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SECTION 01 1000 SUMMARY

PART 1 GENERAL

- 1.1 PROJECT
 - A. Project Name: Alamo Colleges Welding Facility Kerrville, TX.
 - B. Owner's Name: Alamo Colleges.
 - C. Architect's Name: Marmon Mok Architecture.
 - D. The Project consists of the alteration of an existing 4000 sf building into classrooms with a welding facility.
- 1.2 CONTRACT DESCRIPTION
 - A. Contract Type: A single prime contract based on a Stipulated Price as described in the Agreement Form.
- 1.3 DESCRIPTION OF ALTERATIONS WORK
 - A. Scope of demolition and removal work is indicated on drawings and specified in Section 02 4100.
 - B. Scope of alterations work is indicated on drawings.
 - C. Plumbing: Replace existing system with new construction.
 - D. HVAC: Replace existing system with new construction.
 - E. Electrical Power and Lighting: Replace existing system with new construction.

1.4 GENERAL NOTES

- A. It is the intent of these documents to construct an asbestos free and hazmat free project. In order to protect persons in contact with this project from any unnecessary exposure to any asbestos fibers, and to comply with the Asbestos Hazard Emergency Response Act it is prohibited to use any asbestos containing materials in all forms in the construction and operation of this facility.
- B. In new construction or alteration/renovation work, should the Contractor encounter previously unknown hazardous materials, the Contractor shall immediately cease work and notify the Architect. Major work for removal or treatment of such materials is not part of the work of this contract.
- C. Mold, mildew, and/or any other fungus is not allowed on this project. Any new materials which acquire this type of infection must be immediately removed from the project.
 - 1. Refer also to Section 09 2116 Gypsum Board Assemblies for specific procedures dealing with gypsum board installation.
- D. Failure to comply with these requirements constitutes non-compliance with the specifications and an unacceptable project.
- E. The Owner shall appoint and retain materials testing and construction observation services. When testing or observations reveal substandard, defective, non-compliant, or other wise unacceptable work, the Contractor shall correct such work and bear the cost of retesting/observation where testing/observation had revealed the unacceptable work.
- F. Preparation of new or existing substrate:
 - 1. New substrates shall be prepared as recommended by manufacturer of new work/ finish(es)/ material(s)/ product(s)/ equipment/ item(s) and/or any other new element(s).
 - 2. Cut, move, and remove existing finish(es), material(s), product(s), equipment, item(s), and/or other element(s) (hereinafter referred to as "existing element(s)") and prepare substrate as necessary for application of new work/ finish(es)/ material(s)/ product(s)/ equipment/ item(s) and/or any other new element(s) (hereinafter referred to as "new work") required for a complete and satisfactory professional installation.
 - a. This includes the removal of existing element(s) whenever the existing element(s) is/are not to remain in place or is/are not an appropriate substrate and/or condition for the new work, as determined by the manufacturer or Architect. This includes, but is not limited to, existing flooring, wall elements, and/or other floor, wall, ceiling, and/or other existing element(s) (interior and exterior), unsuitable substrate and/or condition, and/or other material which compromises the new work installation, or is/are not

acceptable to the manufacturer of the new work, or voids the warranty of the new work application(s).

- 3. Prepare new and existing substrates and surfaces as required to receive new work/ finish(es)/ material(s)/ product(s)/ equipment/ item(s) and/or any other new element(s) application(s).
- G. Temporary Removal
 - 1. Work of the respective specification section for new work over existing construction may include temporary removal of "existing elements", repair and preparation of existing substrate(s) required for a proper, complete and satisfactory professional installation of new work.
 - 2. Carefully cut, move, or remove other existing elements to remain, as necessary for access or proper application of alterations and renovation work. Replace and restore in working order at completion to a finished condition indistinguishable from the new work.
- H. Installation of Door, Cabinet and other Owner sensitive Hardware.
 - 1. This requirement shall be for any product or unit that will require installation of all door hardware and locks that are to receive a core with the Alamo Colleges keyway.
 - 2. Door Hardware, Cabinet locks and other Owner sensitive hardware installation shall be turnkey by Hardware supplier, except where the hardware is traditionally provided to other suppliers such as storefront manufacturers and other manufacturers requiring their installation. Hardware supplier shall provide experienced factory trained personnel who have completed installations similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance. Hardware installation shall be under the direction and control of an Architectural Hardware Consultant (AHC). Self installation by General Contractor or any other contractor shall not be allowed. Prior to Substantial Completion, hardware supplier and supervising Architectural Hardware Consultant (AHC) shall perform a final inspection of installed door hardware and state in written report whether work complies with or deviates from requirements, including whether door hardware is properly installed, operating and adjusted.
- I. On renovation/alteration/remodel work at existing buildings, this contractor shall include in their responsibilities the care and maintenance of the HVAC filters and return air grills for the area(s) which the work of this contract occurs. The filters shall be examined weekly and replaced with clean filters appropriate to the unit. Upon Substantial Completion clean/new filters shall be placed in the HVAC units and all coils for the HVAC units shall be cleaned.
- J. Debris, rubbish, trash, waste and other matter to be disposed of throughout this project shall be handled in a thorough, neat, proper, legal, and expeditious manner.
- K. The use of explosives is not allowed.
- L. When working with an existing building, provide a secure and weather tight building at all times.
- 1.5 QUALITY ASSURANCE
 - A. The work of each section of these specifications shall be executed by an entity with a minimum experience level in the work described as expressed in the section.
 - B. Where the experience level is not expressed it shall be known here that the experience level must be at least five (5) years of documented experience in the work of the specification section. Contractors and subcontractors must be able to show recent examples of their work (up to (3) three) in the local area.
 - C. Products and fabrications shall be made by manufacturers/fabricators with a minimum experience level expressed in the specification section.
 - D. Where the experience level of the manufacturer/fabricator/contractor is not expressed it shall be known here that the experience level must be at least five (5) years of documented experience in the product or fabrication or service of the items/work described in the specification section.
- 1.6 WORK BY OWNER
 - A. Items noted NIC (Not in Contract) will be supplied and installed by Owner before Substantial Completion. Some items include:
 - 1. Movable cabinets.
 - 2. Furnishings.

- 3. Small equipment.
- 4. Artwork.
- B. Owner will supply the following for installation by Contractor:
 1. Welding curtains.
- 1.7 OWNER OCCUPANCY
 - A. Owner intends to occupy the Project upon Substantial Completion.
 - B. Cooperate with Owner to minimize conflict and to facilitate Owner's operations.
 - C. Schedule the Work to accommodate Owner occupancy.
- 1.8 CONTRACTOR USE OF SITE AND PREMISES
 - A. Construction Operations: Limited to areas noted on Drawings.
 - B. Arrange use of site and premises to allow:
 - 1. Work by Owner.
 - C. Provide access to and from site as required by law and by Owner:
 - 1. Emergency Building Exits During Construction: Keep all exits required by code open during construction period; provide temporary exit signs if exit routes are temporarily altered.
 - 2. Do not obstruct roadways, sidewalks, or other public ways without permit.
 - D. Existing building spaces may not be used for storage.
 - E. Time Restrictions:
 - 1. Limit conduct of especially noisy exterior work to times agreed upon in advance with the Owner and with seven (7) days notice.
 - 2. Limit conduct of especially noisy exterior work to the hours of _____.
 - F. Utility Outages and Shutdown:
 - 1. Limit disruption of utility services to hours the building is unoccupied.
 - a. Coordinate all utility outages with Owner. Provide a minimum of 7 days notice to Owner and authorities having jurisdiction.
 - b. Do not disrupt or shut down life safety systems, including but not limited to fire sprinklers and fire alarm system, without 7 days notice to Owner and authorities having jurisdiction.
 - c. THE RÉQUIREMENTS OF THIS PARAGRAPH SUPERSEDE THE TIME REQUIREMENTS FOR SCHEDULING UTILITY OUTAGES IN ALL SUBSEQUENT SPECIFICATION SECTIONS AND ON ALL DRAWINGS.
 - 2. Prevent accidental disruption of utility services to other facilities.

1.9 AVAILABLE MANUFACTURERS - FOR CONSIDERING PROPOSED SUBSTITUTES

- A. Substitutions: The product(s) referenced by the manufacturer listed or list of manufacturers provided, form the basis of design. The contractor at their option may provide an alternate manufacturer as a proposed substitute, however, if another product is proposed, the Contractor shall provide data from the specified manufacturer & product(s) as well as equivalent data from the proposed manufacturer for a comparison, review, and determination of acceptance (approval or disapproval) by the Architect. Approval cannot be made if adequate comparison information is not provided. Absence of specified manufacturers' data is grounds for disapproval.
 - Comparison format: Provide a three column chart. In the left column (column one) make a list of data (standards, performance requirements, physical characteristics, available options as listed in the specifications) and product, item, and/or system features pertinent to the project. At the center column (column two) provide the corresponding results for the data listed in column one for the specified product, item, or system. At the right column (column three) provide the equivalent information for the proposed substitution.
 - 2. Provide a thorough and clear identification of the proposed substitution.
- B. Refer to Section 01 3000 Administrative Requirements AND Section 01 6000 Product Requirements for substitution procedures.
- C. For each "Substitution Request" form provide a point-for-point comparison showing the values of the specified product, item, system or procedure to the same values of the proposed substitute. See specimen sample "Comparison Sheet" attached at the end of this section.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

SECTION 01 2000 PRICE AND PAYMENT PROCEDURES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Procedures for preparation and submittal of applications for progress payments.
- B. Documentation of changes in Contract Sum and Contract Time.
- C. Correlation of Contractor submittals based on changes.
- D. Record Documents.
- 1.2 RELATED REQUIREMENTS
 - A. Agreement Form
 - B. General Conditions
- 1.3 SCHEDULE OF VALUES
 - A. Form to be used: Submit a printed schedule on AIA Forms G703 Application and Certificate for Payment Continuation Sheet.
 - 1. Contractor's standard form or electronic media print out may be considered for use.
 - a. Submit a sample form to the Architect for review and approval.
 - b. Form shall have all the elements of AIA Forms G703 as a minimum.
 - c. This consideration will be made only with the understanding that the submitted form has the exact and full force and effect of the AIA Form G703 and does not alter in any way AIA Forms G702 and G703.
 - 2. AIA Forms G702 and G703 must be used unless approved otherwise by the Architect.
 - B. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit draft to Architect for approval.
 - C. Forms filled out by hand will not be accepted.
 - D. Submit Schedule of Values in duplicate within 15 days after date of Owner-Contractor Agreement.
 - 1. Submit Schedule of Values, for review and approval by the Architect, more than 10 days prior to the first Application for Payment
 - 2. An approved Schedule of Values must be submitted with the first request for payment and all subsequent requests for payment.
 - 3. The Schedule of Values may only change by Change Order after it has been approved.
 - E. The Schedule of Values and the Construction Progress Schedule shall directly correlate. The work completed in the current period must be accurately reflected in both documents.
 - 1. Only items which have been accomplished and shown in the Construction Progress Schedule for the current time period may be claimed in the Application and Certificate for Payment (request for payment).
 - 2. The Architect/Engineer has the right to ask for and receive additional information or definition on any or all items, including further breakdown.
 - F. Format: Utilize the Table of Contents of this Project Manual. Identify each line item with number and title of the specification Section. Identify General Requirements, Bonds, Insurance,. Also identify Contractor's profit and Contractor's overhead
 - 1. Further breakdown may be required for separately identified items, systems, procedures or processes.
 - G. Revise schedule to list approved Change Orders, with each Application For Payment.
 1. Each Change Order must be separately listed and its contents itemized.
 - H. The entire Schedule of Values must be legible. A minimum ten (10) point font size is recommended. Illegible documents will not be accepted. Legibility is determined by the Architect.
- 1.4 RECORD DOCUMENTS
 - A. Refer to Section 01 3000 Administrative Requirements, item entitled 'Record Documents.'
 - B. Record Documents shall be kept current.

- C. Record Drawings shall be reviewed each month by the Architect (and consultants as applicable) at the time of the submittal of the Application and Certificate for Payment. Record Documents shall be current at time of review for the Application and Certificate for Payment.
- 1.5 APPLICATIONS FOR PROGRESS PAYMENTS
 - A. Payment Period: Submit at intervals stipulated in the Agreement.
 - B. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit sample to Architect for approval.
 - C. Forms filled out by hand will not be accepted.
 - D. For each item, provide a column for listing each of the following:
 - 1. Item Number.
 - 2. Description of work.
 - 3. Scheduled Values.
 - 4. Previous Applications.
 - 5. Work in Place and Stored Materials under this Application.
 - a. When stored materials are claimed, provide a copy of a paid invoice or receipt from the source of the material. Unpaid stored materials are not allowed to be requested for payment.
 - b. Whenever stored materials have not been installed by the time a subsequent Application and Certificate for Payment is due, create a footnote or a new line item identifying the material or materials separately as "previously listed and not installed." Include the accurate amount(s) for each item. Carry this (these) footnote(s) or line item(s) forward until the materials are installed.
 - 6. Authorized Change Orders.
 - 7. Total Completed and Stored to Date of Application.
 - 8. Percentage of Completion.
 - 9. Balance to Finish.
 - 10. Retainage.
 - a. Unless noted otherwise in the Contract Documents, until issuance of Final Certificate for Payment, the Owner will pay 90% of the amount due the Contractor on account of progress payments.
 - E. Execute certification by signature of authorized officer.
 - F. Use data from approved Schedule of Values. Provide dollar value in each column for each line item for portion of work performed and for stored products.
 - G. List each authorized Change Order as a separate line item, listing Change Order number and dollar amount as for an original item of work.
 - 1. Identify contents of Change Order.
 - 2. Itemize contents of Change Orders. Reflect in both the Schedule of Values and the Construction Progress Schedule.
 - H. Submit one electronic and three hard-copies of each Application for Payment.
 - I. Include the following with the application:
 - 1. Transmittal letter as specified for submittals in Section 01 3000.
 - 2. Construction progress schedule, revised and current as specified in Section 01 3000 and Section 01 3216.
 - a. The Construction Progress Schedule must be fully coordinated with the Application and Certificate for Payment Continuation Sheet AIA G703 or equivalent approved sheet.
 - b. Lack of coordination is cause for rejection of the Application and Certificate for Payment.
 - 3. Current construction photographs specified in Section 01 3000.
 - 4. Partial release of liens from major subcontractors and vendors.
 - 5. Provide an itemized list of entries made to the Record Set of documents made since the last Application for Payment. The Owner and Architect may review the record set at the project site for this information. If no entries were made to the Record Set, the Contractor shall make a written statement to that effect.
 - 6. Record Drawings shall be reviewed each month by the Architect, Engineers, and consultants at time of the submittal of the Application and Certificate for Payment. Record

Documents shall be current at the time of each review for Application and Certificate for Payment. Record Documents found not to be current shall be cause for payment request to be rejected.

- 7. Affidavits attesting to off-site stored products.
 - a. Prior approval by the Owner is required before off-site stored products may be submitted. Submittal without prior approval is cause for rejection of payment for these items.
 - b. Products must be suitably stored, marked and maintained separately from other contents of the building. Site must be available for Owner or Architect to verify storage of products.
 - c. Proof of an appropriate current bond for the site of the stored materials is required.
 - d. Provide an appropriate insurance policy for the stored materials of this project as contents of the site. The policy shall cover the replacement of the stored materials without additional cost to the Owner.
- 8. Provide 'Paid' receipts for stored items if requesting payment for these items. Payment by Owner will not be made to Contractor without the 'Paid' receipts.
- 9. Provide a separate sheet indicating Time and Dollar expenditure percentages:
 - a. Provide ratio of time spent to the total time of the contract expressed as a percentage.
 - b. Provide ratio of total dollars (requested to date) to the current contract total expressed as a percentage.
- 10. Provide an updated Submittal Schedule.
- 11. Provide a current Submittal Log indicating the status of each item.
- 12. Provide a current RFI (Request for Information) Log indicating the status of each item.
- 13. Provide Certified Payrolls for the Contractor and Subcontractors covering the current payment period.
- 14. Make available the up-to-date Record Documents for review by Owner, Architect and consultants. Record Documents shall be current at time of review for the Application and Certificate for Payment.

1.6 MODIFICATION PROCEDURES

- A. Submit name of the individual authorized to receive change documents and who will be responsible for informing others in Contractor's employ or subcontractors of changes to the Contract Documents.
- B. For minor changes not involving an adjustment to the Contract Price or Contract Time, Architect will issue instructions directly to Contractor.
- C. For other required changes, Architect will issue a document signed by Owner instructing Contractor to proceed with the change, for subsequent inclusion in a Change Order.
 - The document will describe the required changes and will designate method of determining any change in Contract Price or Contract Time.
 - 2. Promptly execute the change.
- D. For changes for which advance pricing is desired, Architect will issue a document that includes a detailed description of a proposed change with supplementary or revised drawings and specifications, a change in Contract Time for executing the change with a stipulation of any overtime work required and the period of time during which the requested price will be considered valid. Contractor shall prepare and submit a fixed price quotation within days.
- E. Contractor may propose a change by submitting a request for change to Architect, describing the proposed change and its full effect on the work, with a statement describing the reason for the change, and the effect on the Contract Sum and Contract Time with full documentation. Document any requested substitutions in accordance with Section 01 6000.
- F. Computation of Change in Contract Amount: As specified in the Agreement and Conditions of the Contract.
 - 1. For change requested by Architect for work falling under a fixed price contract, the amount will be based on Contractor's price quotation.
 - 2. For change requested by Contractor, the amount will be based on the Contractor's request for a Change Order as approved by Architect.

- 3. For pre-determined unit prices and quantities, the amount will based on the fixed unit prices.
- 4. For change ordered by Architect without a quotation from Contractor, the amount will be determined by Architect based on the Contractor's substantiation of costs as specified for Time and Material work.
- G. Substantiation of Costs: Provide full information required for evaluation.
 - 1. On request, provide the following data:
 - a. Quantities of products, labor, and equipment.
 - b. Taxes, insurance, and bonds.
 - c. Overhead and profit.

2.

- d. Justification for any change in Contract Time.
- e. Credit for deletions from Contract, similarly documented.
- Support each claim for additional costs with additional information:
- a. Origin and date of claim.
- b. Dates and times work was performed, and by whom.
- c. Time records and wage rates paid.
- d. Invoices and receipts for products, equipment, and subcontracts, similarly documented.
- 3. For Time and Material work, submit itemized account and supporting data after completion of change, within time limits indicated in the Conditions of the Contract.
- H. Execution of Change Orders: Architect will issue Change Orders for signatures of parties as provided in the Conditions of the Contract.
- I. After execution of Change Order, promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order as a separate line item and adjust the Contract Price.
 - 1. If a Change Order contains more than one item, separately itemize on the Schedule of Values and the Construction Progress Schedule.
- J. Promptly revise progress schedules to reflect any change in Contract Time, revise sub-schedules to adjust times for other items of work affected by the change, and resubmit.
- K. Promptly enter changes in Project Record Documents.
- 1.7 APPLICATION FOR FINAL PAYMENT
 - A. Prepare Application for Final Payment as specified for progress payments, identifying total adjusted Contract Price, previous payments, and sum remaining due.
 - B. Application for Final Payment will not be considered until the following have been accomplished:
 1. All closeout procedures specified in Section 01 7000.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

SECTION 01 3000 ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

- 1.1 SECTION INCLUDES
 - A. General administrative requirements.
 - B. Preconstruction meeting.
 - C. Progress meetings.
 - D. Construction progress schedule.
 - E. Submittal Schedule.
 - F. Progress photographs.
 - G. Coordination drawings.
 - H. Submittals for review, information, and project closeout.
 - Number of copies of submittals. I.
 - J. Submittal procedures.
 - 1. Transmittal Letter.
 - K. Record Documents.

RELATED REQUIREMENTS 1.2

- A. General Conditions: Dates for applications for payment.
- B. Section 01 6000 Product Requirements: Additional requirements.
- C. Section 01 7000 Execution and Closeout Requirements: Additional coordination requirements.D. Section 01 7800 Closeout Submittals: Project record documents; operation and maintenance data: warranties and bonds.
- 1.3 GENERAL ADMINISTRATIVE REQUIREMENTS
 - A. Conform to requirements of Section 01 7000 Execution and Closeout Requirements for coordination of execution of administrative tasks with timing of construction activities.
- 1.4 PROJECT COORDINATOR
 - A. Cooperate with the Project Coordinator in allocation of mobilization areas of site; for field offices and sheds, for worker access, traffic, and parking facilities.
 - B. During construction, coordinate use of site and facilities through the Project Coordinator.
 - C. Comply with Project Coordinator's procedures for intra-project communications; submittals, reports and records, schedules, coordination drawings, and recommendations; and resolution of ambiguities and conflicts.
 - D. Comply with instructions of the Project Coordinator for use of temporary utilities and construction facilities. Responsibility for providing temporary utilities and construction facilities is identified in Section 01 1000 - Summary.
 - E. Coordinate field engineering and layout work.
 - F. Make the following types of submittals to Architect through the Project Coordinator:
 - Requests for Information. 1.
 - Shop drawings, product data, and samples. 2.
 - Test and inspection reports. 3.
 - Manufacturer's instructions and field reports. 4.
 - Applications for payment and change order requests. 5.
 - Progress schedules. 6.
 - Coordination drawings. 7.
 - Closeout submittals. 8.
- 1.5 SUBSTITUTIONS
 - A. Substitutions will not be considered or accepted after the specified time period for submitting requests for substitutions.
 - Substitutions will not be accepted after the Owner-Contractor Agreement has been signed. 1.
 - 2. Any product, system or procedure not specifically listed or described in the Contract Documents is subject to rejection.

- 3. Submit request for substitutions for approval not later than 14 days prior to the bid date. Upon review by the Architect and if approved, notification will be made by Addendum.
- 4. No response constitutes no approval. The proposed product may not be used on this project for the proposed use.
- 5. Where a listed manufacturers product is submitted, and this product is not the one described in the Contract Documents, the submitter must provide a point for point comparison of the submitted proposed product to the product described in the Contract Documents.
 - a. The Architect will review the data to determine if it will be accepted.
 - b. Products with incomplete comparison data are subject to rejection.
- 6. Use the "Substitution Request (Pre-Bid)" form to accompany the back up material for consideration.
 - a. The form shall be signed by a person authorized to conduct the construction of the proposed project. Signature of the form by secretarial or clerical personnel is cause for rejection.
 - Refer below for the article entitled "AVAILABLE MANUFACTURERS FOR CONSIDERING PROPOSED SUBSTITUTES". A specimen sample "Comparison Sheet" is attached to this Section 01 3000.
- B. Request for substitutions prior to Bid (Pre-Bid).
 - 1. No response constitutes no approval. The proposed product may not be used on this project for the proposed use.
 - 2. Rejection of proposed substitute may be made by letter or memo from the Architect at the Architects sole discretion.
 - 3. Use the "Substitution Request (Pre-Bid)" form to accompany the back up material for consideration.
 - a. The form shall be signed by a person authorized to conduct the construction of the proposed project. Signature of the form by secretarial or clerical personnel is cause for rejection.
 - b. Refer below for the article entitled "AVAILABLE MANUFACTURERS FOR CONSIDERING PROPOSED SUBSTITUTES". A specimen sample "Comparison Sheet" is attached to this Section 01 3000.
- C. Unapproved substitutes shall not be proposed or submitted with the bid. Unapproved substitutes will not be considered if submitted with the bid.
- D. Request for substitution after the Bidding phase (Post-Bid):
 - 1. Substitutions may be considered for use after the Owner-Contractor Agreement has been signed.
 - 2. Submit the request for substitution within 30 days of Contract (Owner-Contractor Agreement) date.
 - 3. Use the "Substitution Request (Post-Bid & After Execution of the Contract)" form to accompany the back up material for consideration.
 - a. The form shall be signed by a person authorized to conduct the construction of the proposed project. Signature of the form by secretarial or clerical personnel is cause for rejection.
 - b. Refer below for the article entitled "AVAILABLE MANUFACTURERS FOR CONSIDERING PROPOSED SUBSTITUTES". A specimen sample "Comparison Sheet" is attached to this Section 01 3000.
 - 4. Notification of approval for the proposed substitute will be made by Architects Supplemental Instruction (ASI).
 - 5. No response constitutes no approval. The proposed product may not be used on this project for the proposed use.
 - 6. Notification of rejection may be made by letter or memo from the Architect at the Architects sole discretion.
- E. Consideration of substitutes:
 - 1. Any product, item, system or procedure not specifically listed or described in the Contract Documents is subject to rejection.

- Where a listed manufacturers product is submitted, and this product is not the one described in the Contract Documents, the submitter must <u>provide a point for point</u> <u>comparison</u> of the submitted proposed product to the specified product described in the Contract Documents. Refer to Section 01 6000 Product Requirements for "Substitution Procedures".
 - a. For each "Substitution Request" form provide a point-for-point comparison showing the values of the specified product, item, system or procedure to the same values of the proposed substitute. Refer to the article below entitled "AVAILABLE MANUFACTURERS - FOR CONSIDERING PROPOSED SUBSTITUTES". See also the specimen sample "**Comparison Sheet**" attached at the end of this section.
 - b. The Architect will review the data to determine if it will be accepted.
 - c. Products with incomplete comparison data are subject to rejection.
 - d. Products determined by the Architect not to be essentially equivalent, or appropriate, or desired, or better than the described product in the Contract Documents will be rejected.
- e. Products with incomplete comparison data are subject to rejection.
- F. Refer also to Section 01 6000 Product Requirements.
- 1.6 AVAILABLE MANUFACTURERS FOR CONSIDERING PROPOSED SUBSTITUTES
 - A. Substitutions: The compliant product(s) by the manufacturer listed or list of manufacturers provided, form the basis of design. The contractor at their option may provide an alternate manufacturer as a proposed substitute, however, if another product is proposed, the Contractor shall provide data from the specified manufacturer & product(s) as well as equivalent data from the proposed manufacturer for a comparison, review, and determination of acceptance (approval or disapproval) by the Architect. Approval cannot be made if adequate comparison information is not provided. Absence of specified manufacturers' data is grounds for disapproval.
 - 1. Comparison format: Provide a three column chart. In the left column (column one) make a list of data (standards, performance requirements, physical characteristics, available options as listed in the specifications) and product, item, and/or system features pertinent to the project. At the center column (column two) provide the corresponding results for the data listed in column one for the specified product, item, or system. At the right column (column three) provide the equivalent information for the proposed substitution.
 - 2. Provide a thorough and clear identification of the proposed substitution.
 - B. Refer to Section 01 3000 Administrative Requirements AND Section 01 6000 Product Requirements for substitution procedures.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

- 3.1 PRECONSTRUCTION MEETING
 - A. Owner will schedule a meeting after Notice of Award.
 - B. Attendance Required:
 - 1. Owner.
 - 2. Architect.
 - 3. Contractor.
 - 4. Major subcontractors.
 - C. Agenda:
 - 1. Execution of Owner-Contractor Agreement.
 - 2. Submission of executed bonds and insurance certificates.
 - 3. Distribution of Contract Documents.
 - 4. Submission of list of subcontractors, list of products, schedule of values, and progress schedule.
 - 5. Designation of personnel representing the parties to Contract, Major subcontractors and Architect.
 - 6. Contractor's Use of Instruments of Service in Electronic Form.

- a. The Architect may, with the concurrence of the Owner, furnish to the Contractor versions of Instruments of Service in electronic form. The Contract Documents executed or identified in accordance with Subparagraph 1.5.1 shall prevail in case of an inconsistency with subsequent versions made through manipulatable electronic operations involving computers. (Note: This is ONLY for architectural files authored by Marmon Mok. Availability of Architect's consultant authored electronic files is at the sole discretion of the individual consultant firm.)
- b. The Contractor shall sign and return the Documents Release & MM Disclaimer for release of electronic Media Documents prior to their release. Contractor's use of electronic media is subject to the limitations expressed in the disclaimer. Design drawings which are schematic in nature, are not available. A copy of the Documents Release & MM Disclaimer entitled "RELEASE OF LIABILITY AND INDEMNIFICATION FOR USE OF ELECTRONIC FILES" follows the Supplementary Conditions.
 - 1) The Contractor shall not transfer or reuse Instruments of Service in electronic or machine-readable form without the prior written consent of the Architect and/or Architect's consultant.
- 7. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
- 8. Scheduling.
- 9. Use of premises by Owner and Contractor.
- 10. Owner 's requirements and partial occupancy prior to completion.
- 11. Construction facilities and controls provided by Owner.
- 12. Temporary utilities provided by Owner.
- 13. Security and housekeeping procedures.
- 14. Application for Payment procedure.
- 15. Procedures for testing.
- 16. Procedures for maintaining record documents.
- 17. Requirements for start-up of equipment.
- 18. Inspection and acceptance of equipment put into service during construction period.
- D. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

3.2 PROGRESS MEETINGS

- A. Schedule and administer meetings throughout progress of the work at maximum bi-monthly intervals.
- B. Attendance Required: Job superintendent, major subcontractors and suppliers, Owner, Architect, as appropriate to agenda topics for each meeting.
- C. Agenda:
 - 1. Review minutes of previous meetings.
 - 2. Review of work progress.
 - 3. Field observations, problems, and decisions.
 - 4. Identification of problems that impede, or will impede, planned progress.
 - 5. Review of submittals schedule and status of submittals.
 - 6. Review of off-site fabrication and delivery schedules.
 - 7. Maintenance of progress schedule.
 - 8. Corrective measures to regain projected schedules.
 - 9. Planned progress during succeeding work period.
 - 10. Coordination of projected progress.
 - 11. Maintenance of quality and work standards.
 - 12. Effect of proposed changes on progress schedule and coordination.
 - 13. Updates to Record Drawings
 - 14. Other business relating to work.
- D. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

3.3 CONSTRUCTION PROGRESS SCHEDULE

- A. Within 10 days after date of the Agreement or the date established in Notice to Proceed, whichever comes first, submit preliminary schedule .
- B. If preliminary schedule requires revision after review, submit revised schedule within 10 days.
- C. Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review.
 - 1. Include written certification that major contractors have reviewed and accepted proposed schedule.
- D. Within 10 days after joint review, submit complete schedule.
- E. Submit updated schedule with each Application for Payment.
- F. Updated Schedules need to clearly identify changes (by cloud) from the previous schedule if changes are other than a reflection of the work accomplished when submitted with the request for payment.
- G. Contractor shall provide a remediation plan whenever unapproved changes are made or other event alters the scheduled work.

3.4 ADVERSE WEATHER

- A. Rain Days (or other inclement weather days) per month may be allowed only for the number of days which exceed the historic mean monthly regional count according to the weather data schedule following these Supplementary Conditions / as recorded by the nearest reporting NOAA Weather Station. Additional days for "muddy" or other unworkable condition(s) will be considered and determined at the sole discretion of the Architect. A copy of the "Weather Data Sheet for San Antonio, Texas" (WX) follows this section.
 - 1. The Contractor shall provide evidence of rain days (or other inclement weather days) and site conditions for each actual rain day and additional day, which is claimed and unclaimable. Rain days and additional days up to the mean number of days per month are considered unclaimable, however, they must be substantiated in the same manner as the excess days in order to justify a claim for the excess days.
 - 2. A "rain day" (or inclement weather day), for the purposes of this contract, is a day that there is one tenth (0.1) of an inch (2.54 mm) of rain, or greater, at the site, prior to 3:00 PM and the resulting conditions disallow work on the site. Conditions must be substantiated and agreed to by the Architect otherwise they will not be allowed.
- B. No additional time shall be allowed for "rain" days (or other inclement weather) if the number is within the amount historically expected in the area according to the nearest weather data collecting entity.

