, curing materials, etc.
  - G. Expansion Joints:
    1. See Section 31 25 27 Sub Paragraph 2.03A for expansion joint materials.
  - H. Expansion Joint Sealer: Comply with requirements of applicable Division 7 sections for performed expansion joint fillers and sealers.

## **2.02 CONCRETE MIX, DESIGN AND TESTING**

- A. Comply with requirements of applicable Division 3 sections for concrete mix design, sampling and testing, and quality control.
- B. Compressive strength, 3000 p.s.i. in 28 days.
- C. Slump:
  1. Walks and drive: 4-1/2" maximum.
  2. Curbs: 3" maximum.

## **PART 3 - EXECUTION**

### **3.01 SURFACE PREPARATION**

- A. Remove any loose material from compacted sub-base surface before placing concrete.
- B. Proof-roll prepared sub-base surface to check for unstable areas and need for additional compaction.
- C. Do not begin paving work until all areas of poor compaction have been corrected.

### **3.02 FORM CONSTRUCTION**

- A. Set forms to required grades and lines, rigidly braced and secured.
- B. Check formwork for grade and alignment to following tolerances:
  1. Top of forms not more than 1/8" in 10'.
  2. Vertical surface on longitudinal axis, not more than 1/4" in 10'.
- C. Install sufficient forms to allow continuous progress of work and so that forms can remain in place at least 24 hours after concrete placement.
- D. Clean forms after each use, and coat with form release agent to insure separation from concrete without damage.

### **3.03 REINFORCEMENT**

Locate, place and support reinforcement as specified in Division 3 sections, unless otherwise indicated.

### **3.04 CONCRETE PLACEMENT**

- A. Comply with requirements of Division 3 sections for mixing and placing concrete and as herein specified.
- B. Moisten sub-base if required to provide a uniform dampened condition at time concrete is placed.
- C. Use methods of placement which prevent segregation of mix.
- D. Consolidate concrete along face of forms and adjacent to transverse joints with internal vibrator.
- E. Use only square face shovel for hand-spreading and consolidation.

- F. Consolidate with care to prevent dislocation of reinforcing, dowels, and joint devices.
- G. Deposit and spread concrete in a continuous operation between transverse joints; if interrupted for more than 1/2 hour, place a construction joint.
- H. When adjacent pavement is placed in separate operations, do not operate equipment on concrete until pavement has attained sufficient strength to carry loads without injury.

### 3.05 JOINTS

- A. General
  - 1. Construct expansion, contraction and construction joints to align with previously placed joints, unless shown otherwise.
- B. Contraction joints:
  - 1. Place as shown on drawings.
  - 2. Construct for a depth of 1/4 concrete thickness as follows:
    - a) Form in fresh concrete by grooving with a recommended cutting tool and finishing edges with a jointer.
    - b) Form by using a power saw equipped with shatterproof abrasive or diamond rimmed blade.
- C. Construction joints:
  - 1. Place at end of placements and where placement operations are stopped for 1/2 hour or more.
  - 2. Construct as shown or use standard metal key-way section forms.
  - 3. Where load transfer-slip dowel devices are used, install so that one end is free to move.
- D. Expansion joints:
  - 1. Provide pre-molded joint filler for expansion joints abutting concrete curbs, catch basins, manholes, inlets, structures, walks and other fixed objects.
  - 2. Locate at 30' o.c. each way maximum, unless otherwise shown and where walks, drives and other slabs abut structural members.
  - 3. Extend joint filler full width and not less than 1/2" or more than 1" from surface to allow space for sealer.
  - 4. Furnish joint filler in one piece for full width being placed, wherever possible.
  - 5. Where joint filler is placed in more than one length, lace or clip joint filler sections together.
  - 6. Protect top edge of joint filler during concrete placement with a metal cap or other temporary material and keep in place until concrete is placed on both sides of joint.
  - 7. Comply with applicable Division 7 sections for preparation of joints, materials, installation and performance.
- E. Expansion Joint Reinforcing:
  - 1. Provide #6 x 2'-6" slip dowel reinforcing at all expansion joints as follows:
    - a) In curbs: three (3).
    - b) In walks: 18" o.c.
    - c) In drives and parking areas: 15" o.c.

### 3.06 CONCRETE FINISHING

- A. After floating, test surface for trueness with a 10' straightedge.

- B. Distribute concrete as required to remove surface irregularities, and refloat repaired areas to provide a continuous smooth finish.
- C. Work edges of slabs, gutters, back top edge of curbs, and formed joints with an edging tool, and round to 1/2" radius.
  