3.5 SUBMITTAL SCHEDULE

- A. The Contractor shall submit a Schedule of Submittals within 30 day of the notice to proceed, unless noted otherwise.
- B. Schedule must be approved by Architect before any submittals are delivered.
 - 1. Architect will review and respond to submitted Submittal Schedule within 14 days after receipt in Architects office.
 - 2. Revise and Resubmit for approval when required by Architect.
 - 3. Schedule cannot be approved in part. Entire schedule must be approved before submittals can begin.
- C. Indicate Specification Section number, item description, proposed date of submittal, and list of any other items or submittals with which this item must be coordinated.
 - 1. Follow numbering procedures identified in paragraph entitled "Submittal Procedures" located below in this Section.
- D. Schedule shall contain itemized list of Shop Drawings, Product Data, Samples, and / or similar submittal requested by the Contract Documents.
 - 1. Also Include and separately identify the following in the schedule (itemize each):
 - a. Identify submittals with Professional Engineer Requirements.
 - b. Identify Manufacturer Qualification Requirements.
 - c. Identify Installer Qualification Requirements.
 - d. Mockup Requirements

- e. Pre-installation Meeting Requirements.
- f. Special Warranty Requirements.
- g. Identify products and submittals with Extra Material Requirements, Tools, Spare Parts and similar items to be turned over to the Owner.
- h. Identify all Field Testing Requirements. Include anticipated date of testing and expected date of test report delivery to Architect and Owner.
- E. Indicate the time required for delivery of the specified item (product, material, report, activity, document, event or other item) to the site after the approval of the submittal.
- F. Submit an updated Submittal Schedule with each Application and Certificate for Payment.
- 3.6 PROGRESS PHOTOGRAPHS
 - A. Provide photographs of site and construction throughout progress of work produced by an experienced photographer, acceptable to Architect.
 - B. Take photographs on date for each application for a payment and as follows:
 - 1. Completion of site clearing.
 - 2. Excavations in progress.
 - 3. Foundations in progress and upon completion.
 - 4. Structural framing in progress and upon completion.
 - 5. Enclosure of building, upon completion.
 - 6. Final completion, minimum of ten (10) photos.
 - C. Take photographs as evidence of existing project conditions as follows:
 - 1. Interior views: At locations of work in this Contract.
 - 2. Exterior views: At locations of work in this Contract.
 - D. Views:
 - 1. Consult with Architect for instructions on views required.
 - 2. Provide factual presentation.
 - 3. Provide correct exposure and focus, high resolution and sharpness, maximum depth of field, and minimum distortion.
 - E. Prints of digital color photographs may submitted in lieu of traditional color photographs.
 - 1. Digital photographs shall be high resolution with a minimum of 300 dpi resolution.
 - 2. Provide three sets of high resolution digital photos with each Application and Certificate for Payment copy submitted
 - F. Provide Key Map of site and floor plan locating photograph point of origin.
 - G. Deliver photographic file or prints with each Application for Payment with transmittal letter specified in this Section.
- 3.7 COORDINATION DRAWINGS
 - A. The General Contractor shall prepare coordination drawings required to facilitate planning and execution of the work of the various subcontractors, trades, and suppliers.
 - B. Review drawings prior to submission to Architect.
- 3.8 REQUEST FOR INFORMATION
 - A. Request For Information (RFI) shall be made for the purpose of clarifying the Contract Documents.
 - B. Responses to RFI's are NOT authorizations to change the Contract Documents.
 - C. Submit issues that can not be reasonably inferred from the Contract Documents.
 - 1. List only one (1) item per Request For Information.
 - 2. Consecutively number each RFI beginning with the number "1."
 - 3. Issues clearly indicated in the Contract Documents will not be responded to in writing.
 - a. An RFI with an issue clearly indicated in the Contract Documents will be voided. The RFI number will not be reused.
 - D. Requests For Information (RFI's) shall be submitted on the attached "Requests For Information" (RFI) form following this section. This form shall not be modified. Use of any other form will not be accepted.
 - 1. RFI's are to be signed by the General Contractor's Superintendent, Project Manager or other individual approved by the Architect.

- a. The Contractor shall submit, for approval of the Architect, the printed name, signature, hand written initials and resume of the proposed personnel.
- b. Only the signature or hand written initials by the approved individuals will be accepted on the RFI's.
- c. RFI's shall be signed by a person authorized (and recognized by the Architect) to conduct the construction of the proposed project. Signature or initials of the form by secretarial or clerical personnel is cause for rejection.
- E. Response by the Architect/Engineer shall be made within seven (7) days from the date of receipt by the Architect/Engineer.
 - 1. Timely responses depend on complete, accurate and factual data from the Contractor. Responses cannot occur without this information.
 - 2. The Architect/Engineer has the right to notify the Contractor when more time may be necessary.
 - 3. Responses required from consultants may require additional time to execute.
 - 4. RFI's received on Friday after 10 AM will be logged in on the following workday (Monday, in most cases) and the response period begins on the day of the log-in at the Architect/Engineer's office.
- F. RFI replies by the Architect/Engineer are **not** an authorization to proceed with work involving additional cost, time, or both. If any reply requires a change to the Contract Documents, a Change Order, Construction Change Directive, or a Minor Change In The Work must be executed in accordance with the Contract Documents.

3.9 SUBMITTALS FOR REVIEW

- A. When the following are specified in individual sections, submit them for review:
 - 1. Product data.
 - 2. Shop drawings.
 - 3. Samples for selection.
 - 4. Samples for verification.
- B. The Contractor must review and approve submittals prior to sending them to the Architect.
 - 1. By approving and submitting Shop Drawings, Product Data, Samples, and similar submittals, the Contractor represents that the Contractor has determined and verified materials, field measurements, and field construction criteria related thereto, and has checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.
 - a. The Contractor is required to submit, for approval of the Architect, a copy of the terminology of the Contractors submittal stamp. This stamp must address solely the Contractors review for compliance with the Contract Documents as stated in the above sentence.
 - 1) Contractor shall have made a rubber stamp bearing the Contractors name, the approved terminology, a line for signature and a line for the date of the signature/initial.
 - b. A sample of acceptable terminology and suggested format for the "Contractors Submittal Review Statement" stamp (GC's Shop Drawing Stamp) is attached at the end of this Section.
 - c. Submittals are to be signed by the Contractors Superintendent, Project Manager or other individual approved by the Architect.
 - 1) The Contractor shall submit, for approval of the Architect, the printed name, signature, hand written initials and resume of the proposed personnel.
 - 2) Only the signature or hand written initials by the approved individuals will be accepted on the submittals.
 - 3) Submittals shall be signed by a person authorized (and recognized by the Architect) to conduct the construction of the proposed project. Signature or initials of the form by secretarial or clerical personnel is cause for rejection.
 - d. Contractor shall notify the Architect immediately of deviations from Architect/Engineer approved submittals.

- 2. Lack of the above certification and signature or initials by the Contractors authorized reviewer will result in the return of the submittal(s) without review by the Architect/Engineer.
- 3. In the unlikely event that it appears that no review or only a cursory submittal review was made, the submittal will be returned for a thorough review by the Contractor.
- C. Submit to Architect for review for the limited purpose of checking for conformance with information given and the design concept expressed in the contract documents.
 - 1. The approval or other action indicated by the Architect is based on information given and the design concept expressed in the Contract Documents. Approval does not relieve the Contractors responsibility to comply with every requirement of the Contract Documents unless proposed deviations have been defined in writing and specifically noted as approved on the submittal. The Contractor must verify all dimensions, quantities, and provisions for other work.
- D. Samples will be reviewed for aesthetic, color, or finish selection.
 - 1. All Color and Finish submittals must be submitted within 60 days of the date of the Agreement or the Notice to Proceed, whichever comes first.
- E. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below and for record documents purposes described in Section 01 7800 Closeout Submittals.
- F. Submittals not reviewed and approved by the Contractors authorized personnel will be returned to the Contractor for the Contractors review and approval, after which, said submittals must be resubmitted for review by the Architect/Engineer.

3.10 SUBMITTALS FOR INFORMATION

- A. When the following are specified in individual sections, submit them for information:
 - 1. Design data.
 - 2. Certificates.
 - 3. Test reports.
 - 4. Inspection reports.
 - 5. Manufacturer's instructions.
 - 6. Manufacturer's field reports.
 - 7. Other types indicated.
- B. Submit for Architect's knowledge as contract administrator or for Owner.

3.11 SUBMITTALS FOR PROJECT CLOSEOUT

- A. Submit Correction Punch List for Substantial Completion.
- B. Submit Final Correction Punch List for Substantial Completion.
- C. Contractor shall submit completed and approved Project Record Documents which includes Drawings, Specifications, Addenda, Change Orders, other modifications and items discovered that are not reflected in the original Contract Documents.
 - 1. Includes electronic format of the drawings.
 - 2. Includes one set of reproducible Record Drawings on three mil double matte finish mylar transparencies.
- D. When the following are specified in individual sections, submit them at project closeout in conformance to requirements of Section 01 7800 Closeout Submittals:
 - 1. Operation and maintenance data.
 - 2. Warranties.
 - 3. Bonds.
 - 4. Other types as indicated.
- E. Submit for Owner's benefit during and after project completion.

3.12 NUMBER OF COPIES OF SUBMITTALS

- A. Documents for Review:
 - 1. Small Size Sheets, Not Larger Than 8-1/2 by 11 inches (215 by 280 mm): Submit the number of copies that Contractor requires, plus two copies that will be retained by Architect.

- 2. Larger Sheets, Not Larger Than 36 by 48 inches (910 by 1220 mm): Submit the number of opaque reproductions that Contractor requires, plus two copies that will be retained by Architect.
- B. Contractor is to maintain the Owner's Record set of Submittals.
- C. Documents for Information: Submit same number of copies as for Documents For Review above..
- D. Samples: Submit the number specified in individual specification sections; one of which will be retained by Architect.
 - 1. Actual samples are required for color. Printed color samples are not acceptable.
 - 2. After review, produce duplicates.
 - 3. Retained samples will not be returned to Contractor unless specifically so stated.

3.13 SUBMITTAL PROCEDURES

- A. General Requirements:
- B. Submit for approval a Schedule of Submittals. Refer to paragraph above entitled "Submittal Schedule."
- C. Submit for approval the full names of the General Contractor's Superintendent or Project Manager along with their signature and initials which they will use in confirming the General Contractors review of the submittals certifying that review, approval, verification of Products required, field dimensions, adjacent construction Work, and coordination of information is in accordance with the requirements of the Work and Contract Documents.
 - 1. Include each individuals phone number, pager number, mobile phone number and fax phone number.
 - 2. Submit the same information for personnel which may replace these individuals at the time of replacement.
 - 3. Only personnel authorized to conduct the construction of the proposed project shall be considered.
 - 4. Signature of secretarial or other clerical staff is not acceptable.
- D. Submittals will begin processing only after approval of Submittal Schedule and approval of signing individual(s).
- E. Transmit each submittal with approved form.
 - 1. Transmittal Form shall be form AIA Document G810 or other approved form bearing the same information.
- F. Sequentially number the transmittal form. Provide Specification section number for item submitted then a Dash (-) and the number 1 for the first product submitted under that section. Examples follow including numbering for revised submittals using Section 09 2116:
 - 1. The first item submitted from the named section would be "09 2116-1";
 - 2. The second item from that section would be "09 2116-2", the third would be "09 2116-3", and so forth.
 - 3. If submittal "09 2116-2" needed to be revised and resubmitted, the number for the resubmittal would have an alphanumeric suffix added (R#), for example: "09 2116-2R1"
 - 4. If another resubmittal was necessary, the number for the resubmittal would be "09 2116-2R2".
- G. Identify Project, Contractor, subcontractor or supplier; pertinent drawing and detail number, and specification section number, as appropriate on each copy.
- H. Apply approved Contractor's stamp, signed or initialed by the General Contractor's Superintendent, or Project Manager, or other approved individual. By approving and submitting Shop Drawings, Product Data, Samples, and similar submittals, the Contractor represents that the Contractor has determined and verified materials, field measurements, and field construction criteria related thereto, or will do so (when the missing limited information becomes available), and has checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.
 - 1. Statements, and/or notes, and/or directions to others (including, but not limited to, subcontractors and suppliers) in the stamped statement are cause for rejection of the submittal.
 - 2. Signature or initial by anyone other than General Contractor's Superintendent or Project Manager or approved individual are cause for rejection.

- 3. Stamped statements differing from the approved statement will not be recognized and are cause for rejection of the submittal.
- I. Partial or incomplete submittals will not be accepted unless previously approved in writing.
- J. For each submittal for review, allow 15 days excluding delivery time to and from the Contractor. The Architect has the right to notify the Contractor when more time may be necessary.
 - Submittals received on Friday after 10 AM will be logged in on the following workday (Monday, in most cases) and the 15 day for review period begins on the day of the log-in at the Architects office.
- K. When revised for resubmission, identify all changes made since previous submission. All changes must be clearly marked. Add a cloud around changes on drawings, schedules and written literature.
- L. Pick-up reviewed submittals at the office of the Architect when notified by the Architect. The Contractor is solely responsible, at the Contractors expense, for the delivery and pick-up of the submittals. The Contractor shall make full arrangements for pick-up and delivery of submittals if not able to do so with the Contractor's own forces.

3.14 RECORD DOCUMENTS

- A. Maintain a paper set of Record Documents including Drawings, Specifications, Addenda, Change Orders, other modifications and items discovered that are not reflected in the original Contract Documents.
- B. Record Documents shall not be the set used for construction on a daily basis. It shall remain on the job site in a climate controlled environment and be accessible for updating and review.
- C. Documents shall be maintained on a daily basis and kept current by the Contractor.
- D. Record documents shall be available for review by Owner, Architect and consultants throughout the course of the work.
- E. Record Drawings shall be reviewed each month by the Architect, Engineers, and consultants at time of the submittal of the Application and Certificate for Payment. Record Documents shall be current at the time of each review for Application and Certificate for Payment. Record Documents found not to be current shall be cause for payment request to be rejected.
- F. These documents shall be maintained separately from and in addition to any electronic format and mylar reproducible Record Documents which may be required.

3.15 ATTACHMENTS

- A. Substitution Request form (Pre-Bid); one page.
- B. Substitution Request form (Post-Bid & after execution of Contract); two page.
- C. Specimen Sample "Comparison Sheet" an example of a point-for-point comparison. one page.
- D. Documents Release & MM Disclaimer entitled "RELEASE OF LIABILITY AND INDEMNIFICATION FOR USE OF ELECTRONIC FILES"; three pages.
- E. (NTC) "Notice To Comply" form; one page.
- F. (WX) "Weather Data Sheet for San Antonio, Texas"; one page.
- G. (RFI) "Request for Information" form; one page.
- H. "Contractor Submittal Review Statement" (GC's Shop Drawing Stamp); one page.

SECTION 01 3216 CONSTRUCTION PROGRESS SCHEDULE

PART 1 GENERAL

- 1.1 SECTION INCLUDES
 - A. Preliminary schedule.
 - B. Construction progress schedule, bar chart type.
- 1.2 RELATED SECTIONS
 - A. Section 01 1000 Summary: Work sequence.
- 1.3 REFERENCE STANDARDS
 - A. M-H (CPM) CPM in Construction Management Project Management with CPM; O'Brien; 2006.

1.4 SUBMITTALS

- A. Within 10 days after date of Agreement, submit preliminary schedule.
- B. If preliminary schedule requires revision after review, submit revised schedule within 10 days.
- C. Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review.
 - 1. Include written certification that major contractors have reviewed and accepted proposed schedule.
- D. Within 10 days after joint review, submit complete schedule.
- E. Submit updated schedule with each Application for Payment.
- F. Submit under transmittal letter form specified in Section 01 3000 ADMINISTRATIVE REQUIREMENTS.
- 1.5 QUALITY ASSURANCE
 - A. Scheduler: Contractor's personnel or specialist Consultant specializing in CPM scheduling with one years minimum experience in scheduling construction work of a complexity comparable to this Project, and having use of computer facilities capable of delivering a detailed graphic printout within 48 hours of request.
- 1.6 SCHEDULE FORMAT
 - A. Listings: In chronological order according to the start date for each activity. Identify each activity with the applicable specification section number.
 - B. Sheet Size: Multiples of 8-1/2 x 11 inches (216 x 280 mm).
 - C. Scale and Spacing: To allow for notations and revisions.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

- 3.1 PRELIMINARY SCHEDULE
 - A. Prepare preliminary schedule in the form of a horizontal bar chart.
- 3.2 CONTENT
 - A. Show complete sequence of construction by activity, with dates for beginning and completion of each element of construction.
 - B. Identify each item by specification section number.
 - C. Identify work of separate stages and other logically grouped activities.
 - D. Provide sub-schedules to define critical portions of the entire schedule.
 - E. Include conferences and meetings in schedule.
 - F. Show accumulated percentage of completion of each item, and total percentage of Work completed, as of the first day of each month.
 - G. Provide separate schedule of submittal dates for shop drawings, product data, and samples, owner-furnished products, and dates reviewed submittals will be required from Architect. Indicate decision dates for selection of finishes.

- H. Indicate delivery dates for owner-furnished products.
- I. Coordinate content with schedule of values specified in Section 01 2000 Price and Payment Procedures.
- J. Provide legend for symbols and abbreviations used.
- 3.3 BAR CHARTS
 - A. Include a separate bar for each major portion of Work or operation.
 - B. Identify the first work day of each week.
- 3.4 NETWORK ANALYSIS
 - A. Prepare network analysis diagrams and supporting mathematical analyses using the Critical Path Method.
 - B. Illustrate order and interdependence of activities and sequence of work; how start of a given activity depends on completion of preceding activities, and how completion of the activity may restrain start of subsequent activities.
 - C. Required Reports: List activities in sorts or groups:
 - 1. By preceding work item or event number from lowest to highest.
 - 2. By amount of float, then in order of early start.
 - 3. Contractor's periodic payment request sorted by Schedule of Values listings.
 - 4. Listing of activities on the critical path.
- 3.5 REVIEW AND EVALUATION OF SCHEDULE
 - A. Participate in joint review and evaluation of schedule with Architect at each submittal.
 - B. Evaluate project status to determine work behind schedule and work ahead of schedule.
 - C. After review, revise as necessary as result of review, and resubmit within 10 days.
- 3.6 UPDATING SCHEDULE
 - A. Maintain schedules to record actual start and finish dates of completed activities.
 - B. Indicate progress of each activity to date of revision, with projected completion date of each activity.
 - 1. Correlate activities shown on Construction Progress Schedule with the amounts shown in the request for payment for the current time period.
 - C. Annotate diagrams to graphically depict current status of Work.
 - D. Identify activities modified since previous submittal, major changes in Work, and other identifiable changes.
 - E. Indicate changes required to maintain Date of Substantial Completion.
 - F. Submit reports required to support recommended changes.
 - G. Provide narrative report to define problem areas, anticipated delays, and impact on the schedule. Report corrective action taken or proposed and its effect.
- 3.7 DISTRIBUTION OF SCHEDULE
 - A. Distribute copies of updated schedules to Contractor's project site file, to subcontractors, suppliers, Architect, Owner, and other concerned parties.
 - B. Instruct recipients to promptly report, in writing, problems anticipated by projections indicated in schedules.

SECTION 01 4000 QUALITY REQUIREMENTS

PART 1 GENERAL

- 1.1 SECTION INCLUDES
 - A. Submittals.
 - B. References and standards.
 - C. Quality Assurance Experience Level.
 - D. Quality Assurance Shop Drawings.
 - E. Testing and inspection agencies and services.
 - F. Control of installation.
 - G. Tolerances.
 - H. Manufacturers' field services.
 - I. Defect Assessment.

1.2 RELATED REQUIREMENTS

- A. General Conditions.
- B. Section 01 3000 ADMINISTRATIVE REQUIREMENTS: Submittal procedures.
- C. Section 01 6000 Product Requirements: Requirements for material and product quality.
- 1.3 REFERENCE STANDARDS
 - ASTM C1021 Standard Practice for Laboratories Engaged in Testing of Building Sealants; 2008 (Reapproved 2014).
 - B. ASTM C1077 Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation; 2014.
 - C. ASTM C1093 Standard Practice for Accreditation of Testing Agencies for Masonry; 2013.
 - D. ASTM E329 Standard Specification for Agencies Engaged in Construction Inspection and/or Testing; 2014a.
 - E. ASTM E543 Standard Specification for Agencies Performing Nondestructive Testing; 2013.
- 1.4 SUBMITTALS
 - A. See Section 01 3000 ADMINISTRATIVE REQUIREMENTS, for submittal procedures.
 - B. Certificates: When specified in individual specification sections, submit certification by the manufacturer and Contractor or installation/application subcontractor to Architect, in quantities specified for Product Data.
 - 1. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
 - 2. Certificates may be recent or previous test results on material or product, but must be acceptable to Architect.
 - C. Manufacturer's Instructions: When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, for the Owner's information. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.
 - D. Manufacturer's Field Reports: Submit reports for Architect's benefit as contract administrator or for Owner.
 - 1. Submit report in duplicate within 30 days of observation to Architect for information.
 - 2. Submit for information for the limited purpose of assessing conformance with information given and the design concept expressed in the contract documents.

1.5 QUALITY ASSURANCE - EXPERIENCE LEVEL

- A. The work of each section of these specifications shall be executed by an entity with a minimum experience level in the work described as expressed in the section.
- B. Where the experience level is not expressed it shall known here that the experience level must be at least five (5) years of documented experience in the work of the specification section. Contractors and subcontractors must be able to show recent examples of their work (up to (3) three) in the local area.

- C. Products and fabrications and services shall be made by manufacturers / fabricators / contractors / service providers with a minimum experience level expressed in the specification section.
- D. Where the experience level of the manufacturer/fabricator/contractor is not expressed it shall known here that the experience level must be at least five (5) years of documented experience in the product or fabrication or service of the items/work described in the specification section.
- E. Upon the Architect/Engineers request, manufacturers / fabricators / contractors / service providers shall provide the names, addresses and phone numbers of a minimum of five (5) references.

1.6 QUALITY ASSURANCE - SHOP DRAWINGS

- A. Where Specifications or drawings call for the performance of shop drawings to be designed and prepared under direct supervision of a Professional Engineer, the Engineer must be experienced in the discipline/design of the work specified and licensed in the state where the project resides.
- B. Shop Drawings prepared under the supervision of a Professional Engineer must bear the Engineers seal and signature.
- C. The Engineer's seal and signature is the only evidence acceptable that the shop drawings were designed and prepared under Engineers supervision.

1.7 REFERENCES AND STANDARDS

- A. For products and workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.
- B. Conform to reference standard of date of issue current on date of Contract Documents, except where a specific date is established by applicable code.
- C. Obtain copies of standards where required by product specification sections.
- D. Maintain copy at project site during submittals, planning, and progress of the specific work, until Substantial Completion.
- E. Should specified reference standards conflict with Contract Documents, request clarification from Architect before proceeding.
- F. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of Architect shall be altered from the Contract Documents by mention or inference otherwise in any reference document.
- 1.8 Testing and Inspection Agencies and Services
 - A. As indicated in individual specification sections, Owner or Contractor shall employ and pay for services of an independent testing agency to perform other specified testing.
 - B. Employment of agency in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.
 - C. Contractor Employed Agency:
 - 1. Testing agency: Comply with requirements of ASTM E329, ASTM E543, ASTM C1021, ASTM C1077, and ASTM C1093.
 - 2. Laboratory: Authorized to operate in State in which Project is located.
 - 3. Laboratory Staff: Maintain a full time registered Engineer on staff to review services.
 - 4. Testing Equipment: Calibrated at reasonable intervals either by NIST or using an NIST established Measurement Assurance Program, under a laboratory measurement quality assurance program.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

- 3.1 CONTROL OF INSTALLATION
 - A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.
 - B. Comply with manufacturers' instructions, including each step in sequence.

QUALITY REQUIREMENTS

- C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect before proceeding.
- D. Comply with specified standards as minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
- E. Have Work performed by persons qualified to produce required and specified quality.
- F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.
- G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

3.2 TOLERANCES

- A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.
- B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Architect before proceeding.
- C. Adjust products to appropriate dimensions; position before securing products in place.

3.3 TESTING AND INSPECTION

- A. See individual specification sections for testing required.
- B. Testing Agency Duties:
 - 1. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
 - 2. Perform specified sampling and testing of products in accordance with specified standards.
 - 3. Ascertain compliance of materials and mixes with requirements of Contract Documents.
 - 4. Promptly notify Architect and Contractor of observed irregularities or non-conformance of Work or products.
 - 5. Perform additional tests and inspections required by Architect.
 - 6. Submit reports of all tests/inspections specified.
- C. Limits on Testing/Inspection Agency Authority:
 - 1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
 - 2. Agency may not approve or accept any portion of the Work.
 - 3. Agency may not assume any duties of Contractor.
 - 4. Agency has no authority to stop the Work.
- D. Contractor Responsibilities:
 - 1. Deliver to agency at designated location, adequate samples of materials proposed to be used that require testing, along with proposed mix designs.
 - 2. Cooperate with laboratory personnel, and provide access to the Work .
 - 3. Provide incidental labor and facilities:
 - a. To provide access to Work to be tested/inspected.
 - b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
 - c. To facilitate tests/inspections.
 - d. To provide storage and curing of test samples.
 - 4. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing/inspection services.
 - 5. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
 - 6. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
- E. Re-testing required because of non-conformance to specified requirements shall be performed by the same agency on instructions by Architect.
- F. Re-testing required because of non-conformance to specified requirements shall be paid for by Contractor.

3.4 MANUFACTURERS' FIELD SERVICES

- A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust and balance of equipment as applicable, and to initiate instructions when necessary.
- B. Submit qualifications of observer to Architect 30 days in advance of required observations.
 1. Observer subject to approval of Architect.
- C. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

3.5 DEFECT ASSESSMENT

A. Replace Work or portions of the Work not conforming to specified requirements.

SECTION 01 5000 TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

- 1.1 SECTION INCLUDES
 - A. Temporary utilities.
 - B. Temporary telecommunications services.
 - C. Temporary sanitary facilities.
 - D. Temporary Controls: Barriers, enclosures, and fencing.
 - E. Security requirements.
 - F. Vehicular access and parking.
 - G. Waste removal facilities and services.
 - H. Field offices.

1.2 TEMPORARY UTILITIES

- A. Provide and pay for all electrical power, lighting, water, heating and cooling, and ventilation required for construction purposes.
- B. Existing facilities may be used.
- C. New permanent facilities may be used.
- D. Use trigger-operated nozzles for water hoses, to avoid waste of water.
- 1.3 TELECOMMUNICATIONS SERVICES
 - A. Provide, maintain, and pay for telecommunications services to field office at time of project mobilization.
 - B. Telecommunications services shall include:
 - 1. Windows-based personal computer dedicated to project telecommunications, with necessary software and laser printer.
 - 2. Telephone Land Lines: One line, minimum; one handset per line.
 - 3. Internet Connections: Minimum of one; DSL modem or faster.
 - 4. Email: Account/address reserved for project use.
 - 5. Facsimile Service: Minimum of one dedicated fax machine/printer, with dedicated phone line.
 - 6. Facsimile Service: Fax-to-email software on personal computer.
 - C. Provide, maintain and pay for facsimile service and a dedicated telephone line to field office at time of project mobilization.
 - D. Telephone and facsimile services shall be made available for use by the Owner, Architect, and consultants.

1.4 TEMPORARY SANITARY FACILITIES

- A. Provide and maintain required facilities and enclosures. Provide at time of project mobilization.
- B. Use of existing facilities located at _____ is permitted.
- C. Maintain daily in clean and sanitary condition.
- D. At end of construction, return facilities to same or better condition as originally found.

1.5 BARRIERS

- A. Provide barriers to prevent unauthorized entry to construction areas, to prevent access to areas that could be hazardous to workers or the public and to protect existing facilities and adjacent properties from damage from construction operations and demolition.
- B. Provide barricades and covered walkways required by governing authorities for public rights-of-way.
- C. Provide protection for plants designated to remain. Replace damaged plants.
- D. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

1.6 FENCING

A. Construction: Contractor's option.

1.7 EXTERIOR ENCLOSURES

- A. Provide temporary insulated weather tight closure of exterior openings to accommodate acceptable working conditions and protection for Products, to allow for temporary heating and maintenance of required ambient temperatures identified in individual specification sections, and to prevent entry of unauthorized persons. Provide access doors with self-closing hardware and locks.
- 1.8 SECURITY
 - A. Provide security and facilities to protect Work, existing facilities, and Owner's operations from unauthorized entry, vandalism, or theft.
 - B. Coordinate with Owner's security program.
- 1.9 VEHICULAR ACCESS AND PARKING
 - A. Comply with regulations relating to use of streets and sidewalks, access to emergency facilities, and access for emergency vehicles.
 - B. Coordinate access and haul routes with governing authorities and Owner.
 - C. Provide and maintain access to fire hydrants, free of obstructions.
 - D. Provide means of removing mud from vehicle wheels before entering streets.
 - E. Provide temporary parking areas to accommodate construction personnel. When site space is not adequate, provide additional off-site parking.
- 1.10 WASTE REMOVAL
 - A. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.
 - B. Provide containers with lids. Remove trash from site periodically.
 - C. If materials to be recycled or re-used on the project must be stored on-site, provide suitable non-combustible containers; locate containers holding flammable material outside the structure unless otherwise approved by the authorities having jurisdiction.
 - D. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.
- 1.11 PROJECT IDENTIFICATION
 - A. Provide project identification sign of design, construction, and location approved by Owner.
 - B. No other signs are allowed without Owner permission except those required by law.
- 1.12 FIELD OFFICES See Section 01 5213
 - A. Office: Weathertight, with lighting, electrical outlets, heating, cooling equipment, and equipped with sturdy furniture, drawing rack, and drawing display table.
 - B. Provide space for Project meetings, with table and chairs to accommodate 6 persons.
- 1.13 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS
 - A. Remove temporary utilities, equipment, facilities, materials, prior to Date of Substantial Completion inspection.
 - B. Remove underground installations to a minimum depth of 2 feet (600 mm). Grade site as indicated.
 - C. Clean and repair damage caused by installation or use of temporary work.
 - D. Restore existing facilities used during construction to original condition.
 - E. Restore new permanent facilities used during construction to specified condition.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

SECTION 01 6000 PRODUCT REQUIREMENTS

PART 1 GENERAL

- 1.1 GENERAL
 - A. Where specific product selection has not been made, is missing, is undetermined, or is unclear, and a determination from the Architect is not available, Contractor shall include an amount sufficient to allow selection(s) from the products highest price group.

1.2 SECTION INCLUDES

- A. General product requirements.
- B. Transportation, handling, storage and protection.
- C. Product option requirements.
- D. Substitution limitations.
- E. Maintenance materials, including extra materials, spare parts, tools, and software.

1.3 RELATED REQUIREMENTS

- A. Section 01 1000 Summary: Lists of products to be removed from existing building.
- B. Section 01 2500 Substitution Procedures: Substitutions made during and after the Bidding/Negotiation Phase.
- C. Section 01 3000 Administrative Requirements: Submittal Schedule and Submittal Procedures.
- D. Section 01 4000 Quality Requirements: Product quality monitoring.
- E. Section 01 6116 Volatile Organic Compound (VOC) Content Restrictions: Requirements for VOC-restricted product categories.
- F. Section 01 7000 Execution and Closeout Requirements: Items to be turned over to the Owner.
- G. Section 01 7800 Closeout Submittals: Items to be turned over to the Owner.

1.4 REFERENCE STANDARDS

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

1.5 SUBMITTALS

- A. In general, substitutions will not be accepted, unless noted otherwise. Procedures for approving product substitutions occur during the Bidding period.
 - 1. Refer to the Instructions to Bidders for substitution Procedures.
 - 2. Refer also to Section 01 3000 Administrative Requirements.
- B. Procedures for approving product substitutions after the Bidding period:
 - 1. Refer to Section 01 3000 Administrative Requirements, Request for substitutes after the Bidding phase.
- C. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.
- D. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
- E. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
 - 1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.
- F. Indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

PART 2 PRODUCTS

- 2.1 EXISTING PRODUCTS
 - A. Do not use materials and equipment removed from existing premises unless specifically required or permitted by the Contract Documents.