- D. After completion of floating and troweling when excess moisture or surface sheen has disappeared, complete surface finish as follows:
  - 1. Walks: Broom finish by drawing a fine-hair broom across concrete surface perpendicular to line of traffic.
  - 2. Inclined surfaces: Provide a coarse non-slip finish by scoring surface with stiff-bristled brush, perpendicular to line of traffic.
  - 3. Drives: Burlap finish by dragging a seamless strip of damp burlap across concrete, perpendicular to line of traffic.
- E. After removal of forms, clean ends of joints and point up minor honeycombed areas.

### **3.07 CURING**

Cure finished paving, complying with applicable requirements of Division 3 section.

### **3.08 REPAIRS AND PROTECTION**

- A. Remove and replace areas with major defects, as directed by Owner's Representative.
- B. Drill test cores where directed by Engineer when necessary to determine magnitude of cracks or defective areas.
- C. Fill core holes in satisfactory pavement areas with Portland cement concrete bonded to pavement with epoxy resin grout.
- D. Exclude traffic from pavement for at least 14 days after placement.
- E. Sweep concrete pavement and wash free of stains, discolorations, dirt and other foreign material just prior to final inspection.

### **3.09 TRAFFIC AND LANE MARKINGS**

- A. Cleaning:
  - 1. Prior to application of paint, sweep and clean surfaces to eliminate loose material and dust.
  - 2. Do not apply paint to pavement unless it is thoroughly dry.
- B. Application:
  - 1. See layout of parking and driving lanes shown on plans.
  - 2. Apply paint with mechanical equipment to produce uniform width lines with straight distinct edges.
  - 3. Apply in two (2) coats at manufacturer's recommended rates to produce markings of five (5) mil minimum wet film thickness for each coat.
  - 4. Color as selected by Engineer.

**END OF SECTION 31 25 14**

## **SECTION 31 25 27 - CONCRETE CURBS**

### **PART 1 - GENERAL**

#### **1.01 RELATED SECTIONS**

- A. 31 25 13 Earthwork.
- B. 03 20 00 Concrete Reinforcement.
- C. 03 30 00 Cast-In-Place Concrete.

#### **1.02 STANDARDS**

- A. ASTM D1751 "Standard Specification for Performed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types)".
- B. AASHTO T180 "Standard Method of Test for Moisture-Density Relations of Soils Using a 10-LB. Rammer and an 18-in. Drop".

### **PART 2 - MATERIALS**

#### **2.01 CONCRETE**

- A. 3,000 psi minimum 28-day compressive strength.

#### **2.02 CURB, AND CURB AND GUTTER FORMS**

- A. Machine placement of curb, or curb and gutter: permitted, if an acceptable finished product true to line, grade, and cross section is produced consistently.

#### **2.03 EXPANSION JOINT MATERIAL**

- A. Joint Filler: Performed, non-extruding resilient asphalt/fiber type, 1/2 in. Thick; ASTM D1751.

#### **2.04 CONCRETE CURB REINFORCING**

- A. Curbs to be reinforced with two #4 reinforcing bars with one at top and one at bottom.

### **PART 3 - EXECUTION**

#### **3.01 GENERAL**

- A. In constructing the work, comply with State highway specifications for road construction.

**END OF SECTION 31 25 27**

## **SECTION 31 31 16- TERMITE CONTROL**

### **PART 1 - GENERAL**

#### **1.01 RELATED DOCUMENTS**

Drawings, Technical Specifications, TSUS construction specifications Division 1, TSUS uniform general conditions for construction contract, safety requirements of OSHA and prevailing building codes & city, state and county.

#### **1.02 DESCRIPTION OF WORK**

Provide soil treatment as herein specified:

- A. Under entire building slab
- B. Under and around all beams
- C. Around perimeter of building

#### **1.03 QUALITY ASSURANCE**

- A. Applicator shall be licensed for termite treatment by the Structural Pest Control Board of Texas.
- B. Materials and application shall conform to "Approved Reference Procedure" of the National Pest Control Association and the Environmental Protection Agency.

#### **1.04 JOB CONDITIONS**

- A. Do not apply soil treatment solution until excavating, filling and grading operations are completed.
- B. Do not apply soil treatment to frozen or excessively wet soils or during inclement weather.