- B. Unforeseen historic items encountered remain the property of the Owner; notify Owner promptly upon discovery; protect, remove, handle, and store as directed by Owner.
- C. Existing materials and equipment indicated to be removed, but not to be re-used, relocated, reinstalled, delivered to the Owner, or otherwise indicated as to remain the property of the Owner, become the property of the Contractor; remove from site.
- D. Reused Products: Reused products include materials and equipment previously used in this or other construction, salvaged and refurbished as specified.
- 2.2 NEW PRODUCTS
 - A. Provide new products unless specifically required or permitted by the Contract Documents.
 - B. DO NOT USE products having any of the following characteristics:
 - 1. Made using or containing CFC's or HCFC's.
 - 2. Made of wood from newly cut old growth timber.
 - 3. Containing lead, cadmium, asbestos.
 - C. Where all other criteria are met, Contractor shall give preference to products that:
 - 1. If used on interior, have lower emissions, as defined in Section 01 6116.
 - 2. If wet-applied, have lower VOC content, as defined in Section 01 6116.
 - D. Provide interchangeable components of the same manufacture for components being replaced.
 - E. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Size terminal lugs to NFPA 70, include lugs for terminal box.
 - F. Cord and Plug: Provide minimum 6 foot (2 m) cord and plug including grounding connector for connection to electric wiring system. Cord of longer length is specified in individual specification sections.
- 2.3 PRODUCT OPTIONS
 - A. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.
 - B. Products Specified by Naming One or More Manufacturers: Use the product specified by the manufacturer specified. Use of a product of one of the other manufacturers named must still receive approval in writting before it is allowed for use on this project. Otherwise no options or substitutions allowed.
 - 1. Substitutions are not accepted on or after the date of the Agreement, unless noted otherwise.
 - 2. Refer also to Section 01 3000 Administrative Requirements.
 - C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.
 - 1. Substitutions are not accepted on or after the date of the Agreement, unless noted otherwise.
 - 2. Refer also to Section 01 3000 Administrative Requirements.

2.4 MAINTENANCE MATERIALS

- A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.
- B. Deliver to Project site and deliver to designated location; obtain written acknowledgement or receipt prior to final payment.

PART 3 EXECUTION

- 3.1 SUBSTITUTION LIMITATIONS
 - A. See Section 01 2500 Substitution Procedures.
 - B. Any product, system or procedure not specifically listed or described in the Contract Documents is subject to rejection.
 - C. A request for substitution constitutes a representation that the submitter:
 - 1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product.
 - a. The submitter must provide information and certification in writing <u>showing point for</u> <u>point comparison</u> for the proposed substitute with the specified product, including color selections. The submitter shall provide data from the specified product and

manufacturer as well as data from the proposed manufacturer for a comparison, review, and determination of acceptance (approval or disapproval) by the Architect.

- 1) Absence of specified manufacturers' data is grounds for disapproval. Approval cannot be made if adequate comparison information is not provided.
- D. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals,
- 3.2 OWNER-SUPPLIED PRODUCTS
 - A. See Section 01 1000 Summary for identification of Owner-supplied products.
 - B. Owner's Responsibilities:
 - 1. Arrange for and deliver Owner reviewed shop drawings, product data, and samples, to Contractor.
 - 2. Arrange and pay for product delivery to site.
 - 3. On delivery, inspect products jointly with Contractor.
 - 4. Submit claims for transportation damage and replace damaged, defective, or deficient items.
 - 5. Arrange for manufacturers' warranties, inspections, and service.
 - C. Contractor's Responsibilities:
 - 1. Review Owner reviewed shop drawings, product data, and samples.
 - 2. Receive and unload products at site; inspect for completeness or damage jointly with Owner.
 - 3. Handle, store, install and finish products.
 - 4. Repair or replace items damaged after receipt.
- 3.3 TRANSPORTATION AND HANDLING
 - A. Package products for shipment in manner to prevent damage; for equipment, package to avoid loss of factory calibration.
 - B. If special precautions are required, attach instructions prominently and legibly on outside of packaging.
 - C. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.
 - D. Transport and handle products in accordance with manufacturer's instructions.
 - E. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.
 - F. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.
 - G. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage, and to minimize handling.
 - H. Arrange for the return of packing materials, such as wood pallets, where economically feasible.
- 3.4 STORAGE AND PROTECTION
 - A. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication.
 - B. Store and protect products in accordance with manufacturers' instructions.
 - C. Store with seals and labels intact and legible.
 - D. Store sensitive products in weather tight, climate controlled, enclosures in an environment favorable to product.
 - E. For exterior storage of fabricated products, place on sloped supports above ground.
 - F. Provide off-site storage and protection when site does not permit on-site storage or protection.
 - 1. Refer to Supplementary Conditions and Section 01 2000 for requirements concerning off-site storage of materials and equipment. The provisions within the referenced document(s) shall prevail over this paragraph and subparagraph.
 - G. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.
 - H. Comply with manufacturer's warranty conditions, if any.

- I. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.
- J. Prevent contact with material that may cause corrosion, discoloration, or staining.
- K. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.
- L. Transportation of stored products is the responsibility of the Contractor.
- M. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.
- N. Extra materials, tools, spare parts, maintenance products, and similar items to be turned over to the Owner at Substantial Completion:
 - 1. Store items to be turned over to the Owner.
 - 2. Protect indoors and in weather tight conditions. Store interior materials in climatic conditions similar to normal conditions for which the installed product is to exist. All other materials shall be stored at temperature between 60 and 80 degrees F and humidity shall not exceed 60%.
 - 3. All items shall be packaged appropriately.
 - a. Extra Materials shall be provided unused and in manufactures original unopened packaging clearly marked as to contents and products to be used with. Extra materials must be an exact match of installed materials.
 - b. Tools, spare parts, maintenance products, and similar items shall be boxed or packaged ready for storage.
 - 4. Clearly mark and identify all extra materials, tools, spare parts, maintenance products, and similar items.
 - a. Include specification section number and name.
 - b. Label with manufacturer's name and model number where applicable.
 - c. Plainly identify the use of the item(s).
 - 5. Refer also to Section 01 7800 Closeout Submittals.

SECTION 01 6116

VOLATILE ORGANIC COMPOUND (VOC) CONTENT RESTRICTIONS

PART 1 GENERAL

- 1.1 SECTION INCLUDES
 - A. Requirements for Indoor-Emissions-Restricted products.
 - B. Requirements for VOC-Content-Restricted products.
 - C. Requirement for installer certification that they did not use any non-compliant products.
 - D. VOC restrictions for product categories listed below under "DEFINITIONS."
 - E. All products of each category that are installed in the project must comply; Owner's project goals do not allow for partial compliance.

1.2 RELATED REQUIREMENTS

- A. Section 01 3000 ADMINISTRATIVE REQUIREMENTS: Submittal procedures.
- B. Section 01 4000 Quality Requirements: Procedures for testing and certifications.
- C. Section 01 6000 Product Requirements: Fundamental product requirements, substitutions and product options, delivery, storage, and handling.
- 1.3 DEFINITIONS
 - A. Indoor-Emissions-Restricted Products: All products in the following product categories, whether specified or not:
 - B. VOC-Content-Restricted Products: All products in the following product categories, whether specified or not:
 - 1. Interior paints and coatings applied on site.
 - 2. Interior adhesives and sealants applied on site, including flooring adhesives.
 - C. VOC-Restricted Products: All products of each of the following categories when installed or applied on-site in the building interior:
 - 1. Adhesives, sealants, and sealer coatings.
 - 2. Carpet.
 - 3. Carpet tile.
 - 4. Resilient floor coverings.
 - 5. Acoustical ceilings and panels.
 - 6. Other products when specifically stated in the specifications.
 - D. Interior of Building: Anywhere inside the exterior weather barrier.
 - E. Adhesives: All gunnable, trowelable, liquid-applied, and aerosol adhesives, whether specified or not; including flooring adhesives, resilient base adhesives, and pipe jointing adhesives.
 - F. Sealants: All gunnable, trowelable, and liquid-applied joint sealants and sealant primers, whether specified or not; including firestopping sealants and duct joint sealers.
 - G. Inherently Non-Emitting Materials: Products composed wholly of minerals or metals, unless they include organic-based surface coatings, binders, or sealants; and specifically the following:
 - 1. Concrete.
 - 2. Clay brick.
 - 3. Metals that are plated, anodized, or powder-coated.
 - 4. Glass.
 - 5. Ceramics.
 - 6. Solid wood flooring that is unfinished and untreated.

1.4 REFERENCE STANDARDS

- A. 40 CFR 59, Subpart D National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; current edition.
- B. ASTM D3960 Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings; 2005 (Reapproved 2013).
- C. CAL (CDPH SM) Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions From Indoor Sources Using Environmental Chambers; California Department of Public Health; v1.1, 2010.
- D. CARB (SCM) Suggested Control Measure for Architectural Coatings; California Air Resources Board; 2007.

- E. CHPS (HPPD) High Performance Products Database; Current Edition at www.chps.net/.
- F. CRI (GLP) Green Label Plus Testing Program Certified Products; www.carpet-rug.org; current edition.
- G. GreenSeal GS-36 Commercial Adhesives; 2011.
- H. SCAQMD 1113 South Coast Air Quality Management District Rule No.1113; current edition.
- I. SCAQMD 1168 South Coast Air Quality Management District Rule No.1168; current edition.
- J. SCS (CPD) SCS Certified Products; current listings at www.scscertified.com.
- K. UL (GGG) GREENGUARD Gold Certified Products; current listings at http://http://productguide.ulenvironment.com/QuickSearch.aspx.

1.5 SUBMITTALS

- A. See Section 01 3000 ADMINISTRATIVE REQUIREMENTS, for submittal procedures.
- B. Evidence of Compliance: Submit for each different product in each applicable category.
- C. Product Data: For each VOC-restricted product used in the project, submit evidence of compliance.
- D. Installer Certifications Regarding Prohibited Content: Require each installer of any type of product (not just the products for which VOC restrictions are specified) to certify that either 1) no adhesives, joint sealants, paints, coatings, or composite wood or agrifiber products have been used in the installation of installer's products, or 2) that such products used comply with these requirements.

1.6 QUALITY ASSURANCE

- A. Indoor Emissions Standard and Test Method: CAL (CDPH SM), using Standard Private Office exposure scenario and the allowable concentrations specified in the method, and range of total VOC's after 14 days.
 - 1. Wet-Applied Products: State amount applied in mass per surface area.
 - 2. Paints and Coatings: Test tinted products, not just tinting bases.
 - 3. Evidence of Compliance: Acceptable types of evidence are the following;
 - a. Current UL (GGG) certification.
 - b. Current SCS (CPD) Floorscore certification.
 - c. Current SCS (CPD) Indoor Advantage Gold certification.
 - d. Current listing in CHPS (HPPD) as a low-emitting product.
 - e. Current CRI (GLP) certification.
 - f. Test report showing compliance and stating exposure scenario used.
 - 4. Product data submittal showing VOC content is NOT acceptable evidence.
 - 5. Manufacturer's certification without test report by independent agency is NOT acceptable evidence.
- B. VOC Content Test Method: 40 CFR 59, Subpart D (EPA Method 24), or ASTM D3960, unless otherwise indicated.
 - 1. Evidence of Compliance: Acceptable types of evidence are:
 - a. Report of laboratory testing performed in accordance with requirements.
 - b. Published product data showing compliance with requirements.
- C. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.
- 1.7 QUALITY ASSURANCE
 - A. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

PART 2 PRODUCTS

- 2.1 MATERIALS
 - A. All Products: Comply with the most stringent of federal, State, and local requirements, or these specifications.
 - B. Indoor-Emissions-Restricted Products: Comply with Indoor Emissions Standard and Test Method, except for:
 - 1. Inherently Non-Emitting Materials.
 - C. VOC-Content-Restricted Products: VOC content not greater than required by the following:
- 1. Adhesives, Including Flooring Adhesives: SCAQMD 1168 Rule.
- 2. Joint Sealants: SCAQMD 1168 Rule.
- 3. Paints and Coatings: Each color; most stringent of the following:
 - a. 40 CFR 59, Subpart D.
 - b. SCAQMD 1113 Rule.
 - c. CARB (SCM).
- D. Adhesives and Joint Sealants: Provide only products having volatile organic compound (VOC) content not greater than required by South Coast Air Quality Management District Rule No.1168.
 - 1. Evidence of Compliance: Acceptable types of evidence are:
 - a. Report of laboratory testing performed in accordance with requirements.
 - b. Published product data showing compliance with requirements.
- E. Aerosol Adhesives: Provide only products having volatile organic compound (VOC) content not greater than required by GreenSeal GS-36.
 - 1. Evidence of Compliance: Acceptable types of evidence are:
 - a. Current GreenSeal Certification.
 - b. Published product data showing compliance with requirements.
- F. Paints and Coatings: Provide products having VOC content as specified in Section 09 9000.
- G. Carpet Tile and Adhesive: Provide products having VOC content not greater than that required for CRI Green Label Plus certification.
 - 1. Evidence of Compliance: Acceptable types of evidence are:
 - a. Current Green Label Plus Certification.
 - b. Report of laboratory testing performed in accordance with requirements.
- H. Other Product Categories: Comply with limitations specified elsewhere.

PART 3 EXECUTION

- 3.1 FIELD QUALITY CONTROL
 - A. Owner reserves the right to reject non-compliant products, whether installed or not, and require their removal and replacement with compliant products at no extra cost to Owner.
 - B. Additional costs to restore indoor air quality due to installation of non-compliant products will be borne by Contractor.

VOLATILE ORGANIC COMPOUND (VOC) CONTENT RESTRICTIONS

SECTION 01 7000 EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL

- 1.1 SECTION INCLUDES
 - A. Examination, preparation, and general installation procedures.
 - B. Requirements for alterations work, including selective demolition, _____.
 - C. Pre-installation meetings.
 - D. Cutting and patching.
 - E. Surveying for laying out the work.
 - F. Cleaning and protection.
 - G. Starting of systems and equipment.
 - H. Demonstration and instruction of Owner personnel.
 - I. Closeout procedures, including Contractor's Correction Punch List, except payment procedures.
- 1.2 RELATED REQUIREMENTS
 - A. Section 01 1000 Summary: Limitations on working in existing building; continued occupancy; work sequence; identification of salvaged and relocated materials.
 - B. Section 01 3000 ADMINISTRATIVE REQUIREMENTS: Submittals procedures, Electronic document submittal service.
 - C. Section 01 4000 Quality Requirements: Testing and inspection procedures.
 - D. Section 01 5000 Temporary Facilities and Controls: Temporary exterior enclosures.
 - E. Section 01 7800 Closeout Submittals: Project record documents, operation and maintenance data, warranties and bonds. Extra materials, tools, spare parts, maintenance products, and similar items.
 - F. Individual Product Specification Sections:
 - 1. Advance notification to other sections of openings required in work of those sections.
- 1.3 REFERENCE STANDARDS
 - A. NFPA 241 Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2013.
- 1.4 SUBMITTALS
 - A. See Section 01 3000 ADMINISTRATIVE REQUIREMENTS, for submittal procedures.
 - B. Survey work: Submit name, address, and telephone number of Surveyor before starting survey work.
 - 1. On request, submit documentation verifying accuracy of survey work.
 - 2. Submit a copy of site drawing signed by the Land Surveyor, that the elevations and locations of the work are in conformance with Contract Documents.
 - 3. Submit surveys and survey logs for the project record.
 - C. Cutting and Patching: Submit written request in advance of cutting or alteration that affects:
 - 1. Structural integrity of any element of Project.
 - 2. Integrity of weather exposed or moisture resistant element.
 - 3. Efficiency, maintenance, or safety of any operational element.
 - 4. Visual qualities of sight exposed elements.
 - 5. Work of Owner or separate Contractor.
 - 6. Include in request:
 - a. Identification of Project.
 - b. Location and description of affected work.
 - c. Necessity for cutting or alteration.
 - d. Description of proposed work and products to be used.
 - e. Effect on work of Owner or separate Contractor.
 - f. Written permission of affected separate Contractor.
 - g. Date and time work will be executed.
 - D. Project Record Documents: Accurately record actual locations of capped and active utilities.

1.5 QUALIFICATIONS

- A. For demolition work, employ a firm specializing in the type of work required.1. Minimum of three years of documented experience.
- B. For surveying work, employ a land surveyor registered in TEXAS and acceptable to Architect. Submit evidence of surveyor's Errors and Omissions insurance coverage in the form of an Insurance Certificate. Employ only individual(s) trained and experienced in collecting and recording accurate data relevant to ongoing construction activities,
- C. For field engineering, employ a professional engineer of the discipline required for specific service on Project, licensed in TEXAS. Employ only individual(s) trained and experienced in establishing and maintaining horizontal and vertical control points necessary for laying out construction work on project of similar size, scope and/or complexity.

1.6 PROJECT CONDITIONS

- A. Use of explosives is not permitted.
- B. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.
- C. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.
- D. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.
- E. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere and over adjacent property.
- F. Erosion and Sediment Control: Plan and execute work by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.
 - 1. Minimize amount of bare soil exposed at one time.
 - 2. Provide temporary measures such as berms, dikes, and drains, to prevent water flow.
 - 3. Construct fill and waste areas by selective placement to avoid erosive surface silts or clays.
 - 4. Periodically inspect earthwork to detect evidence of erosion and sedimentation; promptly apply corrective measures.
- G. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations.
 - 1. At All Times: Excessively noisy tools and operations will not be tolerated inside the building at any time of day; excessively noisy includes jackhammers.
 - 2. Outdoors: Limit conduct of especially noisy exterior work to the hours of 8 am to 5 pm.
- H. Pest and Rodent Control: Provide methods, means, and facilities to prevent pests and insects from damaging the work.
- I. Pollution Control: Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations. Comply with federal, state, and local regulations.

1.7 COORDINATION

- A. See Section 01 1000 for occupancy-related requirements.
- B. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.
- C. Notify affected utility companies and comply with their requirements.
- D. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.
- E. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on drawings. Follow routing indicated for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

- F. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.
- G. Coordinate completion and clean-up of work of separate sections.
- H. After Owner occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

PART 2 PRODUCTS

- 2.1 PATCHING MATERIALS
 - A. New Materials: As specified in product sections; match existing products and work for patching and extending work.
 - B. Type and Quality of Existing Products: Determine by inspecting and testing products where necessary, referring to existing work as a standard.
 - C. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 01 6000 Product Requirements.

PART 3 EXECUTION

- 3.1 EXAMINATION
 - A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.
 - B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.
 - C. Examine and verify specific conditions described in individual specification sections.
 - D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.
 - E. Verify that utility services are available, of the correct characteristics, and in the correct locations.
 - F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

3.2 PREPARATION

- A. Preparation of new or existing substrate:
 - 1. New substrates shall be prepared as recommended by manufacturer of new work/ finish(es)/ material(s)/ product(s)/ equipment/ item(s) and/or any other new element(s).
 - 2. Cut, move, and remove existing finish(es), material(s), product(s), equipment, item(s), and/or other element(s) (hereinafter referred to as "existing element(s)") and prepare substrate as necessary for application of new work/ finish(es)/ material(s)/ product(s)/ equipment/ item(s) and/or any other new element(s) (hereinafter referred to as "new work") required for a complete and satisfactory professional installation.
 - a. This includes the removal of existing element(s) whenever the existing element(s) is/are not to remain in place or is/are not an appropriate substrate and/or condition for the new work, as determined by the manufacturer or Architect. This includes, but is not limited to, existing flooring, wall elements, and/or other floor, wall, ceiling, and/or other existing element(s) (interior and exterior), unsuitable substrate and/or condition, and/or other material which compromises the new work installation, or is/are not acceptable to the manufacturer of the new work, or voids the warranty of the new work application(s).
 - 3. Prepare new and existing substrates and surfaces as required to receive new work/ finish(es)/ material(s)/ product(s)/ equipment/ item(s) and/or any other new element(s) application(s).
- B. Temporary Removal
 - 1. Work of the respective specification section for new work over existing construction may include temporary removal of "existing elements", repair and preparation of existing

substrate(s) required for a proper, complete and satisfactory professional installation of new work.

- 2. Carefully cut, move, or remove other existing elements, to remain, as necessary for access or proper application of alterations and renovation work. Replace and restore in working order at completion to a finished condition indistinguishable from the new work.
- 3. Refer also to Section 01 1000 Summary, for additional information at the "General Notes" article regarding Temporary Removal.
- C. Remove unsuitable material not marked for salvage, such as rotted wood, corroded metals, and deteriorated masonry and concrete. Replace materials as specified for finished work.
- D. Remove debris and abandoned items from area and from concealed spaces.
- E. Close openings in exterior surfaces to protect existing work and salvage items from weather and extremes of temperature and humidity. Insulate ducts and piping to prevent condensation in exposed areas.
- F. Prepare surfaces and remove surface finishes to provide for proper installation of new work and finishes.
- G. Clean substrate surfaces prior to applying next material or substance.
- H. Seal cracks or openings of substrate prior to applying next material or substance.
- I. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

3.3 PREINSTALLATION MEETINGS

- A. When required in individual specification sections, convene a preinstallation meeting at the site prior to commencing work of the section.
- B. Require attendance of parties directly affecting, or affected by, work of the specific section.
- C. Notify Architect four days in advance of meeting date.
- D. Prepare agenda and preside at meeting:
 - 1. Review conditions of examination, preparation and installation procedures.
 - 2. Review coordination with related work.
- E. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.
- 3.4 LAYING OUT THE WORK
 - A. Verify locations of survey control points prior to starting work.
 - B. Promptly notify Architect of any discrepancies discovered.
 - C. Protect survey control points prior to starting site work; preserve permanent reference points during construction.
 - D. Promptly report to Architect the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.
 - E. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Architect.
 - F. Utilize recognized engineering survey practices.

3.5 GENERAL INSTALLATION REQUIREMENTS

- A. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.
- B. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.
- C. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.
- D. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.
- E. Make neat transitions between different surfaces, maintaining texture and appearance.F. Transitions:
 - 1. Transition from existing to new shall not be apparent.
 - 2. When existing finish surfaces are cut such that a smooth unapparent transition is not possible, terminate existing surface along a straight line at a natural line of division and make recommendation to Architect.
 - 3. Transitions (new to new work and/or new to existing work) where a change in plane occurs are not acceptable, unless noted or shown otherwise.

- a. Transitions where change in plane of less than 1/4 inch occur shall be corrected to eliminate the change in plane.
- b. Where change in plane can not be eliminated or change in plane of 1/4 inch or more occurs where new work meets existing work, submit recommendation for providing a smooth transition for Architect review and request instruction.
- G. Where removal of partitions or walls results in adjacent spaces becoming one, rework floors walls and ceilings to a smooth flat plane without breaks, steps or bulkheads, unless noted or shown otherwise.
- H. Recover and refinish work that exposes mechanical and/or electrical work exposed accidentally or incidentally during the work.

3.6 ALTERATIONS

- A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
 - 1. Verify that construction and utility arrangements are as indicated.
 - 2. Report discrepancies to Architect before disturbing existing installation.
 - 3. Beginning of alterations work constitutes acceptance of existing conditions.
- B. Keep areas in which alterations are being conducted separated from other areas that are still occupied.
 - 1. Provide, erect, and maintain temporary dustproof partitions of construction specified in Section 01 5000 in locations indicated on drawings.
- C. Maintain weatherproof exterior building enclosure except for interruptions required for replacement or modifications; take care to prevent water and humidity damage.
 - 1. Where openings in exterior enclosure exist, provide construction to make exterior enclosure weatherproof.
 - 2. Insulate existing ducts or pipes that are exposed to outdoor ambient temperatures by alterations work.
- D. Remove existing work as indicated and as required to accomplish new work.
 - 1. Remove items indicated on drawings.
 - 2. Relocate items indicated on drawings.
 - 3. Where new surface finishes are to be applied to existing work, perform removals, patch, and prepare existing surfaces as required to receive new finish; remove existing finish if necessary for successful application of new finish.
 - 4. Where new surface finishes are not specified or indicated, patch holes and damaged surfaces to match adjacent finished surfaces as closely as possible.
- E. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove, relocate, and extend existing systems to accommodate new construction.
 - 1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components; if necessary, modify installation to allow access or provide access panel.
 - 2. Where existing systems or equipment are not active and Contract Documents require reactivation, put back into operational condition; repair supply, distribution, and equipment as required.
 - 3. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
 - a. Disable existing systems only to make switchovers and connections; minimize duration of outages.
 - b. Provide temporary connections as required to maintain existing systems in service.
 - 4. Verify that abandoned services serve only abandoned facilities.
 - 5. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification; patch holes left by removal using materials specified for new construction.
- F. Protect existing work to remain.
 - 1. Prevent movement of structure; provide shoring and bracing if necessary.

- 2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
- 3. Repair adjacent construction and finishes damaged during removal work.
- 4. Patch as specified for patching new work.
- G. Adapt existing work to fit new work: Make as neat and smooth transition as possible.
 - 1. When existing finished surfaces are cut so that a smooth transition with new work is not possible, terminate existing surface along a straight line at a natural line of division and make recommendation to Architect.
 - 2. Where removal of partitions or walls results in adjacent spaces becoming one, rework floors, walls, and ceilings to a smooth plane without breaks, steps, or bulkheads.
 - 3. Where a change of plane of 1/4 inch (6 mm) or more occurs in existing work, remove work and replace with new if existing can not be repositioned to an acceptable condition as determined by Architect.
 - 4. Trim existing wood doors as necessary to clear new floor finish. Refinish trim as required.
- H. Patching: Where the existing surface is not indicated to be refinished, patch to match the surface finish that existed prior to cutting. Where the surface is indicated to be refinished, patch so that the substrate is ready for the new finish.
- I. Refinish existing surfaces as indicated:
 - 1. Where rooms or spaces are indicated to be refinished, refinish all visible existing surfaces to remain to the specified condition for each material, with a neat transition to adjacent finishes.
 - 2. If mechanical or electrical work is exposed accidentally during the work, re-cover and refinish to match.
- J. Clean existing systems and equipment.
- K. Remove demolition debris and abandoned items from alterations areas and dispose of off-site; do not burn or bury.
- L. Do not begin new construction in alterations areas before demolition is complete.
- M. Comply with all other applicable requirements of this section.

3.7 CUTTING AND PATCHING

- A. Whenever possible, execute the work by methods that avoid cutting or patching.
- B. See Alterations article above for additional requirements.
- C. Perform whatever cutting and patching is necessary to:
 - 1. Complete the work.
 - 2. Fit products together to integrate with other work.
 - 3. Provide openings for penetration of mechanical, electrical, and other services.
 - 4. Match work that has been cut to adjacent work.
 - 5. Repair areas adjacent to cuts to required condition.
 - 6. Repair new work damaged by subsequent work.
 - 7. Remove samples of installed work for testing when requested.
 - 8. Remove and replace defective and non-conforming work.
- D. Execute cutting and patching including excavation and fill to complete the work, to uncover work in order to install improperly sequenced work, to remove and replace defective or non-conforming work, to remove samples of installed work for testing when requested, to provide openings in the work for penetration of mechanical and electrical work, to execute patching to complement adjacent work, and to fit products together to integrate with other work.
- E. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.
- F. Employ original installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.
- G. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.
- H. Restore work with new products in accordance with requirements of Contract Documents.
- I. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- J. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 07 8400, to full thickness of the penetrated element.

K. Patching:

- 1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
- 2. Match color, texture, and appearance.
- 3. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.
- L. Refinish surfaces to match adjacent finish. For continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
- M. Make neat transitions. Patch work to match adjacent work in texture and appearance. Where new work abuts or aligns with existing, perform a smooth and even transition.
- N. Patch or replace surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. Repair substrate prior to patching finish. Finish patches to produce uniform finish and texture over entire area. When finish cannot be matched, refinish entire surface to nearest intersections.

3.8 PROGRESS CLEANING

- A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.
- B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.
- C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.
- D. Collect and remove waste materials, debris, and trash/rubbish from site periodically and dispose off-site; do not burn or bury.
- E. Debris, rubbish, trash, waste and other matter to be disposed of throughout this project shall be handled in a thorough, neat, proper, legal, and expeditious manner.
- 3.9 PROTECTION OF INSTALLED WORK
 - A. Protect installed work from damage by construction operations.
 - B. Provide special protection where specified in individual specification sections.
 - C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.
 - D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.
 - E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.
 - F. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.
 - G. Prohibit traffic from landscaped areas.
 - H. Remove protective coverings when no longer needed; reuse or recycle coverings if possible.

3.10 SYSTEM STARTUP

- A. Coordinate schedule for start-up of various equipment and systems.
- B. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage.
- C. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.
- D. Verify that wiring and support components for equipment are complete and tested.
- E. Execute start-up under supervision of applicable Contractor personnel and manufacturer's representative in accordance with manufacturers' instructions.
- F. Submit a written report that equipment or system has been properly installed and is functioning correctly.

3.11 DEMONSTRATION AND INSTRUCTION

A. Demonstrate operation and maintenance of products to Owner's personnel two weeks prior to date of Substantial Completion.

- B. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at scheduled time, at equipment location.
- C. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.
- D. Provide a qualified person who is knowledgeable about the Project to perform demonstration and instruction of Owner's personnel.
- E. Perform instruction in a classroom environment located at the site. Exact location to be determined.
- F. Utilize operation and maintenance manuals as basis for instruction. Review contents of manual with Owner's personnel in detail to explain all aspects of operation and maintenance.
- G. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.

3.12 ADJUSTING

- A. Adjust operating products and equipment to ensure smooth and unhindered operation.
- B. Testing, adjusting, and balancing HVAC systems. See Division 23 section(s) and Section 01 4000.

3.13 FINAL CLEANING

- A. Execute final cleaning prior to final project assessment.
- 1. Clean areas to be occupied by Owner prior to final completion before Owner occupancy.
- B. Use cleaning materials that are nonhazardous.
- C. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.
- D. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.
- E. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.
- F. Clean filters of operating equipment.
- G. Clean debris from roofs, gutters, downspouts, scuppers, overflow drains, area drains, drainage systems, and _____.
- H. Clean site; sweep paved areas, rake clean landscaped surfaces.
- I. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

3.14 CLOSEOUT PROCEDURES

- A. Make submittals that are required by governing or other authorities.
 - 1. Provide copies to Architect and Owner.
- B. Accompany Project Coordinator on preliminary inspection to determine items to be listed for completion or correction in the Contractor's Correction Punch List for Contractor's Notice of Substantial Completion.
- C. Notify Architect when work is considered ready for Architect's Substantial Completion inspection.
- D. Submit written certification containing Contractor's Correction Punch List, that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for Architect's Substantial Completion inspection.
- E. Conduct Substantial Completion inspection and create Final Correction Punch List containing Architect's and Contractor's comprehensive list of items identified to be completed or corrected and submit to Architect.
- F. Contractor shall provide electronic format & mylar reproducible Record Drawings in addition to the original paper edition. Request of the Architect the appropriate electronic files after issuance of the Certificate for Substantial Completion.
- G. Complete Record Drawings (original paper edition, electronic format & mylar reproducibles) and submit to Architect.

- H. Ensure Record Documents have been completed and are ready for submission as required by Section 01 7800 Closeout Submittals.
- I. Deliver extra materials, tools, spare parts, maintenance products, and similar items to Owner at the time of Substantial Completion.
- J. Correct items of work listed in Final Correction Punch List and comply with requirements for access to Owner-occupied areas.
- K. Notify Architect when work is considered finally complete and ready for Architect's Substantial Completion final inspection.
- L. Complete items of work determined by Architect listed in executed Certificate of Substantial Completion.

SECTION 01 7800 CLOSEOUT SUBMITTALS

PART 1 GENERAL

- 1.1 SECTION INCLUDES
 - A. Project Record Documents.
 - B. Record Submittal Set.
 - C. Operation and Maintenance Data.
 - D. Warranties and bonds.
 - E. Extra materials, tools, spare parts, maintenance products, and similar items.
- 1.2 RELATED REQUIREMENTS
 - A. General Conditions: Performance bond and labor and material payment bonds, warranty, and correction of work.
 - B. Section 01 3000 ADMINISTRATIVE REQUIREMENTS: Submittals procedures, shop drawings, product data, and samples.
 - C. Section 01 6000 Product Requirements: Items to be turned over to the Owner
 - D. Section 01 7000 Execution and Closeout Requirements: Contract closeout procedures.
 - E. Individual Product Sections: Specific requirements for operation and maintenance data.
 - F. Individual Product Sections: Warranties required for specific products or Work.
 - G. Individual Product Sections: Specific requirements for extra materials, tools, spare parts, maintenance products, and similar items to be turned over to the Owner.

1.3 SUBMITTALS

- A. Project Record Documents: Submit documents to Architect with claim for final Application for Payment.
 - 1. Provide the original paper edition of the Record Drawings.
 - 2. Provide electronic format Record Drawings as prepared by the Contractor. Format may be a scan of the completed and approved paper Record Drawings executed during the course of the Work.
 - a. Provide scans in ".PDF" format.
 - b. Submit electronic files on compact discs (CDs).
 - 3. Provide a completed copy of all other Record Documents, including but not limited to the following:
 - a. Specifications.
 - b. Addenda.
 - c. Change Orders.
 - d. Architects Supplemental Instructions.
 - e. Answered Requests For Information (RFIs).
- B. Complete set of approved Submittals. (Owner's Record Submittal Set.)
 - 1. Submit to the Owner 1 copy of the approved submittals, with an index and a log, at the final inspection.
- C. Operation and Maintenance Data:
 - 1. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. Architect will review draft and return one copy with comments.
 - 2. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit completed documents within ten days after acceptance.
 - 3. Submit one copy of completed documents 15 days prior to final inspection. This copy will be reviewed and returned after final inspection, with Architect comments. Revise content of all document sets as required prior to final submission.
 - 4. Submit two sets of revised final documents in final form within 10 days after final inspection.
- D. Warranties and Bonds:
 - 1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 10 days after acceptance.

- 2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.
- 3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.
- E. Extra materials, tools, spare parts, maintenance products, and similar items:
 - 1. Ensure all items are clearly labeled, packaged, and quantified. Refer to Section 01 6000 Product Requirements.
 - 2. Deliver to location designated by Owner.
- 1.4 LABEL ALL RECORD DOCUMENTS
 - A. All Record Documents must be clearly, in bold face, labeled "RECORD DOCUMENT." Electronic/digital format documents must bear the label within each file.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

- 3.1 PROJECT RECORD DOCUMENTS
 - A. Maintain on site one set of the following record documents; record actual revisions to the Work:
 - 1. Drawings.
 - 2. Specifications.
 - 3. Addenda.
 - 4. Change Orders and other modifications to the Contract.
 - 5. Reviewed shop drawings, product data, and samples.
 - 6. Manufacturer's instruction for assembly, installation, and adjusting.
 - B. Ensure entries are complete and accurate, enabling future reference by Owner.
 - C. Store record documents separate from documents used for construction.
 - D. Record information concurrent with construction progress.
 - 1. Record Documents shall be maintained on a daily basis and kept current.
 - E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
 - 1. Manufacturer's name and product model and number.
 - 2. Product substitutions or alternates utilized.
 - 3. Changes made by Addenda and modifications.
 - F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
 - 1. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
 - 2. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
 - 3. Field changes of dimension and detail.
 - 4. Details not on original Contract drawings.
 - 5. Location of capped utilities.
 - G. Electronic Format Record Drawings provided by Contractor: Legibly mark each item to record actual construction including:
 - 1. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
 - 2. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
 - 3. Field changes of dimension and detail.
 - 4. Details not on original Contract drawings.
 - 5. Locations of capped utilities.
- 3.2 RECORD SUBMITTAL SET
 - A. Reviewed Submittals with Index and Log:
 - 1. Product Data.

- 2. Shop Drawings.
- 3. Samples for Selection.
- 4. Samples for Verification.
- B. Submittals for Information with Index and Log:
 - 1. Design data.
 - 2. Certificates.
 - 3. Test reports.
 - 4. Inspection reports.
 - 5. Manufacturer's instructions.
 - 6. Manufacturer's field reports.
 - 7. Other types indicated.
- 3.3 OPERATION AND MAINTENANCE DATA
 - A. Source Data: For each product or system, list names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.
 - B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.
 - C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.
 - D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.
- 3.4 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES
 - A. For Each Product, Applied Material, and Finish:
 - Product data, with catalog number, size, composition, and color and texture designations.
 Information for re-ordering custom manufactured products.
 - B. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.
 - C. Moisture protection and weather-exposed products: Include product data listing applicable reference standards, chemical composition, and details of installation. Provide recommendations for inspections, maintenance, and repair.
 - D. Additional information as specified in individual product specification sections.
 - E. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.
 - F. Provide a listing in Table of Contents for design data, with tabbed fly sheet and space for insertion of data.

3.5 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

- A. For Each Item of Equipment and Each System:
 - 1. Description of unit or system, and component parts.
 - 2. Identify function, normal operating characteristics, and limiting conditions.
 - 3. Include performance curves, with engineering data and tests.
 - 4. Complete nomenclature and model number of replaceable parts.
- B. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.
- C. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications; typed.
- D. Include color coded wiring diagrams as installed.
- E. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.

- F. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- G. Provide servicing and lubrication schedule, and list of lubricants required.
- H. Include manufacturer's printed operation and maintenance instructions.
- I. Include sequence of operation by controls manufacturer.
- J. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- K. Provide control diagrams by controls manufacturer as installed.
- L. Provide Contractor's coordination drawings, with color coded piping diagrams as installed.
- M. Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
- N. Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
- O. Include test and balancing reports.
- P. Additional Requirements: As specified in individual product specification sections.

3.6 ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS

- A. Assemble operation and maintenance data into durable manuals for Owner's personnel use, with data arranged in the same sequence as, and identified by, the specification sections.
- B. Where systems involve more than one specification section, provide separate tabbed divider for each system.
- C. Prepare instructions and data by personnel experienced in maintenance and operation of described products.
- D. Prepare data in the form of an instructional manual.
- E. Binders: Commercial quality, 8-1/2 by 11 inch (216 by 280 mm) three D side ring binders with durable plastic covers; 2 inch (50 mm) maximum ring size. When multiple binders are used, correlate data into related consistent groupings.
- F. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.
- G. Project Directory: Title and address of Project; names, addresses, and telephone numbers of Architect, Consultants, Contractor and subcontractors, with names of responsible parties.
- H. Tables of Contents: List every item separated by a divider, using the same identification as on the divider tab; where multiple volumes are required, include all volumes Tables of Contents in each volume, with the current volume clearly identified.
- I. Dividers: Provide tabbed dividers for each separate product and system; identify the contents on the divider tab; immediately following the divider tab include a description of product and major component parts of equipment.
- J. Text: Manufacturer's printed data, or typewritten data on 24 pound paper.
- K. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
- L. Arrange content by systems under section numbers and sequence of Table of Contents of this Project Manual.
- M. Contents: Prepare a Table of Contents for each volume, with each product or system description identified, in three parts as follows:
 - 1. Part 1: Directory, listing names, addresses, and telephone numbers of Architect, Contractor, Subcontractors, and major equipment suppliers.
 - 2. Part 2: Operation and maintenance instructions, arranged by system and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:
 - a. Significant design criteria.
 - b. List of equipment.
 - c. Parts list for each component.
 - d. Operating instructions.
 - e. Maintenance instructions for equipment and systems.
 - f. Maintenance instructions for special finishes, including recommended cleaning methods and materials, and special precautions identifying detrimental agents.

- 3. Part 3: Project documents and certificates, including the following:
 - a. Shop drawings and product data.
 - b. Air and water balance reports.
 - c. Certificates.
 - d. Photocopies of warranties and bonds.
- N. Provide a listing in Table of Contents for design data, with tabbed dividers and space for insertion of data.
- O. Table of Contents: Provide title of Project; names, addresses, and telephone numbers of Architect, Consultants, and Contractor with name of responsible parties; schedule of products and systems, indexed to content of the volume.

3.7 WARRANTIES AND BONDS

- A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Substantial completion is determined.
- B. Verify that documents are in proper form, contain full information, and are notarized.
- C. Co-execute submittals when required.
- D. Retain warranties and bonds until time specified for submittal.
- E. Manual: Bind in commercial quality 8-1/2 by 11 inch (216 by 279 mm) three D side ring binders with durable plastic covers.
- F. Cover: Identify each binder with typed or printed title WARRANTIES AND BONDS, with title of Project; name, address and telephone number of Contractor and equipment supplier; and name of responsible company principal.
- G. Table of Contents: Neatly typed, in the sequence of the Table of Contents of the Project Manual, with each item identified with the number and title of the specification section in which specified, and the name of product or work item.
- H. Separate each warranty or bond with index tab sheets keyed to the Table of Contents listing. Provide full information, using separate typed sheets as necessary. List Subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.
- 3.8 EXTRA MATERIALS, TOOLS, SPARE PARTS, MAINTENANCE PRODUCT & SIMILAR ITEMS
 - A. Deliver extra materials, tools, spare parts, maintenance products, and similar items to location(s) designated by Owner at the time of Substantial Completion.
 - B. Ensure that all items are properly packaged, and clearly marked as described at Section 01 6000 - Product Requirements. Refer also to Section 01 7000 - Execution and Closeout Requirements.
 - C. Prepare an inventory list of all items and provide multiple copies of this list. Use this as a checklist with the Owner when turning over to Owner's possession. Obtain Owners acknowledgement for receipt of all items.
 - D. Remaining Materials: Extra materials of value, that remain after completion of associated work, become Owner's property. Dispose of these materials as directed by the Owner.

CLOSEOUT SUBMITTALS

SECTION 02 4100 DEMOLITION

PART 1 GENERAL

- 1.1 SECTION INCLUDESA. Selective demolition of building elements for alteration purposes.
- 1.2 RELATED REQUIREMENTS
 - A. Section 01 1000 Summary: Limitations on Contractor's use of site and premises.
 - B. Section 01 1000 Summary: Description of items to be salvaged or removed for re-use by Contractor.
 - C. Section 01 5000 Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.
 - D. Section 01 6000 Product Requirements: Handling and storage of items removed for salvage and relocation.
 - E. Section 01 7000 Execution and Closeout Requirements: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products; temporary bracing and shoring.
- 1.3 REFERENCE STANDARDS
 - A. 29 CFR 1926 U.S. Occupational Safety and Health Standards; current edition.
 - B. NFPA 241 Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2013.
- 1.4 SUBMITTALS
 - A. See Section 01 3000 ADMINISTRATIVE REQUIREMENTS, for submittal procedures.
 - B. Project Record Documents: Accurately record actual locations of capped and active utilities and subsurface construction.

PART 2 PRODUCTS -- NOT USED

PART 3 EXECUTION

- 3.1 SCOPE
 - A. Remove paving and curbs as required to accomplish new work.
 - B. Remove other items indicated, for salvage, relocation, and recycling.
- 3.2 GENERAL PROCEDURES AND PROJECT CONDITIONS
 - A. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
 - 1. Obtain required permits.
 - 2. Provide, erect, and maintain temporary barriers and security devices.
 - 3. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon or limit access to their property.
 - B. Do not begin removal until receipt of notification to proceed from Owner.
 - C. Protect existing structures and other elements that are not to be removed.
 - 1. Provide bracing and shoring.
 - 2. Prevent movement or settlement of adjacent structures.
 - 3. Stop work immediately if adjacent structures appear to be in danger.
 - D. If hazardous materials are discovered during removal operations, stop work and notify Architect and Owner; hazardous materials include regulated asbestos containing materials, lead, PCB's, and mercury.
 - E. Partial Removal of Paving and Curbs: Neatly saw cut at right angle to surface.
- 3.3 EXISTING UTILITIES
 - A. Coordinate work with utility companies; notify before starting work and comply with their requirements; obtain required permits.
 - B. Protect existing utilities to remain from damage.

- C. Do not disrupt public utilities without permit from authority having jurisdiction.
- D. Do not close, shut off, or disrupt existing utility branches or take-offs that are in use without at least 3 days prior written notification to Owner.
- E. Locate and mark utilities to remain; mark using highly visible tags or flags, with identification of utility type; protect from damage due to subsequent construction, using substantial barricades if necessary.
- F. Remove exposed piping, valves, meters, equipment, supports, and foundations of disconnected and abandoned utilities.

3.4 SELECTIVE DEMOLITION FOR ALTERATIONS

- A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
 - 1. Verify that construction and utility arrangements are as indicated.
 - 2. Report discrepancies to Architect before disturbing existing installation.
 - 3. Beginning of demolition work constitutes acceptance of existing conditions that would be apparent upon examination prior to starting demolition.
- B. Remove existing work as indicated and as required to accomplish new work.
 - 1. Remove items indicated on drawings.
- C. Services (Including but not limited to HVAC, Plumbing, Electrical, and Telecommunications): Remove existing systems and equipment as indicated.
 - 1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components.
 - 2. Verify that abandoned services serve only abandoned facilities before removal.
 - 3. Remove abandoned pipe, ducts, conduits, and equipment; remove back to source of supply where possible, otherwise cap stub and tag with identification.
- D. Protect existing work to remain.
 - 1. Prevent movement of structure; provide shoring and bracing if necessary.
 - 2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
 - 3. Repair adjacent construction and finishes damaged during removal work.
 - 4. Patch as specified for patching new work.
- 3.5 DEBRIS AND WASTE REMOVAL
 - A. Remove debris, junk, and trash from site.
 - B. Leave site in clean condition, ready for subsequent work.
 - C. Clean up spillage and wind-blown debris from public and private lands.

SECTION 04 2000 UNIT MASONRY

PART 1 GENERAL

- 1.1 SECTION INCLUDES
 - A. Concrete Block.
 - B. Mortar and Grout.
 - C. Reinforcement and Anchorage.
 - D. Lintels.
 - E. Accessories.
- 1.2 REFERENCE STANDARDS
 - A. ACI 530/530.1/ERTA Building Code Requirements and Specification for Masonry Structures and Related Commentaries; 2011.
 - B. ASTM A82/A82M Standard Specification for Steel Wire, Plain, for Concrete Reinforcement; 2007.
 - C. ASTM A153/A153M Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.
 - D. ASTM A641/A641M Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire; 2009a (Reapproved 2014).
 - E. ASTM A1064/A1064M Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2015.
 - F. ASTM C90 Standard Specification for Loadbearing Concrete Masonry Units; 2014.
 - G. ASTM C144 Standard Specification for Aggregate for Masonry Mortar; 2011.
 - H. ASTM C150/C150M Standard Specification for Portland Cement; 2016.
 - I. ASTM C207 Standard Specification for Hydrated Lime for Masonry Purposes; 2006 (Reapproved 2011).
 - J. ASTM C270 Standard Specification for Mortar for Unit Masonry; 2014a.
 - K. ASTM C404 Standard Specification for Aggregates for Masonry Grout; 2011.
 - L. ASTM C476 Standard Specification for Grout for Masonry; 2010.
- 1.3 SUBMITTALS
 - A. See Section 01 3000 ADMINISTRATIVE REQUIREMENTS, for submittal procedures.
 - B. Product Data: Provide data for masonry units, fabricated wire reinforcement, mortar, and masonry accessories.
 - C. Manufacturer's Certificate: Certify that masonry units meet or exceed specified requirements.
- 1.4 QUALITY ASSURANCE
 - A. Comply with provisions of ACI 530/530.1/ERTA, except where exceeded by requirements of the contract documents.
 - B. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section with minimum three years of documented experience.
 - C. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.
- 1.5 DELIVERY, STORAGE, AND HANDLING
 - A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

PART 2 PRODUCTS

- 2.1 CONCRETE MASONRY UNITS
 - A. Manufacturers:
 - 1. Headwaters Construction Materials, formerly Southwest Concrete Products, San Antonio Plant & Sales office: 2233 Ackerman Rd., San Antonio, TX 78219; T: (210) 666-4989, Toll-Free: (888) 464-2399; F: (210) 666-8141; www.headwaterscm.com.

- 2. Featherlite Corporation, 508 McNeil Rd., Round Rock, TX 78681, TL512) 255-2573; F: (512) 255-2572; E-mail tatwood@brick.com; Web Site: www.featherlitetexas.com.
- 3. Substitutions: See Section 01 6000 Product Requirements.
- B. Concrete Block: Comply with referenced standards and as follows:
 - 1. Size: Standard units with nominal face dimensions of 16 by 8 inches (400 by 200 mm) and nominal depth of 8 inches (200 mm).
 - 2. Load-Bearing Units: ASTM C90, normal weight.
 - a. Hollow block, as indicated.
 - b. Exposed Faces: Manufacturer's standard color and texture.
- 2.2 MORTAR AND GROUT MATERIALS
 - A. Portland Cement: ASTM C150/C150M, Type I.
 - 1. Not more than 0.60 percent alkali.
 - B. Hydrated Lime: ASTM C207, Type S.
 - C. Mortar Aggregate: ASTM C144.
 - D. Grout Aggregate: ASTM C404.
 - E. Water: Clean and potable.
 - F. Pre-mix Mortar is not allowed. No exceptions.
 - G. Masonry Cement is not allowed. No exceptions.
 - H. Lime substitutes are not allowed. No exceptions.

2.3 REINFORCEMENT AND ANCHORAGE

- A. Manufacturers:
 - 1. Blok-Lok Limited: www.blok-lok.com.
 - 2. Hohmann & Barnard, Inc: www.h-b.com.
 - 3. WIRE-BOND: www.wirebond.com.
 - 4. Substitutions: See Section 01 6000 Product Requirements.
- B. Single Wythe Joint Reinforcement: Truss or ladder type; ASTM A1064/A1064M steel wire, mill galvanized to ASTM A641/A641M, Class 3; 0.1483 inch (3.8 mm) side rods with 0.1483 inch (3.8 mm) cross rods; width as required to provide not more than 1 inch (25 mm) and not less than 1/2 inch (13 mm) of mortar coverage on each exposure.
- C. Strap Anchors for Anchorage to Existing: Bent steel shapes configured as required for specific situations, 1-1/4 in (32 mm) width, 0.105 in (2.7 mm) thick, hot dip galvanized to ASTM A 153/A 153M, Class B.
- 2.4 ACCESSORIES
 - A. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.

2.5 LINTELS

A. Refer to the drawings for lintel schedule.

2.6 MORTAR AND GROUT MIXES

- A. Mortar for Unit Masonry: ASTM C270, using the Proportion Specification.
 - 1. Exterior, loadbearing masonry: Type N.
 - 2. Interior, loadbearing masonry: Type N.
 - 3. Interior, non-loadbearing masonry: Type N.
- B. Grout: ASTM C476; consistency required to fill completely volumes indicated for grouting; fine grout for spaces with smallest horizontal dimension of 2 inches (50 mm) or less; coarse grout for spaces with smallest horizontal dimension greater than 2 inches (50 mm).
- C. Mixing: Use mechanical batch mixer and comply with referenced standards.

PART 3 EXECUTION

- 3.1 EXAMINATION
 - A. Verify that field conditions are acceptable and are ready to receive masonry.
 - B. Verify that related items provided under other sections are properly sized and located.
 - C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

3.2 PREPARATION

A. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

3.3 COLD AND HOT WEATHER REQUIREMENTS

- A. Comply with requirements of ACI 530/530.1/ERTA or applicable building code, whichever is more stringent.
- 3.4 COURSING
 - A. Establish lines, levels, and coursing indicated. Protect from displacement.
 - B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.
 - C. Concrete Masonry Units:
 - 1. Bond: Running.
 - 2. Coursing: One unit and one mortar joint to equal 8 inches (200 mm).
 - 3. Mortar Joints: Concave.

3.5 PLACING AND BONDING

- A. Lay hollow masonry units with face shell bedding on head and bed joints.
- B. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.
- C. Remove excess mortar and mortar smears as work progresses.
- D. Interlock intersections and external corners.
- E. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.
- F. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.
- G. Cut mortar joints flush where resilient base is scheduled.

3.6 REINFORCEMENT AND ANCHORAGE - SINGLE WYTHE MASONRY

- A. Install horizontal joint reinforcement 16 inches (400 mm) on center.
- B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches (400 mm) each side of opening.
- C. Place continuous joint reinforcement in first and second joint below top of walls.
- D. Lap joint reinforcement ends minimum 6 inches (150 mm).
- 3.7 LINTELS
 - A. Install loose steel lintels over openings.
 - B. Install reinforced unit masonry lintels over openings where steel or precast concrete lintels are not scheduled.
 - 1. Openings to 42 inches (1070 mm): Place two, No. 3 (M9) reinforcing bars 1 inch (25 mm) from bottom web.
 - 2. Openings from 42 inches (1070 mm) to 78 inches (1980 mm): Place two, No. 5 (M16) reinforcing bars 1 inch (25 mm) from bottom web.
 - 3. Openings over 78 inches (1980 mm): Reinforce openings as detailed.
 - 4. Do not splice reinforcing bars.
 - 5. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch (13 mm) of dimensioned position.
 - 6. Place and consolidate grout fill without displacing reinforcing.
 - 7. Allow masonry lintels to attain specified strength before removing temporary supports.
 - C. Maintain minimum 8 inch (200 mm) bearing on each side of opening.

3.8 GROUTED COMPONENTS

- A. Reinforce bond beams with 2, No. 5 (M16) bars, 1 inch (25 mm) from bottom web.
- B. Lap splices minimum 24 bar diameters.
- C. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch (13 mm) of dimensioned position.
- D. Place and consolidate grout fill without displacing reinforcing.

E. At bearing locations, fill masonry cores with grout for a minimum 12 inches (300 mm) either side of opening.

3.9 BUILT-IN WORK

- A. As work progresses, install built-in metal door frames and other items to be built into the work and furnished under other sections.
- B. Install built-in items plumb, level, and true to line.
- C. Bed anchors of metal door and glazed frames in adjacent mortar joints. Fill frame voids solid with grout.
 - 1. Fill adjacent masonry cores with grout minimum 12 inches (300 mm) from framed openings.
- D. Do not build into masonry construction organic materials that are subject to deterioration.

3.10 TOLERANCES

- A. Maximum Variation from Alignment of Columns: 1/4 inch (6 mm).
- B. Maximum Variation From Unit to Adjacent Unit: 1/16 inch (1.6 mm).
- C. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft (6 mm/3 m) and 1/2 inch in 20 ft (13 mm/6 m) or more.
- D. Maximum Variation from Plumb: 1/4 inch (6 mm) per story non-cumulative; 1/2 inch (13 mm) in two stories or more.
- E. Maximum Variation from Level Coursing: 1/8 inch in 3 ft (3 mm/m) and 1/4 inch in 10 ft (6 mm/3 m); 1/2 inch in 30 ft (13 mm/9 m).
- F. Maximum Variation of Mortar Joint Thickness: Head joint, minus 1/4 inch, plus 3/8 inch (minus 6.4 mm, plus 9.5 mm).
- G. Maximum Variation from Cross Sectional Thickness of Walls: 1/4 inch (6 mm).
- 3.11 CUTTING AND FITTING
 - A. Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.
- 3.12 CLEANING
 - A. Remove excess mortar and mortar droppings.
 - B. Replace defective mortar. Match adjacent work.
 - C. Clean soiled surfaces with cleaning solution.
 - D. Use non-metallic tools in cleaning operations.

3.13 PROTECTION

A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

SECTION 06 1000 ROUGH CARPENTRY

PART 1 GENERAL

- 1.1 SECTION INCLUDES
 - A. Fire retardant treated wood materials.
 - B. Concealed wood blocking, nailers, and supports.
 - C. Miscellaneous wood nailers, furring, and grounds.
- 1.2 REFERENCE STANDARDS
 - A. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.
 - B. AWPA U1 Use Category System: User Specification for Treated Wood; 2012.
 - C. PS 1 Structural Plywood; 2009.
 - D. PS 20 American Softwood Lumber Standard; 2010.
 - E. SPIB (GR) Grading Rules; 2014.
- 1.3 DELIVERY, STORAGE, AND HANDLING
 - A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.
 - B. Fire Retardant Treated Wood: Prevent exposure to precipitation during shipping, storage, or installation.

PART 2 PRODUCTS

- 2.1 GENERAL REQUIREMENTS
 - A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
 - 1. If no species is specified, provide any species graded by the agency specified; if no grading agency is specified, provide lumber graded by any grading agency meeting the specified requirements.
 - 2. Grading Agency: Any grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee (www.alsc.org) and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.
 - B. Lumber fabricated from old growth timber is not permitted.
- 2.2 DIMENSION LUMBER FOR CONCEALED APPLICATIONS
 - A. Grading Agency: Southern Pine Inspection Bureau, Inc; SPIB (GR).
 - B. Sizes: Nominal sizes as indicated on drawings, S4S.
 - C. Moisture Content: S-dry or MC19.
 - D. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
 - 1. Lumber: S4S, No. 2 or Standard Grade.
 - 2. Boards: Standard or No. 3.
- 2.3 CONSTRUCTION PANELS
 - A. Communications and Electrical Room Mounting Boards: PS 1 A-D plywood, or medium density fiberboard; 3/4 inch (19 mm) thick; flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.
 - B. Use "MDF" and "Moisture Resistant MDF" in lieu of particleboard / particle board when work is in and around interior Millwork, Architectural Wood Casework, cabinets, furniture, and other interior finish locations.
- 2.4 FACTORY WOOD TREATMENT
 - A. Treated Lumber and Plywood: Comply with requirements of AWPA U1 Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.
 - 1. Fire-Retardant Treated Wood: Mark each piece of wood with producer's stamp indicating compliance with specified requirements.

B. Fire Retardant Treatment:

SECTION 06 4100 ARCHITECTURAL WOOD CASEWORK

PART 1 GENERAL

- 1.1 SECTION INCLUDES
 - A. Specially fabricated cabinet units.
 - B. Countertops.
 - C. Cabinet hardware.
 - D. Preparation for installing utilities.
 - E. Caulking.
- 1.2 RELATED REQUIREMENTS
 - A. Section 06 1000 Rough Carpentry: Support framing, grounds, and concealed blocking.
- 1.3 REFERENCE STANDARDS
 - A. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.
 - B. AWI/AWMAC/WI (AWS) Architectural Woodwork Standards; 2014.
 - C. AWMAC/WI (NAAWS) North American Architectural Woodwork Standards, U.S. Version 3.0; 2016.
 - D. BHMA A156.9 American National Standard for Cabinet Hardware; 2010.
 - E. ISFA 2-01 Classification and Standards for Solid Surfacing Material; 2013.
 - F. NEMA LD 3 High-Pressure Decorative Laminates; 2005.
 - G. TAS 2012 Texas Accessibility Standards (TAS); 2012.
- 1.4 ADMINISTRATIVE REQUIREMENTS
 - A. Preinstallation Meeting: Convene a preinstallation meeting not less than one week before starting work of this section; require attendance by all affected installers.
- 1.5 SUBMITTALS
 - A. See Section 01 3000 ADMINISTRATIVE REQUIREMENTS, for submittal procedures.
 - B. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
 - 1. Scale of Drawings: 1-1/2 inch to 1 foot (125 mm to 1 m), minimum.
 - 2. Complete details of materials and installation; combine with shop drawings of cabinets and casework and countertop materials specified herein or in other sections.
 - a. Provide seam and joint locations and details at all seam and joint conditions of solid surfacing countertop material at horizontal and vertical applications.
 - C. Product Data:
 - 1. Provide data for hardware accessories.
 - 2. Color matched caulk product data
 - D. Samples: Submit actual samples of architectural cabinet construction, minimum 12 inches (300 mm) square, illustrating proposed cabinet and countertop substrate and finish.
- 1.6 QUALITY ASSURANCE
 - A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.
 - B. Work of this Section shall comply with the TAS.
 - 1. TAS covers scoping and technical requirements for accessibility to sites, facilities, buildings, and elements by individuals with disabilities in the state of Texas.
- 1.7 DELIVERY, STORAGE, AND HANDLING
 - A. Protect units from moisture damage.
- 1.8 FIELD CONDITIONS
 - A. During and after installation of custom cabinets, maintain temperature and humidity conditions in building spaces at same levels planned for occupancy.

PART 2 PRODUCTS

2.1 CABINETS

- A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.
- 2.2 WOOD-BASED COMPONENTS
 - A. Wood fabricated from old growth timber is not permitted.
- 2.3 LAMINATE MATERIALS
 - A. Manufacturers:
 - 1. Formica Corporation: www.formica.com.
 - 2. Panolam Industries International, Inc\Nevamar: www.nevamar.com.
 - 3. Wilsonart: www.wilsonart.com.
 - B. High Pressure Decorative Laminate (HPDL): NEMA LD 3, types as recommended for specific applications.

2.4 COUNTERTOPS

- A. Solid Surfacing Countertops: Solid surfacing sheet or plastic resin casting over continuous substrate.
 - 1. Flat Sheet Thickness: 1/4 inch (6 mm), minimum.
 - 2. Solid Surfacing Sheet and Plastic Resin Castings: Complying with ISFA 2-01 and NEMA LD 3; acrylic or polyester resin, mineral filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard woodworking tools; no surface coating; color and pattern consistent throughout thickness.
 - a. Manufacturers:
 - 1) Avonite Surfaces: www.avonitesurfaces.com.
 - 2) Dupont: www.corian.com.
 - 3) Formica Corporation: www.formica.com.
 - 4) Wilsonart: www.wilsonart.com.
 - 5) Substitutions: See Section 01 6000 Product Requirements.
 - b. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
 - c. NSF approved for food contact.
 - d. Finish on Exposed Surfaces: Matte, gloss rating of 5 to 20.
 - e. Color and Pattern: As selected by Architect from manufacturer's full line.
 - 3. Other Components Thickness: 1/2 inch (12 mm), minimum.
 - 4. Exposed Edge Treatment: Built up to minimum 1-1/4 inch (32 mm) thick; square edge.
 - 5. Back and End Splashes: Same sheet material, square top; minimum 4 inches (102 mm) high.
 - 6. Fabricate in accordance with AWI/AWMAC/WI (AWS), Section 11 Countertops, Custom Grade.

2.5 ACCESSORIES

- A. Color Matched Caulk: Provide factory color matched siliconized latex caulk.
 - 1. Product: FormFill Color Matched Caulk, available from FormFill Products, Clarksville, TX, 75426; T: (903) 427-0267; F: (903) 427-0261; Web site: www.formfillproducts.com.
 - 2. Color: As selected by Architect to match material(s) identified by Architect.
- B. Adhesive: Type recommended by fabricator to suit application.

2.6 HARDWARE

- A. Hardware: BHMA A156.9, types as recommended by fabricator for quality grade specified.
- 2.7 FABRICATION
 - A. Assembly: Shop assemble cabinets for delivery to site in units easily handled and to permit passage through building openings.
 - B. Edging: Fit shelves, doors, and exposed edges with specified edging. Do not use more than one piece for any single length.

- C. Fitting: When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide matching trim for scribing and site cutting.
- D. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners.
 - 1. Apply laminate backing sheet to reverse side of plastic laminate finished surfaces.
 - 2. Cap exposed plastic laminate finish edges with material of same finish and pattern.
- E. Solid Surfacing: Fabricate tops up to 144 inches (3657 mm) long in one piece; join pieces with adhesive sealant in accordance with manufacturer's recommendations and instructions.
 - 1. Exposed to view seams and joints of same materials shall be invisable to find at the completed work. The finished work shall have the effect of a monolithic material crafted out of a single piece of material. Adhering material shall match solid surfacing material and shall be undetectable at all exposed to view conditions.
 - 2. Exposed to view seams and joints of dissimilar materials shall be butted, unless detailed otherwise, without any gaps or adhering materials evident.
- F. Provide cutouts for plumbing fixtures. Verify locations of cutouts from on-site dimensions. Prime paint cut edges.

PART 3 EXECUTION

- 3.1 EXAMINATION
 - A. Verify adequacy of backing and support framing.
- 3.2 INSTALLATION
 - A. Set and secure custom cabinets in place, assuring that they are rigid, plumb, and level.
 - B. Clean and prepare locations to be caulked including, but not limited to countertops, backsplashes, side splashes, cabinets, vanities and adjoining surfaces.
 - 1. Apply color matched caulk at countertop material locations as recommended by manufacturer.
 - 2. Apply paint grade caulk at non-countertop material locations as recommended by manufacturer.

3.3 ADJUSTING

- A. Adjust installed work.
- B. Adjust moving or operating parts to function smoothly and correctly.