#### **1.05 WARRANTY**

- A. **Provide a warranty for a period of five (5) years from acceptance of structures.**
- B. **Warranty signed by applicator and contractor.**
- C. **Warranty to certify that applied treatment will prevent infestation of subterranean termites during the warranty period, and if termite activity is discovered, contractor will retreat the soil and repair damage caused by termites.**

### **PART 2 - PRODUCTS**

#### **2.01 PRODUCTS**

- A. An emulsified concentrated insecticide for dilution with water.
- B. Do not dilute with fuel oil.
- C. At the time of preparation of this section, the following termiticides were acceptable, however the treatment is governed by 1.03 above:
  - 1. Dursban T.C.
  - 2. Dagnet
  - 3. Pryfon
  - 4. Demon T.C.
  - 5. Torpedo

- D. Mix concentrate in accordance with manufacturer's directions.

## **PART 3 - EXECUTION**

### **3.01 APPLICATION**

- A. Surface Preparation
  - 1. Remove foreign materials from areas to be treated.
  - 2. Treat under slabs prior to placement of vapor barrier.
  - 3. Loosen, rake, and level soils to be treated on exterior of building.
- B. Application Rates: Apply soil treatment solution as follows:
  - 1. Apply 4 gallons of solution per 10 lineal feet along both sides of grade beams.
  - 2. Apply 1 gallon of solution per 10 square feet under slabs.
  - 3. Apply 4 gallons of solution per 10 lineal feet along outside edge of building.
  - 4. Saturate not less than 1 foot in depth and 2 feet around each pipe or conduit penetration.
- C. Apply at least 12 hours prior to placement of concrete.
- D. Post signs warning workers that soil poisoning has been applied and do not remove until treated areas have been covered by other construction.

**END OF SECTION 31 31 16**

## **SECTION 31 38 80 - DRILLED FOOTINGS**

### **PART 1 - GENERAL**

#### **1.01 RELATED DOCUMENTS**

Drawings, Technical Specifications, TSUS construction specifications Division 1, TSUS uniform general conditions for construction contract, safety requirements of OSHA and prevailing building codes & city, state and county.

#### **1.02 DESCRIPTION OF WORK**

- A. Extent of drilled footings is shown on drawings.
- B. Location of footings including diameters of shafts and bells is shown on drawings.
- C. Elevation of bottom of bells, tops of shafts and details are shown on plans.
- D. Placement of concrete.

#### **1.03 QUALITY ASSURANCE**

- A. Engage a licensed Professional Engineer to perform layouts and measurements of drilled footings.
- B. Layout work for footings to lines and levels required before excavation.
- C. Provide actual horizontal axial locations, diameters, bottom and top elevations.
- D. Employ testing laboratory to determine designated bearing strata and to perform concrete tests.

#### **1.04 JOB CONDITIONS**

- A. Site Information
  - 1. Data on subsurface conditions are not intended as representations or warranties of continuity of such conditions.
  - 2. Owner is not responsible for interpretations or conclusions drawn by contractor from data shown.
  - 3. Data are made for convenience of Contractor and are not guaranteed to represent conditions that may be encountered.
- B. Existing Utilities
  - 1. Locate underground utilities by careful hand excavation before starting footing excavation.
  - 2. Protect from excavation operation utilities that are to remain in place.
  - 3. Should uncharted or incorrectly charted utilities be encountered contact Engineer for directions as to procedure.
  - 4. Repair damaged utilities to satisfaction of owner.

### **PART 2 - PRODUCTS**

#### **2.01 MATERIALS**

Concrete and reinforcing as noted in Section 03 30 00 - Cast-in Place Concrete and Section 03 20 00 - Concrete Reinforcing.



## **PART 3 - EXECUTIONS**

### **3.01 EXCAVATION**

- A. Excavate footings to required depths shown on drawings or to desired bearing strata.
- B. Excavate closely spaced footings and those occurring in fragile or sand strata, only after adjacent footings have been excavated, filled with concrete and allowed to set.
- C. Excavate shafts to depths and diameter shown then excavate bells to sizes indicated on drawings.
- D. Prior to the placement of concrete inspect excavation and remove any loose material.

### **3.02 REINFORCING**

- A. Clean steel thoroughly prior to fabrication.
- B. Fabricate cages of steel and place into excavation.
- C. Place steel accurately and symmetrically about axis of shaft and hold securely in place during placement of concrete.

### **3.03 CONCRETE PLACEMENT**

- A. Place concrete immediately after excavation and inspection of footing.
- B. Pump out any water in excavation that may cause segregation of concrete.
- C. Place concrete in one continuous operation and vibrate for consolidation.

**END OF SECTION 31 38 80**