3.4 CLEANING

A. Clean casework, counters, shelves, hardware, fittings, and fixtures.

ARCHITECTURAL WOOD CASEWORK

SECTION 07 9200 JOINT SEALANTS

PART 1 GENERAL

- SECTION INCLUDES
 A. Nonsag gunnable joint sealants.
- 1.2 RELATED REQUIREMENTS
 - A. Section 08 7100 Door Hardware: Setting exterior door thresholds in sealant.
 - B. Section 09 2116 Gypsum Board Assemblies: Sealing acoustical and sound-rated walls and ceilings.
 - C. Section 09 3000 Tiling: Sealant between tile and plumbing fixtures and at junctions with other materials and changes in plane.
- 1.3 REFERENCE STANDARDS
 - A. ASTM C661 Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer; 2006 (Reapproved 2011).
 - B. ASTM C834 Standard Specification for Latex Sealants; 2014.
 - C. ASTM C920 Standard Specification for Elastomeric Joint Sealants; 2014.
 - D. ASTM C1193 Standard Guide for Use of Joint Sealants; 2016.
 - E. ASTM C1248 Standard Test Method for Staining of Porous Substrate by Joint Sealants; 2008 (Reapproved 2012).
 - F. SCAQMD 1168 South Coast Air Quality Management District Rule No.1168; current edition.

1.4 SUBMITTALS

- A. See Section 01 3000 ADMINISTRATIVE REQUIREMENTS, for submittal procedures.
- B. Product Data for Sealants: Submit manufacturer's technical data sheets for each product to be used, that includes the following.
 - 1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.
 - 2. List of backing materials approved for use with the specific product.
 - 3. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
 - 4. Substrates the product should not be used on.
- C. Submit manufacturer's product data and details showing:
 - 1. Joint Sealants: Layout of recommended minimum and maximum joint sealant width to depth relationships, and recommended primers for substrates and conditions indicated. Include material specifications showing compliance with requirements.
- D. Color Cards for Selection: Where sealant color is not specified, submit manufacturer's color cards showing standard colors available for selection.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Non-Sag Sealants: Permits application in joints on vertical surfaces without sagging or slumping.
 - 1. BASF Construction Chemicals-Building Systems: www.buildingsystems.basf.com.
 - 2. Dow Chemical Company; ____
 - consumer.dow.com/en-us/industry/ind-building-construction.html/#sle.
 - 3. Hilti, Inc: www.us.hilti.com.
 - 4. Momentive Performance Materials, Inc (formerly GE Silicones): www.momentive.com.
 - 5. Pecora Corporation: www.pecora.com.
 - 6. Sika Corporation: www.usa-sika.com.
 - 7. W.R. Meadows, Inc: www.wrmeadows.com.

- 8. Substitutions: See Section 01 6000 Product Requirements.
- 2.2 JOINT SEALANT APPLICATIONS
 - A. Scope:
 - 1. Exterior Joints: Seal open joints, whether or not the joint is indicated on the drawings, unless specifically indicated not to be sealed. Exterior joints to be sealed include, but are not limited to, the following items.
 - a. Wall expansion and control joints.
 - b. Joints between door, window, and other frames and adjacent construction.
 - c. Joints between different exposed materials.
 - d. Other joints indicated below.
 - 2. Interior Joints: Do not seal interior joints unless specifically indicated to be sealed. Interior joints to be sealed include, but are not limited to, the following items.
 - a. Joints between door, window, and other frames and adjacent construction.
 - b. Other joints indicated below.
 - 3. Do not seal the following types of joints.
 - a. Joints indicated to be treated with manufactured expansion joint cover or some other type of sealing device.
 - b. Joints where sealant is specified to be provided by manufacturer of product to be sealed.
 - c. Joints where installation of sealant is specified in another section.
 - d. Joints between suspended panel ceilings/grid and walls.
 - B. Exterior Joints: Use nonsag non-staining silicone sealant, Type SIL, unless otherwise indicated.
 - C. Interior Joints: Use non-sag polyurethane sealant, Type STPU, unless otherwise indicated.
 - 1. Wall and Ceiling Joints in Non-Wet Areas: Acrylic emulsion latex sealant; Type ACREM.
 - 2. Joints between Fixtures in Wet Areas and Floors, Walls, and Ceilings: Mildew-resistant silicone sealant; white; Type MRSIL.
- 2.3 JOINT SEALANTS GENERAL
 - A. Sealants and Primers: Provide products having lower volatile organic compound (VOC) content than indicated in SCAQMD 1168.
- 2.4 NONSAG JOINT SEALANTS
 - A. Type SIL Non-Staining Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.
 - 1. Movement Capability: _____, minimum.
 - 2. Non-Staining To Porous Stone: Non-staining to light-colored natural stone when tested in accordance with ASTM C1248.
 - 3. Dirt Pick-Up: Reduced dirt pick-up compared to other silicone sealants.
 - 4. Hardness Range: 15 to 35, Shore A, when tested in accordance with ASTM C661.
 - 5. Color: To be selected by Architect from manufacturer's standard range.
 - 6. Cure Type: Single-component, neutral moisture curing.
 - 7. Service Temperature Range: Minus 65 to 180 degrees F (Minus 54 to 82 degrees C).
 - 8. Manufacturers:
 - a. Dow Chemical Company; 791 Silicone Weatherproofing Sealant:
 - consumer.dow.com/en-us/industry/ind-building-construction.html/#sle.
 - b. Sika Corporation; Sikasil WS-295: www.usa-sika.com/#sle.
 - c. Substitutions: See Section 01 6000 Product Requirements.
 - B. Type MRSIL Mildew-Resistant Silicone Sealant: ASTM C920, Grade NS, Uses M and A; single component, mildew resistant; not expected to withstand continuous water immersion or traffic.
 - 1. Color: White.
 - 2. Manufacturers:
 - a. Sika Corporation; Sikasil GP: www.usa-sika.com/#sle.
 - b. Substitutions: See Section 01 6000 Product Requirements.
 - C. Type ____ Hybrid Urethane Sealant: ASTM C920, Grade NS, Uses M and A; single component; not expected to withstand continuous water immersion or traffic.

- 1. Movement Capability: Plus and minus 35 percent, minimum.
- 2. Hardness Range: 20 to 40, Shore A, when tested in accordance with ASTM C661.
- 3. Color: Match adjacent finished surfaces.
- 4. Service Temperature Range: Minus 40 to 180 degrees F (Minus 40 to 82 degrees C).
- 5. Manufacturers:
 - a. Substitutions: See Section 01 6000 Product Requirements.
- D. Type ACREM Acrylic Emulsion Latex: Water-based; ASTM C834, single component, non-staining, non-bleeding, non-sagging; not intended for exterior use.
 - 1. Color: To be selected by Architect from manufacturer's standard range.
 - 2. Grade: ASTM C834; Grade Minus 18 Degrees C.
 - 3. Manufacturers:
 - a. Franklin International, Inc; Titebond GREENchoice Acoustical Smoke & Sound Sealant: www.titebond.com/#sle.
 - b. Sherwin-Williams Company; Powerhouse Siliconized Acrylic Latex Sealant: www.sherwin-williams.com/#sle.
 - c. Substitutions: See Section 01 6000 Product Requirements.

PART 3 EXECUTION

- 3.1 EXAMINATION
 - A. Verify that joints are ready to receive work.
 - B. Verify that backing materials are compatible with sealants.
- 3.2 PREPARATION
 - A. Remove loose materials and foreign matter that could impair adhesion of sealant.
 - B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.
 - C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.
 - D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.
- 3.3 INSTALLATION
 - A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.
 - B. Perform installation in accordance with ASTM C1193.
 - C. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer, except where specific dimensions are indicated.
 - D. Install bond breaker backing tape where backer rod cannot be used.
 - E. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.
 - F. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.
 - G. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.

JOINT SEALANTS

SECTION 08 1113 HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

- 1.1 SECTION INCLUDES
 - A. Non-fire-rated hollow metal doors and frames.
 - B. Hollow metal frames for wood doors.
 - C. Thermally insulated hollow metal doors with frames.
 - D. Accessories, including glazing.
- 1.2 RELATED REQUIREMENTS
 - A. Section 08 7100 Door Hardware.
 - B. Section 08 8000 Glazing: Glass for doors and borrowed lites.
 - C. Section 09 9000 Painting: Field painting.
- 1.3 ABBREVIATIONS AND ACRONYMS
- 1.4 REFERENCE STANDARDS
 - A. ADA Standards Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
 - B. ANSI/SDI A250.4 Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors; 2011.
 - C. ANSI/SDI A250.8 Specifications for Standard Steel Doors and Frames (SDI-100); 2014.
 - D. ASTM A653/A653M Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.
 - E. ASTM A1008/A1008M Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable; 2015.
 - F. ASTM A1011/A1011M Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2014.
 - G. BHMA A156.115 American National Standard for Hardware Preparation in Steel Doors and Steel Frames; 2014.
 - H. ICC A117.1 Accessible and Usable Buildings and Facilities; 2009.
 - I. NAAMM HMMA 830 Hardware Selection for Hollow Metal Doors and Frames; 2002.
 - J. NAAMM HMMA 831 Hardware Locations for Hollow Metal Doors and Frames; 2011.
 - K. NAAMM HMMA 840 Guide Specifications for Installation and Storage of Hollow Metal Doors and Frames; 2007.
 - L. NAAMM HMMA 861 Guide Specifications for Commercial Hollow Metal Doors and Frames; 2006.
 - M. SDI 117 Manufacturing Tolerances for Standard Steel Doors and Frames; 2013.
- 1.5 SUBMITTALS
 - A. See Section 01 3000 ADMINISTRATIVE REQUIREMENTS, for submittal procedures.
 - B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes; and one copy of referenced standards/guidelines.
 - C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and any indicated finish requirements.
 - D. Installation Instructions: Manufacturer's published instructions, including any special installation instructions relating to this project.
 - E. Manufacturer's Certificate: Certification that products meet or exceed specified requirements.
- 1.6 QUALITY ASSURANCE
 - A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years documented experience.
 - B. Maintain at project site copies of reference standards relating to installation of products specified.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Comply with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
- B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion and adverse effects on factory applied painted finish.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Hollow Metal Doors and Frames:
 - 1. Ceco Door, an Assa Abloy Group company: www.assaabloydss.com.
 - 2. De La Fontaine Inc: www.delafontaine.com.
 - 3. Republic Doors: www.republicdoor.com.
 - 4. Steelcraft, an Allegion brand: www.allegion.com/sle.
 - 5. Substitutions: See Section 01 6000 Product Requirements.

2.2 DESIGN CRITERIA

- A. Requirements for Hollow Metal Doors and Frames:
 - 1. Steel used for fabrication of doors and frames shall comply with one or more of the following requirements; Galvannealed steel conforming to ASTM A653/A653M, cold-rolled steel conforming to ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel conforming to ASTM A1011/A1011M, Commercial Steel (CS) Type B for each.
 - 2. Accessibility: Comply with ICC A117.1 and ADA Standards.
 - 3. Exterior Door Top Closures: Flush end closure channel, with top and door faces aligned.
 - 4. Door Edge Profile: Manufacturers standard for application indicated.
 - 5. Typical Door Face Sheets: Flush.
 - 6. Glazed Lights: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings. Style: Manufacturers standard.
 - 7. Hardware Preparations, Selections and Locations: Comply with NAAMM HMMA 830 and NAAMM HMMA 831 or BHMA A156.115 and ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
 - 8. Zinc Coating for Typical Interior and/or Exterior Locations: Provide metal components zinc-coated (galvanized) and/or zinc-iron alloy-coated (galvannealed) by the hot-dip process in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness, unless noted otherwise for specific hollow metal doors and frames.
 - a. Based on SDI Standards: Provide at least A40/ZF120 (galvannealed) when necessary, coating not required for typical interior door applications, and at least A60/ZF180 (galvannealed) for corrosive locations.
- B. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

2.3 HOLLOW METAL DOORS

- A. Exterior and Interior Doors: Thermally insulated.
 - 1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
 - a. Level 3 Extra Heavy-duty.
 - b. Physical Performance Level A, 1,000,000 cycles; in accordance with ANSI/SDI A250.4.
 - c. Model 1 Full Flush.
 - d. Door Face Metal Thickness: 16 gage, 0.053 inch (1.3 mm), minimum.
 - e. Zinc Coating: A60/ZF180 galvannealed coating; ASTM A653/A653M.
 - 2. Core Material: Polystyrene, 1 lbs/cu ft minimum density.
 - 3. Door Thermal Resistance: R-Value of 6.0 minimum, for installed thickness of polystyrene.
 - 4. Door Thickness: 1-3/4 inch (44.5 mm), nominal.
 - 5. Top Closures for Outswinging Doors: Flush with top of faces and edges.
- 6. Door Face Sheets: Flush.
- 7. Weatherstripping: Refer to Section 08 7100.
- 8. Door Finish: Factory primed and field finished.

2.4 HOLLOW METAL FRAMES

- A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.
- B. Exterior Door Frames: Full profile/continuously welded type.
 - 1. Galvanizing: Components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with A40/ZF120 coating.
 - 2. Frame Metal Thickness: 16 gage, 0.053 inch (1.3 mm), minimum.
 - 3. Frame Finish: Factory primed and field finished.
 - 4. Weatherstripping: Separate, see Section 08 7100.
- C. Interior Door Frames, Non-Fire Rated: Slip-on type at gypsum board walls, and knock-down type at masonry walls.
 - 1. Frame Metal Thickness: 16 gage, 0.053 inch (1.3 mm), minimum.
 - 2. Frame Finish: Factory primed and field finished.
- D. Frames for Wood Doors: Comply with frame requirements in accordance with corresponding door.
- E. Provide mortar guard boxes for hardware cut-outs in frames to be installed in masonry or to be grouted.
- F. Frames in Masonry Walls: Size to suit masonry coursing with head member 4 inch (102 mm) high to fill opening without cutting masonry units.

2.5 ACCESSORIES

- A. Glazing: Tempered glass, 1/4 inch (6 mm) thick.
- B. Removable Stops: Formed sheet steel, mitered or butted corners; prepared for countersink style tamper proof screws.
- C. Grout for Frames: Portland cement grout with maximum 4 inch (102 mm) slump for hand troweling; thinner pumpable grout is prohibited.
- D. Silencers: Resilient rubber, fitted into drilled hole; provide three on strike side of single door, three on center mullion of pairs, and two on head of pairs without center mullions.
- E. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.

PART 3 EXECUTION

- 3.1 EXAMINATION
 - A. Verify existing conditions before starting work.
 - B. Verify that opening sizes and tolerances are acceptable.
 - C. Verify that finished walls are in plane to ensure proper door alignment.
- 3.2 PREPARATION
 - A. Coat inside of frames to be installed in masonry or to be grouted, with bituminous coating, prior to installation.
- 3.3 INSTALLATION
 - A. Install doors and frames in accordance with manufacturer's instructions and related requirements of specified door and frame standards or custom guidelines indicated.
 - B. Coordinate frame anchor placement with wall construction.
 - C. Grout frames in masonry construction, using hand trowel methods; brace frames so that pressure of grout before setting will not deform frames.
 - D. Install door hardware as specified in Section 08 7100.
 - E. Comply with glazing installation requirements of Section 08 8000.
- 3.4 TOLERANCES
 - A. Clearances Between Door and Frame: Comply with related requirements of specified frame standards or custom guidelines indicated in accordance with SDI 117 or NAAMM HMMA 861.
 - B. Maximum Diagonal Distortion: 1/16 inch (1.6 mm) measured with straight edge, corner to corner.

3.5 ADJUSTING

A. Adjust for smooth and balanced door movement. **END OF SECTION**

SECTION 08 1416 FLUSH WOOD DOORS

PART 1 GENERAL

- 1.1 SECTION INCLUDES
 - A. Flush wood doors; flush and flush glazed configuration; non-rated.
- 1.2 RELATED REQUIREMENTS
 - A. Section 08 1113 Hollow Metal Doors and Frames.
 - B. Section 08 7100 Door Hardware.
 - C. Section 08 8000 Glazing.
- 1.3 REFERENCE STANDARDS
 - A. ASTM C1048 Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2012.
 - B. AWI/AWMAC/WI (AWS) Architectural Woodwork Standards; 2014.
 - C. AWMAC/WI (NAAWS) North American Architectural Woodwork Standards, U.S. Version 3.0; 2016.
- 1.4 SUBMITTALS
 - A. See Section 01 3000 ADMINISTRATIVE REQUIREMENTS, for submittal procedures.
 - B. Product Data: Indicate door core materials and construction; veneer species, type and characteristics.
 - C. Shop Drawings: Show doors and frames, elevations, sizes, types, swings, undercuts, beveling, blocking for hardware, factory machining, factory finishing, cutouts for glazing and other details.
 1. Provide information as required by AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS).
 - D. Samples: Submit two samples of door construction, 4 by 4 inch (100 by 100 mm) in size cut from top corner of door.
 - E. Samples: Submit two samples of door veneer, 8 by 8 inch (200 by 200 mm) in size illustrating wood grain, stain color, and sheen.
 - F. Manufacturer's Installation Instructions: Indicate special installation instructions.
 - G. Warranty, executed in Owner's name.
- 1.5 QUALITY ASSURANCE
 - A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section, with not less than three years of documented experience.
 - B. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than three years of documented experience.
- 1.6 DELIVERY, STORAGE, AND HANDLING
 - A. Package, deliver and store doors in accordance with specified quality standard.
 - B. Accept doors on site in manufacturer's packaging. Inspect for damage.
 - C. Protect doors with resilient packaging sealed with heat shrunk plastic. Do not store in damp or wet areas; or in areas where sunlight might bleach veneer. Seal top and bottom edges with tinted sealer if stored more than one week. Break seal on site to permit ventilation.
- 1.7 WARRANTY
 - A. See Section 01 7800 Closeout Submittals, for additional warranty requirements.
 - B. Interior Doors: Provide manufacturer's warranty for the life of the installation.
 - C. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

PART 2 PRODUCTS

- 2.1 MANUFACTURERS
 - A. Wood Veneer Faced Doors:
 - 1. Eggers Industries: www.eggersindustries.com.
 - 2. Graham Wood Doors: www.grahamdoors.com.

- 3. Marshfield DoorSystems, Inc: www.marshfielddoors.com.
- 4. Substitutions: See Section 01 6000 Product Requirements.

2.2 DOORS AND PANELS

- A. Doors: Refer to drawings for locations and additional requirements.
 - 1. Quality Standard: Custom Grade, Heavy Duty performance, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.
 - 2. Wood Veneer Faced Doors: 5-ply unless otherwise indicated.
- B. Interior Doors: 1-3/4 inches (44 mm) thick unless otherwise indicated; flush construction.
 1. Provide solid core doors at each location.
 - 2. Wood veneer facing with factory transparent finish.
- 2.3 DOOR AND PANEL CORES
 - A. Non-Rated Solid Core and 20 Minute Rated Doors: Type structural composite lumber core (SCLC), plies and faces as indicated.
- 2.4 DOOR FACINGS
 - A. Veneer Facing for Transparent Finish: Red oak, veneer grade in accordance with quality standard indicated, plain sliced (flat cut), with book match between leaves of veneer, running match of spliced veneer leaves assembled on door or panel face.

2.5 DOOR CONSTRUCTION

- A. Fabricate doors in accordance with door quality standard specified.
- B. Cores Constructed with stiles and rails:
 - 1. Provide solid blocks at lock edge for hardware reinforcement.
 - 2. Provide solid blocking for other throughbolted hardware.
- C. Glazed Openings: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings.
- D. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.
- E. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.
- F. Provide edge clearances in accordance with the quality standard specified.
- 2.6 FACTORY FINISHING WOOD VENEER DOORS
 - A. Finish work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 5 -Finishing for grade specified and as follows:
 - 1. Transparent:
 - a. System 11, Polyurethane, Catalyzed.
 - b. Stain: As selected by Architect.
 - c. Sheen: Satin.
 - B. Factory finish doors in accordance with approved sample.
- 2.7 ACCESSORIES
 - A. Glazed Openings:
 - 1. Heat-Strengthened and Fully Tempered Glass: ASTM C1048.
 - 2. Tint: Clear.
 - B. Glazing Stops: Wood, of same species as door facing, butted corners; prepared for countersink style tamper proof screws.
 - C. Door Hardware: As specified in Section 08 7100.

PART 3 EXECUTION

- 3.1 EXAMINATION
 - A. Verify existing conditions before starting work.
 - B. Verify that opening sizes and tolerances are acceptable.
 - C. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

3.2 INSTALLATION

- A. Install doors in accordance with manufacturer's instructions and specified quality standard.
- B. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.
- C. Use machine tools to cut or drill for hardware.
- D. Coordinate installation of doors with installation of frames and hardware.
- E. Coordinate installation of glazing.

3.3 TOLERANCES

- A. Conform to specified quality standard for fit and clearance tolerances.
- B. Conform to specified quality standard for telegraphing, warp, and squareness.

3.4 ADJUSTING

- A. Adjust doors for smooth and balanced door movement.
- B. Adjust closers for full closure.

FLUSH WOOD DOORS

SECTION 08 3323 OVERHEAD COILING DOORS

PART 1 GENERAL

- 1.1 SECTION INCLUDESA. Overhead coiling doors, operating hardware, exterior, manual operation.
- 1.2 RELATED REQUIREMENTS
 - A. Section 08 7100 Door Hardware: Cylinder cores and keys.

1.3 SUBMITTALS

- A. See Section 01 3000 ADMINISTRATIVE REQUIREMENTS, for submittal procedures.
- B. Product Data: Provide general construction and component connections and details.
- C. Shop Drawings: Indicate pertinent dimensioning, anchorage methods, hardware locations, and installation details.
- D. Samples: Submit two slats, 6 inch (150 mm) in size illustrating shape, color and finish texture.
- E. Manufacturer's Installation Instructions: Indicate installation sequence and procedures, adjustment and alignment procedures.
- F. Maintenance Data: Indicate lubrication requirements and frequency and periodic adjustments required.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Overhead Coiling Doors:
 - 1. Cornell Iron Works, Inc: www.cornelliron.com.
 - 2. Overhead Door Corporation: www.overheaddoor.com.
 - 3. Wayne-Dalton, a Division of Overhead Door Corporation: www.wayne-dalton.com.
 - 4. Substitutions: See Section 01 6000 Product Requirements.

2.2 COILING DOORS

- A. Exterior Coiling Doors: Steel slat curtain.
 - 1. Sandwich slat construction with insulated core of foamed-in-place polyurethane insulation; minimum R-value of 8.1 (RSI-value of 1.43).
 - 2. Nominal Slat Size: 2 inches (50 mm) wide x required length.
 - 3. Finish: Factory painted, color as selected.
 - 4. Guide, Angles: Galvanized steel.
 - 5. Hood Enclosure: Manufacturer's standard; primed steel.
 - 6. Manual hand chain lift operation.
 - 7. Mounting: Surface mounted.

PART 3 EXECUTION

- 3.1 EXAMINATION
 - A. Verify that opening sizes, tolerances and conditions are acceptable.

3.2 INSTALLATION

- A. Install units in accordance with manufacturer's instructions.
- B. Use anchorage devices to securely fasten assembly to wall construction and building framing without distortion or stress.
- C. Securely and rigidly brace components suspended from structure. Secure guides to structural members only.
- D. Fit and align assembly including hardware; level and plumb, to provide smooth operation.
- E. Install perimeter trim and closures.

3.3 TOLERANCES

- A. Maintain dimensional tolerances and alignment with adjacent work.
- B. Maximum Variation From Plumb: 1/16 inch (1.6 mm).

- C. Maximum Variation From Level: 1/16 inch (1.6 mm).
- D. Longitudinal or Diagonal Warp: Plus or minus 1/8 inch per 10 ft (3.2 mm per 3 m) straight edge.

3.4 ADJUSTING

A. Adjust operating assemblies for smooth and noiseless operation.

3.5 CLEANING

- A. Clean installed components.
- B. Remove labels and visible markings.

SECTION 08 5113 ALUMINUM WINDOWS

PART 1 GENERAL

- 1.1 SECTION INCLUDES
 - A. Extruded aluminum windows with operating sash.
 - B. Factory glazing.
- 1.2 RELATED REQUIREMENTS
 - A. Section 07 9200 Joint Sealants: Sealing joints between window frames and adjacent construction.
- 1.3 REFERENCE STANDARDS
 - A. AAMA/WDMA/CSA 101/I.S.2/A440 North American Fenestration Standard/Specification for windows, doors, and skylights; 2011.
 - B. AAMA CW-10 Care and Handling of Architectural Aluminum From Shop to Site; 2015.
 - C. ASTM B221 Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.
 - D. ASTM B221M Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes [Metric]; 2013.
- 1.4 SUBMITTALS
 - A. See Section 01 3000 ADMINISTRATIVE REQUIREMENTS, for submittal procedures.
 - B. Product Data: Provide component dimensions, information on glass and glazing, internal drainage details, and descriptions of hardware and accessories.
 - C. Grade Substantiation: Prior to submitting shop drawings or starting fabrication, submit one of the following showing compliance with specified grade:
 - 1. Evidence of AAMA Certification.
 - 2. Test report(s) by independent testing agency itemizing compliance and acceptable to authorities having jurisdiction.
 - D. Test Reports: Prior to submitting shop drawings or starting fabrication, submit test report(s) by independent testing agency showing compliance with performance requirements in excess of those prescribed by specified grade.
 - E. Manufacturer's Installation Instructions: Include complete preparation, installation, and cleaning requirements.
 - F. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.
- 1.6 DELIVERY, STORAGE, AND HANDLING
 - A. Comply with requirements of AAMA CW-10.
 - B. Protect finished surfaces with wrapping paper or strippable coating during installation. Do not use adhesive papers or sprayed coatings that bond to substrate when exposed to sunlight or weather.
- 1.7 FIELD CONDITIONS
 - A. Do not install sealants when ambient temperature is less than 40 degrees F (5 degrees C).
- 1.8 WARRANTY
 - A. See Section 01 7800 Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

- 2.1 MANUFACTURERS
 - A. Basis of Design: Don Young Company, Inc.; 8220 Series Single Hung, LC-PG50: www.dycwindows.com.
 - B. Substitutions: See Section 01 6000 Product Requirements.
- 2.2 WINDOWS
 - A. Aluminum Windows: Extruded aluminum frame and sash, factory fabricated, factory finished, with operating hardware, related flashings, and anchorage and attachment devices.
 - 1. Frame Depth: 3-1/2 inches (88.9 mm).
 - 2. Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors; fasteners and attachments concealed from view; reinforced as required for operating hardware and imposed loads.
 - 3. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.
 - 4. Movement: Accommodate movement between window and perimeter framing and deflection of lintel, without damage to components or deterioration of seals.
 - 5. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
 - B. Performance Requirements: Provide products that comply with the following:
 - 1. Grade: AAMA/WDMA/CSA 101/I.S.2/A440 requirements for specific window type:
 - a. Performance Class (PC): LC.
 - b. Performance Grade (PG): 50, with minimum design pressure (DP) of 50.13 psf (2400 Pa).
 - 2. Member Deflection: Limit member deflection to flexure limit of glass in any direction, with full recovery of glazing materials.
 - C. Single-Hung Type:
 - 1. Construction: Thermally broken.
 - 2. Provide screens.
 - 3. Glazing: Double; clear; low-e.
 - 4. Exterior Finish: Color anodized with organic seal.
- 2.3 MATERIALS
 - A. Extruded Aluminum: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper.
- 2.4 FINISHES
 - A. Electrostatically applied powder coat.
 - B. Finish Color: Bronze.

PART 3 EXECUTION

- 3.1 EXAMINATION
 - A. Verify that wall openings are ready to receive aluminum windows.
- 3.2 INSTALLATION
 - A. Install windows in accordance with manufacturer's instructions.
 - B. Install window assembly in accordance with AAMA/WDMA/CSA 101/I.S.2/A440.
 - C. Attach window frame and shims to perimeter opening to accommodate construction tolerances and other irregularities.
 - D. Align window plumb and level, free of warp or twist. Maintain dimensional tolerances and alignment with adjacent work.
 - E. Install sill and sill end angles.
 - F. Set sill members and sill flashing in continuous bead of sealant.

3.3 ADJUSTING

A. Adjust hardware for smooth operation and secure weathertight closure.

3.4 CLEANING

- A. Remove protective material from factory finished aluminum surfaces.
- B. Wash surfaces by method recommended and acceptable to window manufacturer; rinse and wipe surfaces clean.
- C. Remove excess glazing sealant by moderate use of mineral spirits or other solvent acceptable to sealant and window manufacturer.

ALUMINUM WINDOWS

SECTION 08 71 00 FINISH HARDWARE

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Work under this section comprises of furnishing and installing hardware specified herein and noted on drawings for a complete and operational system, including any electrified hardware components, systems, controls and hardware for aluminum entrance doors. Any door shown on the drawing and not specifically referenced in the hardware sets shall be provided with identical hardware as specified on other similar openings and shall be included in the finish hardware suppliers bid. All fire rated door shall be provided with fire rated hardware as required by local code Authority as part of the hardware supplier's base bid. The hardware supplier shall coordinate with all affected suppliers as required to insure a functional card access system.
- B. The Hardware Supplier shall notify the Architect in writing of any discrepancies (five (5) days prior to bid date) that could and/or would result in hardware being supplied that is none functional, hardware specified and/or hardware that has not been specified that will result in any code violations and any door that is not covered in this specification. Failure of the hardware supplier to address any such issue shall be considered acceptance of the hardware specified and all discrepancies shall be corrected at the hardware supplier's expense and considered a part of their base bid. Change orders shall not be issued if deemed by the Architect and/or Alamo Colleges to fall under and/or be covered as a part of the supplier's base bid, due to failure to comply with this instruction notification.
- C. Items include but are not limited to the following:
 - 1. Hinges & Continuous Hinges
 - 2. Flush Bolts
 - 3. Exit Devices
 - 4. Locksets and Cylinders
 - 5. Push Plates Pulls
 - 6. Coordinators
 - 7. Closers
 - 8. Kick, Mop and Protection Plates
 - 9. Stops, Wall Bumpers, Overhead Controls
 - 10. Electrified Hold Open Devices
 - 11. Thresholds, Seals and Door Bottoms
 - 12. Silencers
 - 13. Miscellaneous Trim and Accessories
 - 14. Wiring Diagrams
 - 15. Installation of all Finish Hardware

1.2 RELATED DOCUMENTS

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

1.3 RELATED WORK

- A. Specified elsewhere that should be examined for its effect upon this section:
 - 1. Section 06 20 00 Finish Carpentry
 - 2. Section 08 12 14 Standard Steel Frames.
 - 3. Section 08 13 14 Standard Steel Doors.
 - 4. Section 08 14 16 Flush Wood Doors.
 - 5. Section 08 41 13 Aluminum-Framed Entrances and Storefronts.
 - 6. Section 13 70 10 Card Access Control
 - 7. Division 26 Electrical

FINISH HARDWARE

1.4 REFERENCES SPECIFIED

- A. In this section subject to compliance as directed:
 - 1. NFPA-80 Standard for Fire Doors and Windows
 - 2. NFPA-101 Life Safety Code
 - 3. ADA The Americans with Disabilities Act Title III Public Accommodations
 - 4. ANSI-A 117.1 American National Standards Institute Accessible and Usable Buildings and Facilities
 - 5. ANSI-A 156.5 American National Standards institute -Auxiliary Locks and Associated Products
 - 6. UFAS Uniform Federal Accessibility Standards
 - 7. UL Underwriter's Laboratories
 - 8. WHI Warnock Hersey International, Testing Services
 - 9. State and Local Codes including Authority Having Jurisdiction
 - 10. UL10C Positive Pressure
 - 11. IBC-2012 International Building Code
 - 12. BHMA Builder's Hardware Manufacturer's Association
 - 13. DHI Door and Hardware Institute
 - 14. NFPA-70 National Electrical Code
- 1.5 SUBMITTALS
 - A. Hardware Schedules:
 - 1. Submit copies of schedule in accordance with Division 1, General Requirements. Schedule to be in vertical format, listing each door opening, including: handing of opening, all hardware scheduled for opening or otherwise required to allow for proper function of door opening as intended, and finish of hardware. At doors with door closers or door controls include degree of door opening. Supply the schedules all Finish Hardware within two (2) weeks from date purchase order is received by the hardware supplier.
 - 2. Submit manufacturer's cut/catalog sheets on all hardware items and any required special mounting instructions with the hardware schedule.
 - B. Certification of Compliance:
 - 1. Submit any information necessary to indicate compliance to all of these specifications as required.
 - 2. Submit a statement from the manufacturer that electronic hardware and systems being supplied comply with the operational descriptions exactly as specified.
 - C. Submit any samples necessary as required by the Architect.
 - D. Templates for finish hardware items to be sent to related door and frame suppliers within three (3) working days of receipt of approved hardware schedule.\
 - E. Electronic Security Hardware: Coordinate installation of the electronic security with the Architect and provide installation and technical data to the Architect and other related subcontractor(s). Upon completion of the electronic security hardware installation, verify that all components are working properly and state in the required guarantee that this inspection has been preformed.
 - F. Wiring Diagrams: Provide complete wiring diagrams for each opening requiring electrified hardware, except openings where only magnetic hold-opens are specified. Provide a copy with each hardware schedule submitted after approval. Supply a copy with delivery of hardware to job site and another copy to owner at time of job completion.
 - G. Doors and Frames used in positive pressure opening assemblies shall meet UL10C in areas where this specification includes Seals for smoke door.

1.6 QUALITY ASSURANCE

A. Hardware supplier to be a qualified, Factory Authorized, direct distributor of the products to be furnished. In addition, the supplier to have in their regular employment an A.H.C. or person of equivalent experience who will be made available at reasonable times to consult with the Architect/Contractor and/or Owner regarding any matters affecting the finish hardware on this project.

- B. All hardware used in labeled fire or smoke rated openings to be listed for those types of openings and bear the identifying label or mark indicating UL. (Underwriter's Laboratories) approved for fire. Exit devices in non-labeled openings to be listed for panic.
- 1.7 DELIVERY, HANDLING AND PACKAGE
 - A. Furnish all hardware with each unit clearly marked and numbered in accordance with the hardware schedule. Include door and item number for each.
 - B. Pack each item of hardware completes with all necessary parts and fasteners.
 - C. Properly wrap and cushion each item to prevent scratches and dents during delivery and storage.

1.8 SEQUENCING AND SCHEDULING

A. Any part of the finish hardware required by the frame or door manufacturers or other suppliers that is needed in order to produce doors or frames is to be sent to those suppliers in a timely manner, so as not to interrupt job progress.

1.9 WARRANTY

- A. All finish hardware shall be supplied with a Two- (2) year warranty against defects in materials and workmanship, commencing with substantial completion of the project except as follows:
 - 1. All Closers to have a thirty- (30) year written warranty.
 - 2. All Exit Devices to have a three- (3) year written warranty.
 - 3. All Grade 1 Locksets to have a ten- (10) year written warranty.
 - 4. All Continuous Hinges to have a ten- (10) year written warranty.

PART 2 - PRODUCTS

- 2.1 FASTENERS
 - A. Furnish with finish hardware all necessary screws, bolts and other fasteners of suitable size and type to anchor the hardware in position for a long life under hard use.
 - B. Furnish fastenings where necessary with expansion shields, toggle bolts and other anchors designated by the Architect according to the material to which the hardware is to be applied and the recommendations of the hardware manufacturer. All closers and exit devices on labeled wood doors shall be through-bolted if required be the door manufacturer. All thresholds shall be fastened with machine screws and anchors. Where specified in the hardware sets, security type fasteners of the type called for are to be supplied.
 - C. Design of all fastenings shall harmonize with the hardware as to material and finish.
 - D. All hardware shall be installed with the Manufacturers standard screws as provided. Use of any other type of fasteners shall not be permitted.

2.2 ENVIRONMENTAL CONCERN FOR PACKAGING

A. Hardware shipped to the project job site shall be packaged in biodegradable packs such as paper or cardboard boxes and wrapping.

2.3 HINGES

- A. All hinges to be of one manufacturer as hereafter listed for continuity and consideration of warranty. Provide one of the following manufacturers Select, Hager, Ives or Stanley.
- B. Unless otherwise specified provide five-knuckle, heavy-duty, ball-bearing, button tip, full mortise template type hinges with non-rising loose pins. Provide non-removable pins for out swinging doors at secured areas or as called for in this specification (Reference 3.02 Hardware Sets).
- C. Exterior Door Hinges
 - 1. Provide out-swinging door hinges of solid bronze, steel, aluminum or stainless steel with non-removable pins or security studs as called for in this specification (Reference 3.02 hardware sets).
- D. Interior Door Hinges

- 1. Stainless steel or steel polished and/or plated to match specified finish shall be provided. Furnish three (3) hinges up to 90 inches high and one (1) additional hinge for every 30 inches or fraction thereof unless otherwise specified in 3.02 Hardware Sets.
- E. Provide size 4½" x 4½" for all 1¾" thick doors up to and including 36 inches wide (1 1/2 pairs). Doors over 1¾" through 2¼" thick, use 5" x 5" hinges. Doors over 36 inches use 4 1/2" x 4 1/2" (2 pair) unless otherwise specified in 3.02 Hardware Sets.
- F. Were required to clear the trim and/or to permit the doors to swing 180 degrees furnish hinges of sufficient throw.
- G. Provide heavy weight hinges on all doors over 36 inches in width.
- H. At labeled door's steel or stainless steel, ball-bearing-type hinges shall be provided. For all doors equipped with closers provide ball-bearing-type hinges.
- I. Finishes
 - 1. At wood doors, hinges are to be plated to match adjacent hardware or as called for in 3.02 Hardware Sets.
 - 2. At hollow metal doors, hinges are to be aluminum or stainless steel at exterior outswinging doors, unless otherwise specified in 3.02 Hardware Sets.
- J. Continuous hinges shall be as specified.
- 2.4 LOCK AND LOCK TRIM
 - A. All of the locksets, latch sets, and trim to be of one manufacturer as hereafter listed for continuity of design and consideration of warranty. Locks, passage sets and privacy sets shall be the product of Schlage Lock Co., "ND" series with Rhodes Vandlgard lever (No Substitutions Allowed). All locks, passage and privacy sets are to be provided in a dull chrome (626) finish. All locks and cylinders shall be prepared for large format Schlage interchangeable cores in the key section required by Alamo Colleges. Verify the key section with the Alamo Colleges locksmith prior to fabrication or ordering.
 - B. Provide metal wrought box strike boxes and curved lip strikes with proper lip length to protect trim of the frame, but not to project more than 1/8 inch beyond frame trim or the inactive leaf of a pair of doors. All pairs of doors shall have a 3/4" latch projection.
 - C. Mechanical Locks shall meet ANSI Operational Grade 1, Series 4000 as specified in 3.02 Hardware Sets.
 - 1. Hand of lock is to be easily reversible in the field or non-handed.
 - 2. All lever trim is to be through-bolted through the door.
 - 3. All pairs of doors shall be provided with a $\frac{3}{4}$ " latch throw or projection.

2.5 PERMANENT CYLINDERS, KEYING AND ACCEPTABLE SUPPLIERS

- A. The hardware supplier shall provide locks and Exit devices requiring cylinders prepared for Schlage large format interchangeable core 6 pin key System and comply with performance requirements of ANSI A156.5. All keys shall be manufactured of nickel silver material only. All exterior and interior locks shall be supplied with keyed construction cores for the duration of the construction period by the hardware supplier. Construction cores are to be returned to the hardware supplier no later than thirty (30) days after the installation of permanent cores. The hardware supplier shall provide ten- (10) construction keys and two- (2) construction control keys total (No Substitutions Allowed).
- B. All permanent cores shall be supplied "1" bitted with four (4) blank or "0" bitted keys per core directly to the Alamo College (signature required for proof of delivery). All permanent keying shall be done by the Alamo Colleges. The Alamo Colleges shall install all permanent cores and return all of the construction cores to the general contractor (Verify Keyway required prior to fabrication with Alamo Colleges). The general contractor shall return the construction cores to the hardware supplier for credit. Permanent keys delivered to Alamo Colleges as "1" bitted, shall be rejected. Key blanks must be "0" bitted in order for the Alamo Colleges to use the key as specified. Cores shall be Schlage large format (No Substitution).

FINISH HARDWARE

- 2.6 EXIT DEVICES
 - A. All exit devices and trim, including electrified items, to be of one manufacturer as hereafter listed and in the hardware sets for continuity of design and consideration of warranty.
 - B. Exit Devices to be "UL" listed for life safety. All exit devices for labeled doors shall have "UL" label for "Fire Exit Hardware". All devices mounted on labeled wood doors are to be through-bolted or per the manufacturer's listing requirements. All devices shall conform to NFPA 80 and NFPA 101 requirements.
 - C. All exit devices to be of a heavy duty, chassis mounted design, with one-piece removable covers, eliminating necessity of removing the device from the door for standard maintenance and keying requirements.
 - D. All trims to be through-bolted to the lock stile case. Lever design to be the same as specified with the lock sets (#06/Rhodes).
 - E. Exit Devices to be the modern push rail design. Finish shall be satin aluminum (628).
 - F. All devices shall carry a three- (3) year warranty against manufacturing defects and workmanship.
 - G. Exit Devices shall be convertible in the field to accept electrified operations with out purchasing completely new exit devices.
 - H. Exit Devices shall be Von Duprin "99" series as specified (No Substitution).

2.7 SURFACE-MOUNTED DOOR CLOSERS

- A. All closers for this project shall be the products of a single manufacturer for continuity of design and consideration of warranty. All door closers shall be mounted as to achieve the maximum degree of opening (trim permitting).
- B. All closers to be heavy duty, surface-mounted, fully hydraulic, rack and pinion action with high strength cast iron cylinder to provide control throughout the entire door opening cycle. All closers shall have been tested and passed a ten million-cycle test.
- C. Size all closers in accordance with the manufacturer's recommendations at the factory.
- D. All closers to have adjustable spring power sizes 1 through 4 or 6 as specified and separate tamper resistant, brass, non-critical regulating screw valves for closing speed, latching speed and back-check control as a standard feature unless specified other wise.
- E. All closer covers to be rectangular, full cover type of non-ferrous, non-corrosive material painted to match closer.
- F. Closer to have heavy-duty arms. All closer arms shall be of sufficient length to accommodate the reveal depth and to insure proper installation
- G. Supply appropriate arm assembly for each closer so that closer body and arm are mounted on non-public side of door opening and on the interior side of exterior openings, except where required otherwise in the hardware sets.
 - 1. All parallel arm mounted closers to be factory indexed to insure proper installation.
 - 2. Furnish heavy-duty cold forged parallel arms for all parallel arm mounted closers.
- H. Provide closers with special application and heavy-duty arms as specified in the hardware sets or as otherwise called for to insure a proper operating, long lasting opening. Install all Surface closers as to swing the maximum degree of opening without exception.
- I. Finish: Sprayed enamel finish shall match other hardware.
- J. Closers shall be LCN 4040XP as specified (No Substitutions Allowed).
- 2.8 AUTOMATIC DOOR OPENERS
 - A. All automatic door openers shall be:
 - 1. LCN #9531 STD Single (Pull Side Mount)
 - 2. LCN #9542 REG Single (Push Side Mount)
 - 3. LCN #9553 REG2 Double (Push Side Mount) simultaneous
 - 4. LCN #9553 STD2 Double (Pull Side Mount) simultaneous
 - B. Provide two (2) each Hard-Wired Actuators & Mounting Boxes (8310-853T x 8310-867F or 8310 867S) 4.5" diameter engraved with handicapped logo & push-to-open. Provide Weather Ring 8310-801 for all exterior mounted Actuator's. Provide key operated "On/Off" switches #8310-806K at all Automatic operators.

FINISH HARDWARE

2.9 DOOR STOPS AND HOLDERS

- A. Door stops are to be furnished for every door leaf. Every door is to have a floor, wall, or an overhead stop.
- B. Place doorstops in such a position that they permit maximum door swing, but do not present a hazard of obstruction. Furnish floor strikes for floor holders of proper height to engage holders of doors. The contractor shall place wood blocking in all stud walls specified and scheduled to receive wall stops.
- C. Where overhead stops and holders are specified, or otherwise required for proper door operation, they are to be heavy duty and of extruded brass, bronze or stainless steel with no plastic parts as specified.
- D. Finish: Same as other hardware where available.
- E. Acceptable Products
 - 1. Floor and wall stops as listed in hardware sets. Equivalent products as manufactured by Ives, Rockwood and Trimco are acceptable.

2.10 PUSH PLATES, DOOR PULLS, AND KICKPLATES

- A. All push plates, door pulls, kick plates and other miscellaneous hardware as listed in hardware sets. Equivalent products as manufactured by lves, Rockwood and Trimco are acceptable.
- B. Kick plates to be 10 inches high and Mop plates to be 6 inches high, both by 2 inches or 1 inch less than door width (LDW) as specified. They are to be of 16 gauge (.050 inches) thick stainless steel. For door with louvers or narrow bottom rails, kick plate height to be 1 inch less dimension shown from the bottom of the door to the bottom of the louver or glass.
- C. Where required armor plates, edge guards and other protective hardware shall be supplied in sizes as scheduled in the hardware sets.
- D. Finish: Same as other hardware where available.

2.11 FLUSH BOLTS AND COORDINATORS

- A. Provide Flush bolts with Dust Proof Strikes as indicated in the individual hardware sets by Ives, Rockwood and Trimco are acceptable. Finish shall match adjacent hardware.
- B. Provide and install only at locations approved by code.

2.12 THRESHOLDS AND SEALS

- A. Provide materials and finishes as listed in hardware sets and manufactured by Zero. Equivalent product by National Guard Products and Pemko are acceptable. All thresholds must be in accordance with the requirements of the ADA and ANSI A117.1.
- B. Provide thresholds with wood screws and plastic anchors. Supply all necessary anchoring devices for weather strip and sound seal.
- C. Seals shall comply with requirements of UL10C. All thresholds, door bottoms and weather stripping shall be provided with silicone inserts as specified in 3.02 Hardware Sets.
- D. Seals shall comply with the requirements of the Wood Door Manufacturer's certification requirements.

2.13 REMOVABLE MULLIONS

A. Removable mullions will be Von Duprin KR4954 & KR9954 type with I/C mortise cylinders. Finish shall be sprayed aluminum (SP28). Provide one (1) Mullion Storage Bracket MT54 with every mullion supplied (No Substitutions Allowed).

2.14 FINISHES

- A. Finishes for all hardware are as required in this specification and the hardware sets.
- B. Special care is to be taken to make uniform the finish of all various manufactured items.

2.15 DOOR SILENCERS AND KEY CABINET

- A. Provide door silencers at all openings without gasket. Provide two- (2) each at each pair of doors and three (3) or four- (4) each for each single door (coordinate with the frame manufacturer).
- B. Key Cabinet is not required for this project.

2.16 PROPRIETARY PRODUCTS

- A. References to specific products are used to establish quality standards of utility and performance. Unless otherwise approved provide only the specified product.
- B. All other materials, not specifically described, but required for a complete and proper finish hardware installation, are to be selected by the Contractor, subject to the approval of the Architect and Alamo Colleges.
- C. Architect and Alamo Colleges reserve the right to approve all the substitutions proposed for this specification. All requests for substitution to be made prior to bid in accordance with Division 1, General Requirements, and are to be in writing, hand delivered to the Architect. Two (2) copies of the manufacturer's brochures and a physical sample of each item in the appropriate design and finish shall accompany requests for substitution.

PART 3 - EXECUTION OF AND/OR INSTALLATION

- 3.1 INSTALLATION OF FINISH HARDWARE
 - A. All finish hardware shall be installed by the finish hardware supplier with at least ten (10) years of experience after a pre-installation meeting between the contractor, electrical contractor hardware Manufacturers representative, the hardware supplier, the hollow metal supplier and the wood door supplier. The finish hardware supplier/installer shall be responsible for the proper installation and function of all doors and hardware. Installation shall include wiring all electrified products (Including the required wire) to the power supply and/or junction box.
 - B. Check hardware against the reviewed hardware schedule upon delivery. Store the hardware in a dry and secure location to protect against loss and damage.
 - C. Install finish hardware in accordance with approved hardware schedule and manufacturers' printed instructions. Pre-fit hardware before finish is applied to door; remove and reinstall after finish is complete and dry. Install and adjust hardware so that parts operate smoothly, close tightly, and do not rattle.
 - D. Mortise and cutting to be done neatly, and evidence of cutting to be concealed in the finished work. Protect all Finish hardware from scratching or other damage.
 - E. The hardware supplier/installer, general contractor, representatives of the lock, exit device and closer manufacturers shall after three (3) months of the owner's acceptance of the facility perform an onsite survey of the finish hardware. Any item of finish hardware found to be defective or out of adjustment shall be replaced or adjusted for the proper function and operation of the door assembly at the supplier's and/or installer's expense.

3.2 HARDWARE SETS

HARDWARE SET #01 - EXTERIOR - EXISTING DOORS:

101 108B 116

Each to Have:

ALL HARDWARE

EXISTING TO BE RE-USED

HARDWARE SET #02 - EXTERIOR - OVERHEAD DOOR

DOORS:

117B

Each to Have:

ALL HARDWARE PROVIDED BY THE OH DOOR MFG

HARDWARE SET #03 - MEN & WOMEN RESTROOM

115

DOORS:

114

Each to Have:

1	EA	CONT. HINGE	112XY-DOOR HEIGHT	628	IVE
1	EA	PUSH PLATE	8200 8" X 16"	630	IVE
1	EA	PULL PLATE	8305 8" 3.5" X 15"	630	IVE
1	EA	SURFACE CLOSER	4040XP REG OR PA AS REQ TBSRT	689	LCN
1	EA	KICK PLATE	8400 10" X 1 1/2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE SET #04 - INTERIOR - ACCESS CONTROLLED

DOORS:

102 111		103 113	104	105	106	108A	
Each t	o Have:						
2	EA	HINGE		5BB1 4.5 X 4.5		652	IVE
1	EA	ELECTRIC HINGE		5BB1 4.5 X 4.5 TW8		652	IVE
1	EA	FSIC CORE		23-030		626	SCH
1	EA	SURFACE CLOSEF	2	4040XP REG OR PA	AS REQ TBSRT	689	LCN
1	EA	KICK PLATE		8400 10" X 1 1/2" LD	W B-CS	630	IVE
1	EA	WALL STOP		WS406/407CCV		630	IVE
3	EA	SILENCER		SR64		GRY	IVE
		ELECTRIC LOCK		AD300-CY-70-MT-RH BY OTHER)	HO-TD (PROVIDE	D	
		POWER SOURCE		PROVIDED BY OTH	ER		

HARDWARE SET #05 - INTERIOR - ACCESS CONTROLLED

DOORS:

109 112

Each to Have:

2	EA	HINGE	5BB1HW 5 X 4.5 NRP	652	IVE
1	EA	ELECTRIC HINGE	5BB1HW 5 X 4.5 TW8	652	IVE

FINISH HARDWARE

1	EA	FSIC CORE	23-030	626	SCH
1	EA	SURFACE CLOSER	4040XP REG OR PA AS REQ TBSRT	689	LCN
1	EA	KICK PLATE	8400 10" X 1 1/2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
3	EA	SILENCER	SR64	GRY	IVE
		ELECTRIC LOCK	AD300-CY-70-MT-RHO-TD (PROVIDED		
			BY OTHER)		
		POWER SOURCE	PROVIDED BY OTHER		

HARDWARE SET #06 - INTERIOR - ACCESS CONTROLLED

DOORS:

112A

Each to Have:

2	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	ELECTRIC HINGE	5BB1 4.5 X 4.5 TW8	652	IVE
1	EA	FSIC CORE	23-030	626	SCH
1	EA	WALL STOP	WS406/407CCV	630	IVE
3	EA	SILENCER	SR64	GRY	IVE
		ELECTRIC LOCK	AD300-CY-70-MT-RHO-TD (PROVIDED		
			BY OTHER)		
		POWER SOURCE	PROVIDED BY OTHER		

HARDWARE SET #07 - EXTERIOR - ACCESS CONTROLLED

DOORS:

117A

Each to Have:

1	EA	CONT. HINGE	112XY EPT-DOOR HEIGHT	626	IVE
1	EA	POWER TRANSFER	EPT-10	SP28	VON
1	EA	ELECTRIC EXIT DEVICE	RX-QEL-99-NL-SNB	628	VON
1	EA	RIM CYLINDER	20-079	626	SCH
1	EA	FSIC CORE	23-030	626	SCH
1	EA	SURFACE CLOSER	4040XP SCUSH TBSRT	689	LCN
1	EA	KICK PLATE	8400 10" X 1 1/2" LDW B-CS	630	IVE
1	EA	RAIN DRIP	142A-FRAME HEAD PLUS 4"	А	ZER
1	EA	HEADER WEATHER	429AA-HEADER WIDTH	AA	ZER
2	EA	JAMBS WEATHER STRIP	328AA-JAMB HEIGHT	AA	ZER
1	EA	THRESHOLD	65A-V3-FRAME WIDTH	А	ZER
1	EA	DOOR BOTTOM/DRIP	8197A-DOOR WIDTH	А	ZER
		CARD READER	MT-15 PROVIDED BY OTHER		
		POWER SOURCE	PROVIDED BY OTHER		

GENERAL NOTE:

FINISH HARDWARE

ALL CONTROLLERS, READER INTERFACES, POWER SUPPLIES, CABLING (POWER & COMMUNICATION) AND OTHER RELATED ITEMS NOT SPECIFIED IN THIS SECTION SHALL BE <u>SUPPLIED & INSTALLED</u> BY THE ACCESS CONTROL CONTRACTOR (TEXAS LOCK & DOOR CLOSER, INC).

ACCESS CONTROLLED LOCKS (AD300/AD400) AND WALL MOUNTED CARD READERS (MT15) SHALL BE INSTALLED & PROVIDED BY TEXAS LOCK & DOOR CLOSER, INC. (210) 701-6275 or (210) 732-6273

SECTION 08 9100 LOUVERS

PART 1 GENERAL

- 1.1 SECTION INCLUDES A. Louvers, frames, and accessories.
- 1.2 RELATED REQUIREMENTS
- 1.3 REFERENCE STANDARDS
 - AAMA 2603 Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2015.
 - B. AMCA 511 Certified Ratings Program for Air Control Devices; 2010.
 - C. ASTM A653/A653M Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

1.4 SUBMITTALS

- A. See Section 01 3000 ADMINISTRATIVE REQUIREMENTS, for submittal procedures.
- B. Product Data: Provide data describing design characteristics, maximum recommended air velocity, design free area, materials and finishes.
- C. Shop Drawings: Indicate louver layout plan and elevations, opening and clearance dimensions, tolerances; head, jamb and sill details; blade configuration, screens, blankout areas required, and frames.
- D. Test Reports: Independent agency reports showing compliance with specified performance criteria.
- 1.5 QUALITY ASSURANCE
 - A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with minimum three years of documented experience.
 - B. Installer Qualifications: Company specializing in performing work of type specified and with at least three years of experience.
- 1.6 WARRANTY
 - A. See Section 01 7800 Closeout Submittals, for additional warranty requirements.
 - B. Provide five year manufacturer warranty against distortion, metal degradation, and failure of connections.

PART 2 PRODUCTS

- 2.1 MANUFACTURERS
 - A. Louvers:
 - 1. Ruskin Co., Kansas City, MO: www.ruskin.com.
 - a. Area Rep: Texas Air Products, San Antonio, TX; (210) 495-8100; contact: Mr. Scot Spiva (210) 363-4999. www,txap.com
 - 2. All-Lite Architectural Products, Fort Worth, TX 76106; www.alllite.com.
 - a. Area Rep: Dalton Architectural Systems, Inc., Cypress, TX 77433; (281) 304-7180; Contact Mr. Greg Dalton - mobile (713) 515-4406, e-mail - gdaltondasi@comcast.net.
 - 3. Architectural Louvers, Cincinati, OH 45232; Toll-free (888) 568-8371; www.archlouvers.com.
 - 4. Substitutions: See Section 01 6000 Product Requirements.
- 2.2 LOUVERS
 - A. Louvers: Factory fabricated and assembled, complete with frame, mullions, and accessories; AMCA Certified in accordance with AMCA 511.
 - 1. Wind Load Resistance: Design to resist positive and negative wind load as required by code without damage or permanent deformation.

- 2. Drainable Blades: Continuous rain stop at front or rear of blade aligned with vertical gutter recessed into both jambs of frame.
- 3. Screens: Provide insect screens at intake louvers and bird screens at exhaust louvers.
- B. Stationary Louvers: Horizontal blade, formed galvanized steel sheet construction, with intermediate mullions matching frame.
 - 1. Product: L375D as manufactured by Ruskin.
 - 2. Free Area: 50 percent, minimum.
 - 3. Blades: Drainable.
 - 4. Frame: 4 inches (100 mm) deep, channel profile; corner joints mitered and, with continuous recessed caulking channel each side.
 - 5. Steel Thickness, Galvanized: Frame 16 gage, 0.0598 inch (1.52 mm) minimum base metal; blades 16 gage, 0.0598 inch (1.52 mm) minimum base metal.
 - 6. Steel Finish: Pigmented organic polyester based coatings, finished after fabrication.

2.3 MATERIALS

- A. Steel Sheet: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G90/Z275 coating.
- 2.4 FINISHES
 - A. Pigmented Organic Coatings: AAMA 2603; polyester or acrylic baked enamel finish.
 - B. Color: As selected from manufacturer's standard colors.
- 2.5 ACCESSORIES
 - A. Screens: Frame of same material as louver, with reinforced corners; removable, screw attached; installed on inside face of louver frame.
 - B. Bird Screen: Interwoven wire mesh of steel, 14 gage, 0.0641 inch (1.63 mm) diameter wire, 1/2 inch (13 mm) open weave, diagonal design.
 - C. Insect Screen: 18 x 16 size steel mesh.
 - D. Fasteners and Anchors: Galvanized steel.
 - E. Flashings: Of same material as louver frame, formed to required shape, single length in one piece per location.
 - F. Sealant for Setting Sills and Sill Flashing: Non-curing butyl type.

PART 3 EXECUTION

- 3.1 EXAMINATION
 - A. Verify that prepared openings and flashings are ready to receive this work and opening dimensions are as indicated on shop drawings.
 - B. Verify that field measurements are as indicated.

3.2 INSTALLATION

- A. Install louver assembly in accordance with manufacturer's instructions.
- B. Install louvers level and plumb.
- C. Set sill members and sill flashing in continuous bead of sealant.
- D. Install flashings and align louver assembly to ensure moisture shed from flashings and diversion of moisture to exterior.
- E. Secure louver frames in openings with concealed fasteners.
- F. Coordinate with installation of mechanical ductwork.

3.3 CLEANING

A. Clean surfaces and components.

SECTION 09 2116 GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

- 1.1 SECTION INCLUDES
 - A. Metal stud wall framing.
 - B. Metal channel ceiling framing.
 - C. Acoustic insulation.
 - D. Gypsum wallboard.
 - E. Joint treatment and accessories.
 - F. Textured finish system.

1.2 RELATED REQUIREMENTS

- A. Section 01 6116 Volatile Organic Compound (VOC) Content Restrictions.
- B. Section 06 1000 Rough Carpentry: Wood blocking product and execution requirements.

1.3 REFERENCE STANDARDS

- A. ASTM A653/A653M Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.
- B. ASTM C475/C475M Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2015.
- C. ASTM C645 Standard Specification for Nonstructural Steel Framing Members; 2014.
- D. ASTM C665 Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2012.
- E. ASTM C754 Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2015.
- F. ASTM C840 Standard Specification for Application and Finishing of Gypsum Board; 2013.
- G. ASTM C954 Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness; 2015.
- H. ASTM C1002 Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2014.
- I. ASTM C1047 Standard Specification for Accessories For Gypsum Wallboard and Gypsum Veneer Base; 2014a.
- J. ASTM C1178/C1178M Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel; 2013.
- K. ASTM C1396/C1396M Standard Specification for Gypsum Board; 2014.
- L. ASTM C1658/C1658M Standard Specification for Glass Mat Gypsum Panels; 2013.
- M. ASTM D3273 Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2012.
- N. GA-216 Application and Finishing of Gypsum Board; 2013.

1.4 SUBMITTALS

- A. See Section 01 3000 ADMINISTRATIVE REQUIREMENTS, for submittal procedures.
- B. Product Data: Provide data on metal framing, gypsum board, accessories, and joint finishing system.
- C. Product Data: Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.
- 1.5 QUALITY ASSURANCE
 - A. Installer Qualifications: Company specializing in performing gypsum board installation and finishing, with minimum three years of experience.

PART 2 PRODUCTS

- 2.1 GYPSUM BOARD ASSEMBLIES
 - A. Provide completed assemblies complying with ASTM C840 and GA-216.

- 1. See PART 3 for finishing requirements.
- 2.2 METAL FRAMING MATERIALS
 - A. Manufacturers Metal Framing, Connectors, and Accessories:
 - 1. Clarkwestern Dietrich Building Systems LLC: www.clarkdietrich.com.
 - 2. Marino: www.marinoware.com.
 - 3. Phillips Manufacturing Company: www.phillipsmfg.com.
 - 4. Substitutions: See Section 01 6000 Product Requirements.
 - B. Non-Loadbearing Framing System Components: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/120 at 5 psf (L/120 at 240 Pa).
 - 1. Studs: "C" shaped with flat or formed webs with knurled faces.
 - 2. Runners: U shaped, sized to match studs.
 - 3. Ceiling Channels: C-shaped.
 - 4. Furring: Hat-shaped sections, minimum depth of 7/8 inch (22 mm).
 - C. Metal Studs at ceramic & porcelain tile walls and other "wet walls" (walls with water pipe or drain pipe penetrations) shall be galvanized and a minimum of 20 gage (33 mil) thick, unless required to be heavier. Galvanized in accordance with ASTM A653/A653M G90/Z275 coating.
 - D. Ceiling Hangers: Type and size as specified in ASTM C754 for spacing required.
 - E. Framing systems which are not covered by or are outside the parameters of ASTM C645 and ASTM C754 shall be submitted with design, drawings, and calculations signed and sealed by a Structural Engineer registered to practice in the jurisdiction where the project is located.
 - F. Drywall Ceiling Grid System: Suspended Grid structure comprising of Main Runners and Cross Tees, including Wall Moldings and Transition Trims, as per manufacturer's instructions may be used in lieu of other metal framing. Provide engineering data with structural engineers seal and signature when requested by authority having jurisdiction.
 - 1. Armstrong Drywall Grid Systems; www.armstrong.com.
 - 2. USG Drywall Suspension Systems (United States Gypsum Company (USG), Chicago, IL.); www.usg.com;
 - 3. Rockfon (Chicago Metallic) Concealed Grid Ceilings; 4849 S. Austin Ave., Chicago, IL 60638 USA; T: (800) 323-7164; F (-800) 222-3744; Email. cs@rockfon.com.
 - 4. Substitutions: See Section 01 6000 Product Requirements.

2.3 BOARD MATERIALS

- A. Manufacturers Gypsum-Based Board:
 - 1. American Gypsum Company: www.americangypsum.com.
 - 2. Georgia-Pacific Gypsum: www.gpgypsum.com.
 - 3. National Gypsum Company: www.nationalgypsum.com.
 - 4. USG Corporation: www.usg.com.
 - 5. Substitutions: See Section 01 6000 Product Requirements.
- B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
 - 1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
 - 2. Glass mat faced gypsum panels as defined in ASTM C1658/C1658M, suitable for paint finish, of the same core type and thickness may be substituted for paper-faced board.
 - 3. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
 - a. Mold-resistant board is required whenever board is being installed before the building is enclosed and conditioned.
 - 4. Thickness:
 - a. Vertical Surfaces: 5/8 inch (16 mm).
 - b. Ceilings: 5/8 inch (16 mm).
 - 5. Paper-Faced Products:
 - a. American Gypsum Company; FireBloc Type X Gypsum Wallboard.
 - b. Georgia-Pacific Gypsum; ToughRock Fireguard X.
 - c. National Gypsum Company; Gold Bond BRAND Fire-Shield Gypsum Board.
 - d. USG Corporation; USG Sheetrock Brand Firecode X.
 - e. Substitutions: See Section 01 6000 Product Requirements.

- 6. Glass Mat Faced Products:
 - a. National Gypsum Company; Gold Bond eXP Fire-Shield Interior Extreme Gypsum Panel.
 - b. USG Corporation; USG Sheetrock Brand Glass-Mat Panels Mold Tough Firecode X.
 - c. Substitutions: See Section 01 6000 Product Requirements.
- C. Backing Board For Wet Areas: One of the following products:
 - 1. Application: Surfaces behind tile in wet areas including all restroom walls.
 - 2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
 - 3. Glass Mat Faced Board: Coated glass mat water-resistant gypsum backing panel as defined in ASTM C1178/C1178M.
 - a. Fire Resistant Type: Type X core, thickness 5/8 inch (16 mm).
 - b. Products:
 - 1) Georgia-Pacific Gypsum; DensShield Tile Backer.
 - 2) National Gypsum Company; Gold Bond eXP Tile Backer.
 - 3) Substitutions: See Section 01 6000 Product Requirements.
- 2.4 ACCESSORIES
 - A. Acoustic Insulation: ASTM C665; preformed glass fiber, friction fit type, unfaced. Thickness: 3-1/2 inch (89 mm).
 - B. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.
 - C. Beads, Joint Accessories, and Other Trim: ASTM C1047, galvanized steel or rolled zinc, unless noted otherwise.
 - 1. Rigid Corner Beads: Low profile, for 90 degree outside corners.
 - D. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.
 - 1. Tape: 2 inch (50 mm) wide, coated glass fiber tape for joints and corners, except as otherwise indicated.
 - 2. Tape: 2 inch (50 mm) wide, creased paper tape for joints and corners, except as otherwise indicated.
 - 3. Ready-mixed vinyl-based joint compound.
 - 4. Chemical hardening type compound.
 - E. Textured Finish Materials: Latex-based compound; plain.
 - F. Screws for Fastening of Gypsum Panel Products to Cold-Formed Steel Studs Less than 0.033 inch (0.84 mm) in Thickness and Wood Members: ASTM C1002; self-piercing tapping screws, corrosion resistant.
 - G. Screws for Fastening of Gypsum Panel Products to Steel Members from 0.033 to 0.112 inch (0.84 to 2.84 mm) in Thickness: ASTM C954; steel drill screws, corrosion resistant.

PART 3 EXECUTION

- 3.1 EXAMINATION
 - A. Verify that project conditions are appropriate for work of this section to commence.
- 3.2 FRAMING INSTALLATION
 - A. Metal Framing: Install in accordance with ASTM C754 and manufacturer's instructions.
 - B. Suspended Ceilings and Soffits: Space framing and furring members as indicated.
 - C. Studs: Space studs at 16 inches on center (at 406 mm on center).
 - 1. Extend partition framing to structure where indicated and to ceiling in other locations.
 - 2. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer's instructions.
 - D. Openings: Reinforce openings as required for weight of doors or operable panels, using not less than double studs at jambs.
 - E. Blocking: Install wood blocking for support of:
 - 1. Framed openings.
 - 2. Wall mounted cabinets.
 - 3. Plumbing fixtures.

- 4. Toilet partitions.
- 5. Toilet accessories.
- 6. Wall mounted door hardware.

3.3 ACOUSTIC ACCESSORIES INSTALLATION

- A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.
- B. Acoustic Sealant: Install in accordance with manufacturer's instructions.
 - 1. Place continuous bead at perimeter of each layer of gypsum board.
 - 2. Seal around all penetrations by conduit, pipe, ducts, and rough-in boxes, except where firestopping is provided.

3.4 BOARD INSTALLATION

- A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.
- B. Single-Layer Non-Rated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.
 - 1. Exception: Tapered edges to receive joint treatment at right angles to framing.
- C. Exposed Gypsum Board in Interior Wet Areas: Seal joints, cut edges, and holes with water-resistant sealant.
- 3.5 INSTALLATION OF TRIM AND ACCESSORIES
 - A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.
 1. Not more than 30 feet (10 meters) apart on walls and ceilings over 50 feet (16 meters) long.
 - B. Corner Beads: Install at external corners, using longest practical lengths.
 - C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.

3.6 JOINT TREATMENT

- A. Glass Mat Faced Gypsum Board and Exterior Glass Mat Faced Sheathing: Use fiberglass joint tape, bedded and finished with chemical hardening type joint compound.
- B. Paper Faced Gypsum Board: Use paper joint tape, bedded with ready-mixed vinyl-based joint compound and finished with ready-mixed vinyl-based joint compound.
- C. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
 - 1. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
 - 2. Level 3: Walls to receive textured wall finish.
 - 3. Level 2: In utility areas, behind cabinetry, and on backing board to receive tile finish.
 - 4. Level 1: Fire rated wall areas above finished ceilings, whether or not accessible in the completed construction.
- D. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
 - 1. Feather coats of joint compound so that camber is maximum 1/32 inch (0.8 mm).
- 3.7 TREATMENT OF "COATED GLASS MAT WATER-RESISTANT GYPSUM BACKING PANELS"
 - A. Finishing of all joints and entire exposed surface of "coated glass mat water-resistant gypsum backing panels" at surfaces not covered by tile:
 - Skim coat entire surface of interior coated fiberglass mat faced gypsum backing panels as recommended by board manufacturer. Surface shall be smooth, and free of tool marks, ridges, and fiberglass fiber texture. Skim coat shall be equal to a Level 5 finish for untextured surfaces. Surfaces with light textures may be equal to a Level 4 finish. Finish Levels shall be according to the latest edition of Gypsum Association publication GA-214 "Recommended Levels of Gypsum Board Finish."
- 3.8 TEXTURE FINISH
 - A. Apply finish texture coating by means of spraying apparatus in accordance with manufacturer's instructions and to match approved sample.

3.9 TOLERANCES

A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet (3 mm in 3 m) in any direction.

GYPSUM BOARD ASSEMBLIES

SECTION 09 3000 TILING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Tile for floor applications.
- B. Tile for wall applications.
- C. Coated glass mat backer board as tile substrate.
- D. Non-ceramic trim.
- 1.2 RELATED REQUIREMENTS
 - A. Section 07 9200 Joint Sealants: Sealing joints between tile work and adjacent construction and fixtures.
 - B. Section 09 2116 Gypsum Board Assemblies: Tile backer board.
- 1.3 REFERENCE STANDARDS
 - A. ANSI A108.1a American National Standard Specifications for Installation of Ceramic Tile in the Wet-Set Method, with Portland Cement Mortar; 2014.
 - B. ANSI A108.1b American National Standard Specifications for Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex-Portland Cement Mortar; 1999 (Reaffirmed 2010).
 - C. ANSI A108.1c Specifications for Contractors Option: Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar or Installation of Ceramic Tile on a Cured Portland Cement Mortar Bed with Dry-Set or Latex-Portland Cement; 1999 (Reaffirmed 2010).
 - D. ANSI A108.4 American National Standard Specifications for Installation of Ceramic Tile with Organic Adhesives or Water Cleanable Tile-Setting Epoxy Adhesive; 2009 (Revised).
 - E. ANSI A108.5 American National Standard Specifications for Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar; 1999 (Reaffirmed 2010).
 - F. ANSI A108.6 American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy; 1999 (Reaffirmed 2010).
 - G. ANSI A108.8 American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant Furan Resin Mortar and Grout; 1999 (Reaffirmed 2010).
 - H. ANSI A108.9 American National Standard Specifications for Installation of Ceramic Tile with Modified Epoxy Emulsion Mortar/Grout; 1999 (Reaffirmed 2010).
 - I. ANSI A108.10 American National Standard Specifications for Installation of Grout in Tilework; 1999 (Reaffirmed 2010).
 - J. ANSI A108.11 American National Standard Specifications for Interior Installation of Cementitious Backer Units; 2010 (Reaffirmed 2016).
 - K. ANSI A108.12 American National Standard for Installation of Ceramic Tile with EGP (Exterior glue plywood) Latex-Portland Cement Mortar; 1999 (Reaffirmed 2010).
 - L. ANSI A108.13 American National Standard for Installation of Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone; 2005 (Reaffirmed 2010).
 - M. ANSI A118.4 American National Standard Specifications for Modified Dry-Set Cement Mortar; 2012 (Revised).
 - N. ANSI A118.7 American National Standard Specifications for High Performance Cement Grouts for Tile Installation; 2010 (Revised).
 - O. ANSI A118.10 American National Standard Specifications for Load Bearing, Bonded, Waterproof Membranes For Thin-Set Ceramic Tile And Dimension Stone Installation; 2014.
 - P. ANSI A118.12 American National Standard Specifications for Crack Isolation Membranes for Thin-set Ceramic Tile and Dimension Stone Installation; 2014.
 - Q. ANSI A137.1 American National Standard Specifications for Ceramic Tile; 2013.1.
 - R. ASTM C373 Standard Test Method for Water Absorption, Bulk Density, Apparent Porosity, and Apparent Specific Gravity of Fired Whiteware Products, Ceramic Tiles, and Glass Tiles; 2014a.

- S. ASTM C1178/C1178M Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel; 2013.
- T. TCNA (HB) Handbook for Ceramic, Glass, and Stone Tile Installation; 2015.

1.4 SUBMITTALS

- A. See Section 01 3000 ADMINISTRATIVE REQUIREMENTS, for submittal procedures.
- B. Product Data: Provide manufacturers' data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.
- C. Shop Drawings: Indicate tile layout, perimeter conditions, junctions with dissimilar materials, thresholds, and setting details.
- D. Samples: Mount tile and apply grout on two plywood panels, minimum 18 by 18 inches (457 by 457 mm) in size illustrating pattern, color variations, and grout joint size variations.
- E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- F. Maintenance Data: Include recommended cleaning methods, cleaning materials, and stain removal methods.
- G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 1. See Section 01 6000 Product Requirements, for additional provisions.
 - 2. Extra Tile: 10 square feet (1 square meters) of each size, color, and surface finish combination.
- DELIVERY, STORAGE, AND HANDLING
 A. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.
- 1.6 FIELD CONDITIONS
 - A. Maintain ambient and substrate temperature of 50 degrees F (10 degrees C) during installation of mortar materials.

PART 2 PRODUCTS

- 2.1 TILE
 - A. Manufacturers: All products by the same manufacturer.
 - 1. Dal-Tile Corporation: www.daltile.com.
 - B. Glazed Wall Tile, Type CTW-1: ANSI A137.1, standard grade.
 - 1. Moisture Absorption: 7.0 to 20.0 percent as tested in accordance with ASTM C373.
 - 2. Size: 4-1/4 by 4-1/4 inch (108 by 108 mm), nominal.
 - 3. Edges: Cushioned.
 - 4. Surface Finish: High gloss.
 - 5. Color(s): To be selected by Architect from manufacturer's standard range.
 - 6. Trim Units: Matching base shapes in sizes coordinated with field tile.
 - 7. Products:
 - a. Semi-Gloss by Daltile.
 - b. Substitutions: See Section 01 6000 Product Requirements.
 - C. Porcelain Tile, Type CT-1 and -2: ANSI A137.1, standard grade.
 - 1. Moisture Absorption: 0 to 0.5 percent as tested in accordance with ASTM C373.
 - 2. Size: 12 by 12 inch (305 by 305 mm), nominal.
 - 3. Thickness: 5/16 inch (8 mm).
 - 4. Edges: Square.
 - 5. Surface Finish: Matte glazed.
 - 6. Color(s): To be selected by Architect from manufacturer's full range.
 - 7. Products:
 - a. Volume 1.0 by Daltile (CT-1) and Volume 1.1 by Daltile (CT-2).
 - b. Substitutions: See Section 01 6000 Product Requirements.
 - D. Porcelain Tile, Type CT-3: ANSI A137.1, standard grade.
 - 1. Moisture Absorption: 0 to 0.5 percent as tested in accordance with ASTM C373.
 - 2. Size: 12 by 24 inch (305 by 610 mm), nominal.
 - 3. Thickness: 3/8 inch (9.5 mm).
 - 4. Edges: Square.
 - 5. Surface Finish: Matte glazed.

- 6. Color(s): To be selected by Architect from manufacturer's full range.
- 7. Products:
 - a. Volume 1.0 by Daltile.
 - b. Substitutions: See Section 01 6000 Product Requirements.
- 2.2 TRIM AND ACCESSORIES
 - A. Non-Ceramic Trim: Brushed stainless steel, style and dimensions to suit application, for setting using tile mortar or adhesive.
 - 1. Applications:
 - a. Open edges of wall tile.
 - b. Open edges of floor tile.
 - c. Transition between floor finishes of different heights.
 - d. Thresholds at door openings.
 - e. Floor to wall joints.
 - f. Borders and other trim as indicated on drawings.
 - 2. Manufacturers:
 - a. Schluter-Systems: www.schluter.com.
 - b. Substitutions: See Section 01 6000 Product Requirements.

2.3 SETTING MATERIALS

- A. Manufacturers:
 - 1. ARDEX Engineered Cements: www.ardexamericas.com.
 - 2. Custom Building Products: www.custombuildingproducts.com.
 - 3. LATICRETE International, Inc: www.laticrete.com.
 - 4. Mapei Corporation: www.mapei.com/US-EN/.
 - 5. Substitutions: See Section 01 6000 Product Requirements.
- B. Latex-Portland Cement Mortar Bond Coat: ANSI A118.4.
 - 1. Applications: Use this type of bond coat where indicated and where no other type of bond coat is indicated.
 - 2. Products:
 - a. ARDEX Engineered Cements; ARDEX X 5: www.ardexamericas.com.
 - b. Custom Building Products; ProLite Premium Rapid Setting Large Format Tile Mortar, with Multi-Surface Bonding Primer: www.custombuildingproducts.com.
 - c. LATICRETE International, Inc; LATICRETE 254 Platinum: www.laticrete.com/#sle.
 - d. Substitutions: See Section 01 6000 Product Requirements.
- C. Large Format Tile Mortar: ANSI A118.4, and A118.11
 - 1. Applications: At CT-3.
 - 2. Products:
 - a. Custom Building Products, **Prolite Premium** Large Format Tile Mortar, Gray. http://www.custombuildingproducts.com.
 - b. Laticrete International, Inc., 255 Multimax, Grey.
 - c. Mapei Corp., **Ultraflex LFT**, Premium, large-format tile mortar with polymer
 - d. Substitutions: See Section 01 6000 Product Requirements.
- 2.4 GROUTS
 - A. High Performance Polymer Modified Grout: ANSI A118.7 polymer modified cement grout.
 - 1. Applications: Use this type of grout where indicated and where no other type of grout is indicated.
 - 2. Use sanded grout for joints 1/8 inch (3.2 mm) wide and larger; use unsanded grout for joints less than 1/8 inch (3.2 mm) wide.
 - 3. Color(s): As selected by Architect from manufacturer's full line.
 - 4. Products:
 - a. Custom Building Products; Prism Color Consistent Grout: www.custombuildingproducts.com.
 - b. LATICRETE International, Inc; LATICRETE PERMACOLOR Grout: www.laticrete.com/#sle.
 - c. Substitutions: See Section 01 6000 Product Requirements.

- B. Urethane, Hybrid Urethane Grout:
 - 1. Applications: Use this type of grout at Restrooms, Lounge, and at other areas indicated.
 - 2. Use sanded grout for joints 1/8 inch wide and larger; use unsanded grout for joints less than 1/8 inch wide.
 - 3. Performance requirements:
 - a. Exceeds grout-relevant portion of ANSI 118.3, including chemical resistance.
 - b. Water Absorption: Less than 1%.
 - c. Chemcal Resistance: Passes per ASTM C267.
 - 4. Color(s): As selected by Architect from manufacturer's full line.
 - 5. Products:
 - a. Bostik Inc; QuartzLock2: www.bostik-us.com.
 - b. LATICRETE International, Inc; Plasma: www.laticrete.com.
 - c. Substitutions: See Section 01 6000 Product Requirements.
- 2.5 Maintenance Materials
 - A. Grout Sealer: Liquid-applied, moisture and stain protection for existing or new Portland cement grout.
 - 1. Composition: Water-based colorless silicone.
 - 2. Products:
 - a. Merkrete, by Parex USA, Inc; Merkrete Grout Sealer: www.merkrete.com/sle.
 - b. Substitutions: See Section 01 6000 Product Requirements.
- 2.6 ACCESSORY MATERIALS
 - A. Concrete Floor Slab Crack Isolation Membrane: Material complying with ANSI A118.12; not intended as waterproofing.
 - 1. Type: Fluid-applied.
 - 2. Thickness: 20 mils (0.5 mm), maximum.
 - 3. Crack Resistance: No failure at 1/16 inch (1.6 mm) gap, minimum.
 - 4. Products:
 - a. LATICRETE International, Inc; LATICRETE Blue 92 Anti-Fracture Membrane: www.laticrete.com/#sle.
 - b. Substitutions: See Section 01 6000 Product Requirements.
 - B. Waterproofing Membrane at Restroom and Lounge Floors: Specifically designed for bonding to cementitious substrate under thick mortar bed or thin-set tile; complying with ANSI A118.10.
 - 1. Crack Resistance: No failure at 1/16 inch (1.6 mm) gap, minimum; comply with ANSI A118.12.
 - 2. Fluid or Trowel Applied Type:
 - a. Material: Synthetic rubber or Acrylic.
 - b. Thickness: 25 mils (0.6 mm), minimum, dry film thickness.
 - c. Products:
 - 1) ARDEX Engineered Cements; ARDEX 8+9: www.ardexamericas.com/#sle.
 - 2) Custom Building Products; RedGard Crack Prevention and Waterproofing Membrane: www.custombuildingproducts.com.
 - 3) LATICRETE International, Inc; LATICRETE HYDRO BAN: www.laticrete.com/#sle.
 - 4) Substitutions: See Section 01 6000 Product Requirements.
 - C. Backer Board: Coated glass mat type complying with ASTM C1178/C1178M; inorganic fiberglass mat on both surfaces and integral acrylic coating vapor retarder.
 - D. Mesh Tape: 2 inch (50 mm) wide self-adhesive fiberglass mesh tape.

PART 3 EXECUTION

- 3.1 EXAMINATION
 - A. Verify that sub-floor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive tile.
 - B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive tile.

- C. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of setting materials to sub-floor surfaces.
- D. Verify that concrete sub-floor surfaces are ready for tile installation by testing for moisture emission rate and alkalinity; obtain instructions if test results are not within limits recommended by tile manufacturer and setting materials manufacturer.
- E. Verify that required floor-mounted utilities are in correct location.
- 3.2 PREPARATION
 - A. Protect surrounding work from damage.
 - B. Vacuum clean surfaces and damp clean.
 - C. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.
 - D. Install backer board in accordance with ANSI A108.11 and board manufacturer's instructions. Tape joints and corners, cover with skim coat of setting material to a feather edge.
 - E. Prepare substrate surfaces for adhesive installation in accordance with adhesive manufacturer's instructions.
- 3.3 INSTALLATION GENERAL
 - A. Install tile and thresholds and grout in accordance with applicable requirements of ANSI A108.1a through ANSI A108.13, manufacturer's instructions, and TCNA (HB) recommendations.
 - B. Lay tile to pattern indicated. Do not interrupt tile pattern through openings.
 - C. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor joints.
 - D. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make grout joints without voids, cracks, excess mortar or excess grout, or too little grout.
 - E. Form internal angles square and external angles bullnosed.
 - F. Install non-ceramic trim in accordance with manufacturer's instructions.
 - G. Sound tile after setting. Replace hollow sounding units.
 - H. Keep control and expansion joints free of mortar, grout, and adhesive.
 - I. Prior to grouting, allow installation to completely cure; minimum of 48 hours.
 - J. Grout tile joints unless otherwise indicated.
 - K. At changes in plane and tile-to-tile control joints, use tile sealant instead of grout, with either bond breaker tape or backer rod as appropriate to prevent three-sided bonding.
- 3.4 INSTALLATION FLOORS THIN-SET METHODS
 - A. Over interior concrete substrates, install in accordance with TCNA (HB) Method F113, dry-set or latex-Portland cement bond coat, with latex-Portland cement grout, unless otherwise indicated.
 - 1. Where waterproofing membrane is indicated, install in accordance with TCNA (HB) Method F122, with latex-Portland cement grout.
 - B. Install tile-to-tile floor movement joints in accordance with TCNA (HB) Method EJ171F.
- 3.5 INSTALLATION WALL TILE
 - A. Over coated glass mat backer board on studs, install in accordance with TCNA (HB) Method W245.

3.6 CLEANING

- A. Clean tile and grout surfaces.
- 3.7 PROTECTION
 - A. Do not permit traffic over finished floor surface for 4 days after installation.
SECTION 09 5100 ACOUSTICAL CEILINGS

PART 1 GENERAL

- 1.1 SECTION INCLUDES A. Acoustical units.
- 1.2 RELATED REQUIREMENTS
 - A. Section 01 6116 Volatile Organic Compound (VOC) Content Restrictions.
 - B. Section 26 5100 Interior Lighting: Light fixtures in ceiling system.
- 1.3 REFERENCE STANDARDS
 - A. ASTM C635/C635M Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2013a.
 - B. ASTM C636/C636M Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels; 2013.
 - C. ASTM E580/E580M Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions; 2014.
 - D. ASTM E1264 Standard Classification for Acoustical Ceiling Products; 2014.
 - E. UL (FRD) Fire Resistance Directory; current edition.
- 1.4 ADMINISTRATIVE REQUIREMENTS
 - A. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.
 - B. Do not install acoustical units until after interior wet work is dry.
- 1.5 SUBMITTALS
 - A. See Section 01 3000 ADMINISTRATIVE REQUIREMENTS, for submittal procedures.
 - B. Product Data: Provide data on suspension system components.
 - C. Samples: Submit two samples 4 by 4 inch (100 by 100 mm) in size illustrating material and finish of acoustical units.
 - D. Manufacturer's Installation Instructions: Indicate special procedures.
 - E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 1. See Section 01 6000 Product Requirements, for additional provisions.
 - 2. Extra Acoustical Units: Quantity equal to 5 percent of total installed.
- 1.6 QUALITY ASSURANCE
 - A. Fire-Resistive Assemblies: Complete assembly listed and classified by UL (FRD) for the fire resistance indicated.
 - B. Suspension System Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
 - C. Acoustical Unit Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- 1.7 FIELD CONDITIONS
 - A. Maintain uniform temperature of minimum 60 degrees F (16 degrees C), and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

PART 2 PRODUCTS

- 2.1 MANUFACTURERS
 - A. Acoustic Tiles/Panels:
 - 1. Armstrong World Industries, Inc: www.armstrong.com.
 - B. Suspension Systems:
 - 1. Same as for acoustical units.

2.2 ACOUSTICAL UNITS

- A. Acoustical Units General: ASTM E1264, Class A.
 - 1. Units for Installation in Fire-Rated Suspension System: Listed and classified for the fire-resistive assembly as part of suspension system.
 - 2. VOC Content: As specified in Section 01 6116.
- B. Acoustical Panels Type SAP: Acoustically transparent membrane faced mineral fiber, ASTM E1264 Type IV, with the following characteristics:
 - 1. Size: 24 by 24 inches (600 by 600 mm).
 - 2. Thickness: 9/16 inches (14 mm).
 - 3. Composition: Wet felted.
 - 4. Edge: Tegular.
 - 5. Surface Color: White.
 - 6. Suspension System: Exposed grid.
 - 7. Products:
 - a. Ultima #1912 by Armstrong.
 - b. Substitutions: Not permitted.
- 2.3 SUSPENSION SYSTEM(S)
 - A. Suspension Systems General: Complying with ASTM C635/C635M; die cut and interlocking components, with stabilizer bars, clips, splices, and hold down clips as required.
 - B. Exposed Steel Suspension System: Formed steel, commercial quality cold rolled; intermediate-duty.
 - 1. Profile: Tee; 9/16 inch (14 mm) wide face.
 - 2. Construction: Double web.
 - 3. Finish: White painted.
 - 4. Products:
 - a. Suprafine XL by Armstrong.
- 2.4 ACCESSORIES
 - A. Support Channels and Hangers: Galvanized steel; size and type to suit application and ceiling system flatness requirement specified.
 - B. Light fixture securement:
 - 1. Extra hanging wires: Provide four hanging wires at all locations of light fixtures within grid for hanging of light fixtures by light fixture installer. Locate one wire at each corner of each light fixture. Required by code.
 - 2. Provide Hold-down clip near each corner of light fixtures to secure fixture to suspension system grid.
 - 3. Refer also to Section 26 5100 Interior Lighting for additional requirements
 - C. Perimeter Moldings: Same material and finish as grid.
 - 1. At Exposed Grid: Provide L-shaped molding for mounting at same elevation as face of grid.

PART 3 EXECUTION

- 3.1 EXAMINATION
 - A. Verify existing conditions before starting work.
 - B. Verify that layout of hangers will not interfere with other work.
- 3.2 INSTALLATION SUSPENSION SYSTEM
 - A. Install suspension system in accordance with ASTM C636/C636M, ASTM E580/E580M, and manufacturer's instructions and as supplemented in this section.
 - B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.
 - C. Locate system on room axis according to reflected plan.
 - D. Install after major above-ceiling work is complete. Coordinate the location of hangers with other work.

- E. Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.
- F. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.
- G. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.
- H. Support fixture loads using supplementary hangers located within 6 inches (150 mm) of each corner, or support components independently.
- I. Do not eccentrically load system or induce rotation of runners.
- J. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
 - 1. Use longest practical lengths.
 - 2. Overlap and rivet corners.
- K. Prep for interior light fixture:
 - 1. Install extra hanging wires for light fixtures. One wire for each corner of each light fixture. Four wires typically for each fixture. Provide more wires where necessary.
 - 2. Provide hold-down clips, one for each corner of light fixtures.
 - 3. Refer also to Section 26 5100 Interior Lighting.
- 3.3 INSTALLATION ACOUSTICAL UNITS
 - A. Install acoustical units in accordance with manufacturer's instructions.
 - B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.
 - C. Fit border trim neatly against abutting surfaces.
 - D. Install units after above-ceiling work is complete.
 - E. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.
 - F. Cutting Acoustical Units:
 - 1. Make field cut edges of same profile as factory edges.
 - G. Install hold-down clips on panels within 20 ft (6 m) of an exterior door.
- 3.4 TOLERANCES
 - A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet (3 mm in 3 m).
 - B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

END OF SECTION

ACOUSTICAL CEILINGS

SECTION 09 6500 RESILIENT BASE

PART 1 GENERAL

- 1.1 SECTION INCLUDES
 - A. Resilient base.
 - B. Installation accessories.
- 1.2 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

- 1.3 REFERENCE STANDARDS
 - A. ASTM F1861 Standard Specification for Resilient Wall Base; 2008 (Reapproved 2012).

1.4 SUBMITTALS

- A. See Section 01 3000 ADMINISTRATIVE REQUIREMENTS, for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.
- C. Selection Samples: Submit manufacturer's complete set of color samples for Architect's initial selection.
- D. Verification Samples: Submit two samples, minimum 6 x 6 inch (150 x 150 mm) in size illustrating color and pattern for each resilient flooring product specified.
- E. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 1. See Section 01 6000 Product Requirements, for additional provisions.
 - Extra Wall Base: Minimum 5% of the number of lineal feet of each type and color, Complete unopened manufacturers packaging. No partial packages.
- 1.5 DELIVERY, STORAGE, AND HANDLING
 - A. Upon receipt, immediately remove any shrink-wrap and check materials for damage and the correct style, color, quantity and run numbers.
 - B. Store all materials off of the floor in an acclimatized, weather-tight space.
 - C. Maintain temperature in storage area between 55 degrees F (13 degrees C) and 90 degrees F (72 degrees C).
 - D. Protect roll materials from damage by storing on end.
 - E. Do not double stack pallets.

1.6 FIELD CONDITIONS

A. Store materials for not less than 48 hours prior to installation in area of installation at a temperature of 70 degrees F (21 degrees C) to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F (13 degrees C).

PART 2 PRODUCTS

- 2.1 RESILIENT BASE
 - A. Resilient Base: ASTM F1861, Type TS rubber, vulcanized thermoset; top set Style B, Cove.
 - 1. Manufacturers:
 - a. Johnsonite, a Tarkett Company: www.johnsonite.com.
 - b. Roppe Corp; Pinnacle Plus: www.roppe.com.
 - c. Substitutions: See Section 01 6000 Product Requirements.
 - 2. Height: 4 inch (100 mm).
 - 3. Thickness: 0.125 inch (3.2 mm).
 - 4. Finish: Satin.
 - 5. Length: Roll.
 - 6. Color: To be selected by Architect from manufacturer's full range.
 - 7. Accessories: Premolded internal corners.

2.2 ACCESSORIES

- A. Primers and Adhesives: Waterproof; types recommended by flooring manufacturer.
 1. VOC Content Limits: As specified in Section 01 6116.
- B. Filler for Coved Base: Plastic.

PART 3 EXECUTION

- 3.1 EXAMINATION
 - A. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive resilient base.

3.2 PREPARATION

- A. Clean substrate.
- B. Apply primer as required to prevent "bleed-through" or interference with adhesion by substances that cannot be removed.
- 3.3 Installation General
 - A. Starting installation constitutes acceptance of existing conditions.
 - B. Install in accordance with manufacturer's written instructions.
 - C. Spread only enough adhesive to permit installation of materials before initial set.
 - D. Fit joints and butt seams tightly.
- 3.4 Installation Resilient Base
 - A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches (45 mm) between joints.
 - B. Miter internal corners. At external corners, 'V' cut back of base strip to 2/3 of its thickness and fold. At exposed ends, use premolded units.
 - C. Install base on solid backing. Bond tightly to wall and floor surfaces.
- 3.5 CLEANING
 - A. Remove excess adhesive from floor, base, and wall surfaces without damage.
 - B. Clean in accordance with manufacturer's written instructions.

END OF SECTION

SECTION 09 9000 PAINTING AND COATING

PART 1 GENERAL

- 1.1 SECTION INCLUDES
 - A. Surface preparation.
 - B. Field application of paints and stains.
 - C. Materials for backpriming woodwork.
 - D. Scope: Finish all interior and exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated, including the following:
 - 1. Both sides and edges of plywood backboards for electrical and telecom equipment before installing equipment.
 - 2. Exposed surfaces of steel lintels and ledge angles.
 - E. Do Not Paint or Finish the Following Items:
 - 1. Items fully factory-finished unless specifically so indicated; materials and products having factory-applied primers are not considered factory finished.
 - 2. Items indicated to receive other finishes.
 - 3. Items indicated to remain unfinished.
 - 4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
 - 5. Stainless steel, anodized aluminum, bronze, terne, and lead items.
 - 6. Floors, unless specifically so indicated.
 - 7. Glass.
 - 8. Acoustical materials, unless specifically so indicated.
 - 9. Concealed pipes, ducts, and conduits.

1.2 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

- 1.3 REFERENCE STANDARDS
 - A. ASTM D 823 Standard Practices for Producing Films of Uniform Thickness of Paint, Varnish, and Related Products on Test Panels; 95(2007).
 - B. ASTM D 3363 Standard Test Method for Film Hardness by Pencil Test; 05(2011)e1.
 - C. ASTM D 3964 Standard Practice for Selection of Coating Specimens for Appearance Measurements; 2010.
 - D. ASTM D4442 Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Base Materials; 2007.

1.4 SUBMITTALS

- A. See Section 01 3000 ADMINISTRATIVE REQUIREMENTS, for submittal procedures.
- B. Product Data: Provide complete list of all products to be used, with the following information for each:
 - 1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
 - 2. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
- C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches (216 by 279 mm) in size, illustrating range of colors available for each finishing product specified.
 - 1. Where sheen is not specified, submit each color in each sheen available.
- D. Certification: By manufacturer that all paints and coatings comply with VOC limits specified.
- E. Manufacturer's Instructions: Indicate special surface preparation procedures.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 6000 Product Requirements, for additional provisions.
 - 2. Extra Paint and Coatings: 1 gallon (4 L) of each color; store where directed.
 - 3. Label each container with color in addition to the manufacturer's label.

- 1.5 QUALITY ASSURANCE
 - A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.
- 1.6 DELIVERY, STORAGE, AND HANDLING
 - A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
 - B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
 - C. Paint Materials: Store at minimum ambient temperature of 45 degrees F (7 degrees C) and a maximum of 90 degrees F (32 degrees C), in ventilated area, and as required by manufacturer's instructions.

1.7 FIELD CONDITIONS

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
- B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- C. Do not apply exterior coatings during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.
- D. Minimum Application Temperatures for Latex Paints: 45 degrees F (7 degrees C) for interiors; 50 degrees F (10 degrees C) for exterior; unless required otherwise by manufacturer's instructions.
- E. Minimum Application Temperature for Varnish Finishes: 65 degrees F (18 degrees C) for interior or exterior, unless required otherwise by manufacturer's instructions.
- F. Provide lighting level of 80 ft candles (860 lx) measured mid-height at substrate surface.

PART 2 PRODUCTS

- 2.1 MANUFACTURERS
 - A. Provide all paint and coating products used in any individual system from the same manufacturer; except as noted.
 - B. Paints:
 - 1. Base Manufacturer: Sherwin-Williams Company: www.sherwin-williams.com. (SW or S-W)
 - 2. Behr Process Corporation: www.behr.com.
 - 3. Kwal Paint, a Comex Group company: www.kwalpaint.com. (Kwl)
 - 4. Benjamin Moore & Co: www.benjaminmoore.com. (BM or Benj. Moore)
 - 5. PPG Architectural Finishes, Inc: www.ppgaf.com. (PPG)
 - C. Transparent Finishes:
 - 1. Base Manufacturer: Sherwin-Williams Company: www.sherwin-williams.com. (SW or S-W)
 - 2. Behr Process Corporation: www.behr.com.
 - 3. Benjamin Moore & Co.. (BM or Benj. Moore)
 - 4. Coronado Paint Company. (Coro)
 - 5. Pittsburgh Paint. (PPG)
 - 6. Kelly-Moore Paint Co. (KM)
 - 7. Kwal Paints. (Kw)
 - D. Stains:
 - 1. Base Manufacturer: Sherwin-Williams Company: www.sherwin-williams.com. (SW or S-W)
 - 2. Behr Process Corporation: www.behr.com.
 - 3. Benjamin Moore & Co.. (BM or Benj. Moore)
 - 4. Coronado Paint Company. (Coro)
 - 5. Pittsburgh Paint. (PPG)
 - 6. Kelly-Moore Paint Co. (KM)
 - 7. Kwal Paints. (Kw)

- E. Primer Sealers: Same manufacturer as top coats.
- F. Block Fillers: Same manufacturer as top coats.
 - 1. Benjamin Moore & Co.. (BM or Benj. Moore)
 - 2. Coronado Paint Company. (Coro)
 - 3. Pittsburgh Paint. (PPG)
 - 4. Kelly-Moore Paint Co. (KM)
 - 5. Kwal Paints. (Kw)
- G. Concrete Sealers:
 - 1. Euclid Chemical Company.
 - 2. L. M. Scofield Co.
 - 3. L & M Construction Chemicals Inc.
 - 4. Dayton Superior Chemical & Concrete Products.
 - 5. UNITEX.
- H. Substitutions: See Section 01 6000 Product Requirements.
- 2.2 PAINTS AND COATINGS GENERAL
 - A. Paints and Coatings: Ready mixed, unless intended to be a field-catalyzed coating.
 - 1. Provide paints and coatings of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
 - 2. Supply each coating material in quantity required to complete entire project's work from a single production run.
 - 3. Do not reduce, thin, or dilute coatings or add materials to coatings unless such procedure is specifically described in manufacturer's product instructions.
 - B. Primers: As follows unless other primer is required or recommended by manufacturer of top coats; where the manufacturer offers options on primers for a particular substrate, use primer categorized as "best" by the manufacturer.
 - C. Volatile Organic Compound (VOC) Content: Comply with Section 01 6116.
- 2.3 CONCRETE CURE AND SEALER
 - A. Verify that all products and procedures are compatible.
 - 1. Coordinate and verify treatment of concrete slab curing and sealing with respective trade(s). Cure and seal procedures and products shall be compatible with flooring products used throughout this project. All affected trades shall make coordinated plans, preparations, product selection, and properly execute curing and sealing to be compatible for satisfactory flooring applications including areas that may need different types of preparation, product, and execution.
 - 2. Products listed below shall be verified by all parties involved in the construction to be compatible with all other products, procedures, and finishes used for this project.
 - B. Cure and Sealers for all locations:
 - 1. Euclid Chemical Company:
 - a. Super Aqua-Cure VOX.
 - 2. L. M. Scofield Company:
 - a. Clear finish coat over new concrete, waterborne sealer: Semi-gloss Scofield Clearcoat.
 - 3. Dayton Superior Safe Cure and Seal (J-18).
 - 4. L & M Dress & Seal WB.
 - 5. UNITEX 12-34.
 - 6. Substitutions: See Section 01600 Product Requirements.
- 2.4 PAINT SYSTEMS EXTERIOR
 - A. Paint E-OP All Exterior Surfaces Indicated to be Painted, Unless Otherwise Indicated: Including concrete masonry and primed wood.
 - 1. Preparation as specified by manufacturer.
 - 2. Two top coats and one coat primer recommended by manufacturer.
 - 3. Primer(s): As recommended by manufacturer of top coats.
 - B. Paint CE-OP-3L Masonry/Concrete, Opaque, Acrylic/Latex, 3 Coat:

- 1. Primer/Filler for CMU only: One coat SW High-Build Heavy Duty Block Filler B42WJ446 (<u>Do NOT use on Concrete</u>).
 - a. Minimum Thickness: 16 mils wet; 8 mils dry per coat.
 - b. Minimum 58% Volume Solids.
 - c. VOC (EPA Method #24): 66 g/L; 0.55 lb/gal.
 - d. Hazardous Air Pollutants (HAPs): 0.0 lbs/gal (0.0 kg/L) of solids.
- 2. Semi-gloss: Two coats of acrylic; SW Pro Industrial™ Zero VOC Semi-Gloss Acrylic, B66-650 Series.
 - a. Minimum Thickness: 6.0 mils wet; 2.5 mils dry per coat.
 - b. Minimum 33% Volume Solids.
 - c. VOC (EPA Method #24): 0 grams/liter; Trace.
 - d. Hazardous Air Pollutants (HAPs): 0.0 lbs/gal (0.0 kg/L) of solids.
- C. Paint ME-OP-3L Ferrous Metals, Unprimed, Latex, 3 Coat:
 - 1. One coat of acrylic primer. SW Pro Industrial[™] Pro-Cryl Universal Primer, B66-310 Series.
 - a. Minimum Thickness: 5 mils wet; 2 mils dry per coat.
 - b. Minimum 37% Volume Solids.
 - c. VOC (EPA Method #24): <100 g/L; <0.83 lb/gal.
 - d. Hazardous Air Pollutants (HAPs): 0.00 lbs/gal (0.000 kg/L) of solids.
 - 2. Semi-gloss: Two coats of latex enamel; SW Pro Industrial[™] Zero VOC Semi-Gloss Acrylic, B66-650 Series.
 - a. Minimum Thickness: 6.0 mils wet; 2.5 mils dry per coat.
 - b. Minimum 33% Volume Solids.
 - c. VOC (EPA Method #24): 0 g/L; Trace. Unreduced.
 - d. Hazardous Air Pollutants (HAPs): 0.00 lbs/gal (0.000 kg/L) of solids.
- D. Paint MgE-OP-3L Galvanized Metals, Acrylic, 3 Coat:
 - 1. One coat acrylic primer. SW Pro Industrial[™] Pro-Cryl Universal Primer, B66-310 Series.
 - a. Minimum Thickness: 5 mils wet; 2 mils dry per coat.
 - b. Minimum 37% Volume Solids.
 - c. VOC (EPA Method #24): <100 g/L; <0.83 lb/gal.
 - d. Hazardous Air Pollutants (HAPs): 0.00 lbs/gal (0.000 kg/L) of solids.
 - 2. Semi-gloss: Two coats of Acrylic coating; SW Pro Industrial[™] Zero VOC Semi-Gloss Acrylic, B66-650 Series.
 - a. Minimum Thickness: 6.0 mils wet; 2.5 mils dry per coat.
 - b. Minimum 33% Volume Solids.
 - c. VOC (EPA Method #24): 0 g/L; Trace. Unreduced.
 - d. Hazardous Air Pollutants (HAPs): 0.00 lbs/gal (0.000 kg/L) of solids.
- 2.5 PAINT SYSTEMS INTERIOR
 - A. Paint I-OP All Interior Surfaces Indicated to be Painted, Unless Otherwise Indicated: Including gypsum board, concrete masonry, wood, and shop primed steel.
 - 1. Two top coats and one coat primer.
 - 2. Primer(s): As recommended by manufacturer of top coats.
 - B. Paint WI-OP-3L Wood, Opaque, Latex, 3 Coat:
 - 1. One coat of latex primer sealer. SW ProMar 200 Zero VOC Interior Latex Primer B28W02600.
 - a. Greenguard Indoor Air Quality Certified.
 - b. Minimum Thickness: 4 mils wet; 1.5 mils dry per coat.
 - c. Minimum 24% Volume Solids.
 - d. VOC : 0 g/L; 0.0 lb/gal.
 - e. Hazardous Air Pollutants (HAPs): 0.00 lbs/gal 0.000 kg/L of solids.
 - 2. Semi-gloss: Two coats of vinyl acrylic finish; SW ProMar 200 Zero VOC Interior Latex Semi-Gloss B31-2600 Series .
 - a. Greenguard Indoor Air Quality Certified.
 - b. Minimum Thickness: 4 mils wet; 1.7 mils dry per coat.
 - c. Minimum 37% Volume Solids.
 - d. VOC : 0 g/L; 0.0 lb/gal.

- e. Hazardous Air Pollutants (HAPs): 0.00 lbs/gal 0.000 kg/L of solids.
- C. Paint WI-TR-V Wood, Transparent, Varnish, No Stain:
 - 1. One coat sealer. SW Wood Classics Fast Dry Sanding Sealer, B26V43.
 - a. Minimum Thickness: 3.5 mils wet; 1.0 mils dry per coat.
 - b. Minimum 29% Volume Solids.
 - c. VOC (less exempt solvents): 522 g/L; 4.36 lb/gal.
 - d. Hazardous Air Pollutants (HAPs): 0.59 lbs/gal 0.071 kg/L of solids.
 - e. Vehicle Type: Linseed Vinyl Toluene Alkyd.
 - 2. Satin: Two coats of varnish; SW Wood Classics Waterborne Polyurethane Varnish, Satin A68F90 series.
 - a. Minimum Thickness: 3.2 mils wet; 0.8 mils dry per coat.
 - b. Minimum 25% Volume Solids.
 - c. VOC : 308 g/L; 2.57 lb/gal.
 - d. Hazardous Air Pollutants (HAPs): 0.00 lbs/gal 0.000 kg/L of solids.
 - e. Vehicle Type: Polyurethane Acrylic.
- D. Paint WI-TR-VS Wood, Transparent, Varnish, Stain:
 - 1. Two coats of stain; SW Wood Classics Interior Oil Stain 250 VOC A49-800 Series.
 - a. Minimum Thickness: 3.0 mils wet; (No dry surface film) per coat.
 - b. Minimum 73% Volume Solids.
 - c. VOC (less exempt solvents): 202 g/L; 1.68 lb/gal.
 - d. Hazardous Air Pollutants (HAPs): 0.00 lbs/gal 0.000 kg/L of solids.
 - e. Vehicle Type: Alkyd.
 - 2. Satin: Two coats of varnish; SW Wood Classics Waterborne Polyurethane Varnish, Satin A68F90 series.
 - a. Minimum Thickness: 3.2 mils wet; 0.8 mils dry per coat.
 - b. Minimum 25% Volume Solids.
 - c. VOC : 308 g/L; 2.57 lb/gal.
 - d. Hazardous Air Pollutants (HAPs): 0.00 lbs/gal 0.000 kg/L of solids.
 - e. Vehicle Type: Polyurethane Acrylic.
- E. Paint CI-OP-3L Concrete/Masonry, Opaque, Latex, 3 Coat:
 - 1. Primer/Filler for CMU only: One coat SW High-Build Heavy Duty Block Filler B42WJ446 (Do NOT use on Concrete).
 - a. Minimum Thickness: 16 mils wet; 8 mils dry per coat.
 - b. Minimum 58% Volume Solids.
 - c. VOC (EPA Method #24): 66 g/L; 0.55 lb/gal.
 - d. Hazardous Air Pollutants (HAPs): 0.0 lbs/gal (0.0 kg/L) of solids.
 - 2. Semi-gloss: Two coats of acrylic; SW Pro Industrial™ Zero VOC Semi-Gloss Acrylic, B66-650 Series.
 - a. Greenguard Indoor Air Quality Certified.
 - b. Minimum Thickness: 6.0 mils wet; 2.5 mils dry per coat.
 - c. Minimum 33% Volume Solids.
 - d. VOC (EPA Method #24): 0 grams/liter; Trace.
 - e. Hazardous Air Pollutants (HAPs): 0.0 lbs/gal (0.0 kg/L) of solids.
 - f. Pencil Hardness: 2B (ASTM D 3363)
 - 3. Egg-Shell: Two coats of acrylic; SW Pro Industrial™ Zero VOC Eg-Shel Acrylic, B66-660 Series.
 - a. Greenguard Indoor Air Quality Certified.
 - b. Minimum Thickness: 6.0 mils wet; 2.5 mils dry per coat.
 - c. Minimum 33% Volume Solids.
 - d. VOC (EPA Method #24): 0 grams/liter; Trace.
 - e. Hazardous Air Pollutants (HAPs): 0.0 lbs/gal (0.0 kg/L) of solids.
 - f. Pencil Hardness: 2B (ASTM D 3363)
- F. Paint MgI-OP-3L Galvanized Metals, Acrylic, 3 Coat:
 - 1. One coat galvanize primer. SW Pro Industrial™ Pro-Cryl Universal Primer, B66-310 Series.
 - a. Minimum Thickness: 5 mils wet; 2 mils dry per coat.

- b. Minimum 37% Volume Solids.
- c. VOC (EPA Method #24) : <100 g/L; <0.83 lb/gal.
- d. Hazardous Air Pollutants (HAPs): 0.00 lbs/gal (0.000 kg/L) of solids.
- 2. Semi-gloss: Two coats of Acrylic coating; SW Pro Industrial[™] Zero VOC Semi-Gloss Acrylic, B66-650 Series.
 - a. Minimum Thickness: 6.0 mils wet; 2.5 mils dry per coat.
 - b. Minimum 33% Volume Solids.
 - c. VOC (EPA Method #24): 0 g/L; Trace. Unreduced.
 - d. Hazardous Air Pollutants (HAPs): 0.00 lbs/gal (0.000 kg/L) of solids.
- G. Paint GI-OP-3L Gypsum Board/Plaster, Acrylic Latex, 3 Coat:
 - 1. For use at Toilet Rooms, Storage Rooms/Closets, and Janitor Closets.
 - 2. One coat of Latex primer sealer; SW ProMar 200 Zero VOC Interior Latex Primer B28W02600.
 - a. Minimum Thickness: 4 mils wet; 1.5 mils dry per coat.
 - b. Minimum 24% Volume Solids.
 - c. VOC (EPA Method #24): 0 g/L; 0 lb/gal.
 - d. Hazardous Air Pollutants (HAPs): 0.00 lbs/gal 0.000 kg/L of solids.
 - e. Vehicle Type: Vinyl Acrylic.
 - 3. Semi-gloss: Two coats of latex enamel; SW Pro Industrial Zero VOC Acrylic.
 - a. Minimum Thickness: 6.0 mils wet; 2.5 mils dry per coat.
 - b. Minimum 33% Volume Solids.
 - c. VOC (EPA Method #24): 0 g/L; 0 lb/gal.
 - d. Hazardous Air Pollutants (HAPs): 0.00 lbs/gal 0.000 kg/L of solids.
 - e. Vehicle Type: Ambient cured, single component Acrylic.
 - f. <<< ===== XvX ==== >>>.
- H. Paint GI-OP-3LA Gypsum Board/Plaster, Latex-Acrylic, 3 Coat:
 - 1. One coat of latex primer sealer, SW ProMar 200 Zero VOC Interior Latex Primer B28W02600.
 - a. Minimum Thickness: 4 mils wet; 1.5 mils dry per coat.
 - b. Minimum 24% Volume Solids.
 - c. VOC (EPA Method #24): 0 g/L; 0 lb/gal.
 - d. Hazardous Air Pollutants (HAPs): 0.00 lbs/gal 0.000 kg/L of solids.
 - e. Vehicle Type: Vinyl Acrylic.
 - 2. Eggshell: Two coats of latex-acrylic enamel; SW ProMar 200 Zero VOC, Interior Latex Eg-Shel, B20-2600 Series.
 - a. Minimum Thickness: 4 mils wet; 1.7 mils dry per coat.
 - b. Minimum 40% Volume Solids.
 - c. VOC (less exempt solvents): 0 g/L; 0.0 lb/gal.
 - d. Hazardous Air Pollutants (HAPs): 0.00 lbs/gal 0.000 kg/L of solids.
 - e. Vehicle Type: Vinyl Acrylic.
- 2.6 ACCESSORY MATERIALS
 - A. Accessory Materials: Provide all primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials required to achieve the finishes specified whether specifically indicated or not; commercial quality.
 - B. Patching Material: Latex filler.
 - C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

- 3.1 EXAMINATION
 - A. Do not begin application of coatings until substrates have been properly prepared.
 - B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
 - C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.
 - D. Test shop-applied primer for compatibility with subsequent cover materials.

- E. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
 - 1. Gypsum Wallboard: 12 percent.
 - 2. Masonry, Concrete, and Concrete Unit Masonry: 12 percent.
 - 3. Interior Wood: 15 percent, measured in accordance with ASTM D4442.
 - 4. Exterior Wood: 15 percent, measured in accordance with ASTM D4442.
- 3.2 PREPARATION
 - A. Clean surfaces thoroughly and correct defects prior to coating application.
 - B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
 - C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.
 - D. Seal surfaces that might cause bleed through or staining of topcoat.
 - E. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
 - F. Concrete and Unit Masonry Surfaces to be Painted: Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter. Remove oil and grease with a solution of tri-sodium phosphate; rinse well and allow to dry. Remove stains caused by weathering of corroding metals with a solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.
 - G. Gypsum Board Surfaces to be Painted: Fill minor defects with filler compound. Spot prime defects after repair.
 - H. Corroded Steel and Iron Surfaces to be Painted: Prepare using at least SSPC-SP 2 (hand tool cleaning) or SSPC-SP 3 (power tool cleaning) followed by SSPC-SP 1 (solvent cleaning).
 - I. Uncorroded Uncoated Steel and Iron Surfaces to be Painted: Remove grease, mill scale, weld splatter, dirt, and rust. Where heavy coatings of scale are evident, remove by hand or power tool wire brushing or sandblasting; clean by washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Prime paint entire surface; spot prime after repairs.
 - J. Shop-Primed Steel Surfaces to be Finish Painted: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.
 - K. Interior Wood Surfaces to Receive Opaque Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats. Back prime concealed surfaces before installation.
 - L. Interior Wood Surfaces to Receive Transparent Finish: Wipe off dust and grit prior to sealing, seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after sealer has dried; sand lightly between coats. Prime concealed surfaces with gloss varnish reduced 25 percent with thinner.
 - M. Exterior Wood to Receive Transparent Finish: Remove dust, grit, and foreign matter; seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes with tinted exterior calking compound after sealer has been applied. Prime concealed surfaces.
 - N. Glue-Laminated Beams: Prior to finishing, wash surfaces with solvent, remove grease and dirt.
 - O. Wood Doors to be Field-Finished: Seal wood door top and bottom edge surfaces with clear sealer.
 - P. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.3 APPLICATION

- A. Apply products in accordance with manufacturer's instructions.
- B. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- C. Apply each coat to uniform appearance.
- D. Sand wood and metal surfaces lightly between coats to achieve required finish.
- E. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- F. Wood to Receive Transparent Finishes: Tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.

G. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.4 FIELD QUALITY CONTROL

- A. See Section 01 4000 Quality Requirements, for general requirements for field inspection.
- B. Architect and Owner will provide field inspection.
- 3.5 CLEANING
 - A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.6 PROTECTION

- A. Protect finished coatings until completion of project.
- B. Touch-up damaged coatings after Substantial Completion.

END OF SECTION

SECTION 10 1400 SIGNAGE

PART 1 GENERAL

- 1.1 SECTION INCLUDES A. Room and door signs.
- 1.2 RELATED REQUIREMENTSA. Section 26 5100 Interior Lighting: Exit signs required by code.
- 1.3 REFERENCE STANDARDS
 - A. TAS 2012 Texas Accessibility Standards (TAS); 2012.

1.4 SUBMITTALS

- A. See Section 01 3000 ADMINISTRATIVE REQUIREMENTS, for submittal procedures.
- B. Product Data: Manufacturer's printed product literature for each type of sign, indicating sign styles, font, foreground and background colors, locations, overall dimensions of each sign.
- C. Signage Schedule: Provide information sufficient to completely define each sign for fabrication, including room number, room name, other text to be applied, sign and letter sizes, fonts, and colors.
 - 1. When room numbers to appear on signs differ from those on drawings, include the drawing room number on schedule.
 - 2. When content of signs is indicated to be determined later, request such information from Owner through Architect at least 2 months prior to start of fabrication; upon request, submit preliminary schedule.
 - 3. Submit for approval by Owner through Architect prior to fabrication.
- D. Samples: Submit one sample of each type of sign, of size similar to that required for project, illustrating sign style, font, and method of attachment.
- E. Selection Samples: Where colors are not specified, submit two sets of color selection charts or chips.
- F. Verification Samples: Submit samples showing colors specified.
- G. Manufacturer's Installation Instructions: Include installation templates and attachment devices.
- 1.5 QUALITY ASSURANCE
 - A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years of documented experience.
- 1.6 DELIVERY, STORAGE, AND HANDLING
 - A. Package signs as required to prevent damage before installation.
 - B. Package room and door signs in sequential order of installation, labeled by floor or building.
 - C. Store tape adhesive at normal room temperature.
- 1.7 FIELD CONDITIONS
 - A. Do not install tape adhesive when ambient temperature is lower than recommended by manufacturer.
 - B. Maintain this minimum temperature during and after installation of signs.
- 1.8 WARRANTY
 - A. See Section 01 7800 Closeout Submittals, for additional warranty requirements.
 - B. Provide five year manufacturer warranty against defects in materials and workmanship.
- 1.9 AVAILABLE MANUFACTURERS
 - A. Substitutions: The product(s) referenced by the manufacturer listed, forms the basis of design. The contractor at their option may provide an alternate manufacturer as an equal, however, if an equal is proposed, the Contractor shall provide data from the specified manufacturer & product(s) as well as equivalent data from the proposed manufacturer for a comparison, review, and determination of acceptance (approval or disapproval) by the Architect. Approval cannot be made if adequate comparison information is not provided. Absence of specified manufacturers' data is grounds for disapproval.

- 1. Provide a thorough and clear identification of the proposed substitution.
- B. Refer to Section 01 3000 Administrative Requirements AND Section Product Requirements for substitution procedures.

PART 2 PRODUCTS

- 2.1 BASIS OF DESIGN MANUFACTURER
 - A. Flat Signs:
 - 1. Takeform; Fusion 01, Quad: www.takeform.net.
 - 2. Substitutions: See Section 01 6000 Product Requirements.
 - a. See article in PART 1 above entitled "Available Manufacturers".

2.2 SIGNAGE APPLICATIONS

A. Sign Standards:

- 1. Engineered and Tested:
 - a. The signage system shall have undergone rigorous testing to ensure longevity and optimal performance. Testing shall include environmental testing to ensure that materials can withstand changes in temperature and humidity without distortion as well as testing to ensure resistance to chemicals and UV effects. Further, mechanical testing shall ensure that the tensile and pull-out strength of mounting hardware is adequate to ensure a safe installation. Test data shall be included with submittals.
- 2. Typography:
 - a. Type style: see drawings. Copy shall be a true, clean, accurate reproduction of typeface(s) specified. Upper and lower case or all caps shall be as indicated in Sign Type drawings and Signage Schedule. Letter spacing to be normal and interline spacing shall be set by manufacturer.
 - b. Arrows, symbols and logo art: To be provided in style, sizes, colors and spacing as shown in drawings.
 - c. Grade II Braille utilizing perfectly round, clear insertion beads.
- 3. Evacuation Maps:
 - a. Evacuation maps shall have a unique "you-are-here" orientation as well as two emergency egress paths. The maps shall show location of fire extinguishers, fire pulls, stairwells, elevators and restrooms.
- 4. Color and Finishes:
 - a. Colors, patterns and artwork: see drawings.
 - b. Message Background: see drawings.
 - c. Finishes are to meet current federal ADA and all state and local requirements.
- B. Accessibility Compliance: Signs are required to comply with TAS.
- C. Room and Door Signs: Provide a sign for every doorway and room, whether it has a door or not, not including corridors, lobbies, and similar open areas.
 - 1. Sign Type: Flat signs with engraved panel media as specified.
 - 2. Provide "tactile" signage, with letters raised minimum 1/32 inch (0.8 mm) and Grade II braille.
 - 3. Office Doors: Identify with room names and numbers to be determined later, not those shown on the drawings; in addition, provide "window" section for replaceable occupant name.
 - 4. Classrooms and Break Rooms: Identify with room names and numbers to be determined later, not those shown on the drawings.
 - 5. Other Rooms: Identify with room numbers to be determined later, not the numbers shown on the drawings.
 - 6. Rest Rooms: Identify with pictograms, the names "MEN", "WOMEN", or "RESTROOM", room numbers to be determined later.
- 2.3 SIGN TYPES
 - A. Flat Signs: Tactile signage media without frame.
 - 1. Wall Mounting of One-Sided Signs: Tape adhesive.

2.4 TACTILE SIGNAGE MEDIA

- A. Signage System:
 - 1. The signage shall incorporate a decorative laminate face with applied graphics including all tactile requirements in adherence to TAS specifications.
 - 2. All signs, including room ID's, directionals and directories shall have a matching appearance and constructed utilizing the same manufacturing process to ensure a consistent look throughout.
- B. Materials:
 - 1. Sign face shall be 0.035" (nominal) standard grade, high pressure surface laminate. A painted sign face shall not be acceptable.
 - 2. The sign shall incorporate balanced construction with the core sandwiched between laminates to prevent warping. Laminate on the sign face only shall not be acceptable.
 - 3. Tactile lettering shall be precision machined, raised 1/32", matte PETG and subsurface colored for scratch resistance.
 - 4. Signs shall incorporate a metal accent bar. Bars shall be anodized with a brushed satin finish. Painted bars shall not be acceptable. Refer to drawings.
- C. Standard Colors:
 - 1. Face/background color shall be standard grade, high pressure laminate, all colors and finishes. Refer to drawings.
 - 2. Standard tactile colors shall match manufacturer's ADA standard color selection. Refer to drawings.
- D. Construction:
 - 1. The signage shall, with the exception of directories and directionals, be a uniform $8 \frac{1}{2}$ " width to facilitate inserts printed on standard width paper.
 - 2. Insert components shall have a .080 thickness non-glare acrylic window and shall be inlaid flush to sign face for a smooth, seamless appearance.
 - 3. The signage shall include modules allowing for inserts, notice holders, occupancy sliders, marker, magnetic, and cork boards. All modules shall be flush to sign face for a smooth, seamless appearance.
 - 4. The laminates (front and back) shall be pressure laminated and precision machined together to a 90-degree angle. Edges shall be smooth, void of chips, burrs, sharp edges and marks.
 - 5. The signage shall utilize an acrylic sphere for Grade II Braille inserted directly into a scratch resistant, high pressure laminate sign face. Braille dots are to be pressure fit in high tolerance drilled holes.
 - 6. Braille dots shall be half hemispherical domed and protruding a minimum 0.025".
 - 7. The signage shall utilize a pressure activated adhesive. The adhesive shall be nonhazardous and shall allow for flexing and deflection of the adhered components due to changes in temperature and moisture without bond failure.
 - 8. All signs shall be provided with appropriate mounting hardware. Hardware shall be finished and architectural in appearance and suitable for the mounting surface.
 - 9. Some signs may be installed on glass. A blank backer is required to be placed on the opposite side of the glass to cover tape and adhesive. The backer shall match the sign in size and shape.
- E. Printed Inserts:
 - 1. The signage shall be capable of accepting paper or acetate inserts to allow changing and updating as required. Insert components shall have a 0.080" thickness non-glare acrylic window and shall be inlayed flush to sign face for a smooth, seamless appearance.
 - 2. The signage contractor shall provide and install all signage inserts.
 - 3. Manufacturer shall provide a template containing layout, font, color, artwork and trim lines to allow Owner to produce inserts on laser or ink jet printer. The template shall be in an Acrobat or Word format (.pdf).

2.5 ACCESSORIES

A. Concealed Screws: Stainless steel, galvanized steel, chrome plated, or other non-corroding metal.

B. Tape Adhesive: Double sided tape, permanent adhesive. **END OF SECTION**

SECTION 10 2113.19 PLASTIC TOILET COMPARTMENTS

PART 1 GENERAL

- 1.1 SECTION INCLUDES
 - A. Solid plastic toilet compartments.
 - 1. High density polyethylene (HDPE) material
 - B. Urinal screens.
- 1.2 RELATED REQUIREMENTS
 - A. Section 06 1000 Rough Carpentry: Blocking and supports.
 - B. Section 10 2800 Toilet, Bath, and Laundry Accessories.
- 1.3 REFERENCE STANDARDS
 - A. ASTM A666 Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.
 - B. NFPA 286 Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth; 2015.
 - C. TAS Texas Accessibility Standards: Required compliance for handicapped accessibility in Texas.
- 1.4 ADMINISTRATIVE REQUIREMENTS
 - A. Coordination: Coordinate the work with placement of support framing and anchors in walls.
- 1.5 SUBMITTALS
 - A. See Section 01 3000 ADMINISTRATIVE REQUIREMENTS, for submittal procedures.
 - B. Product Data: Provide data on panel construction, hardware, and accessories.
 - C. Shop Drawings: Indicate partition plan, elevation views, dimensions, details of wall supports, door swings.
 - D. Product Data: Provide data on panel construction, hardware, and accessories.
 - 1. Provide fire hazard classification test data showing compliance with IBC Section 803.1.2.1 per NFPA 286.
 - E. Samples: Submit two samples of partition panels, 4 by 4 inch (100 by 100 mm) in size illustrating panel finish, color, and sheen.
 - F. Manufacturer's Installation Instructions: Indicate special procedures.

PART 2 PRODUCTS

- 2.1 MANUFACTURERS
 - A. Solid Plastic HPDE Toilet Compartments:
 - 1. Global Partitions, an ASI Group company, Eastanollee, GA 30538; Product Solid Plastic HDPE: www.globalpartitions.com.
 - 2. Scranton Products (Santana/Comtec/Capital); Hiney Hiders Solid Plastic HPDE: www.scrantonproducts.com.
 - 3. Substitutions: Section 01 6000 Product Requirements.

2.2 SOLID PLASTIC TOILET COMPARTMENTS

- A. Toilet Compartments: Factory fabricated doors, pilasters, and divider panels made of solid molded high density polyethylene (HDPE), tested in accordance with NFPA 286, floor-mounted headrail-braced.
 - 1. Color: Single color as selected.
- B. Performance/ Design Criteria:
 - 1. Fire hazard classification:
 - a. Compliance with IBC Section 803.1.2.1 per NFPA 286. Classification in accordance with only ASTM E84 or UL 723 is not an acceptable alternative.
- C. Doors:
 - 1. Thickness: 1 inch (25 mm).
 - 2. Width: 24 inch (610 mm).

- 3. Width for Handicapped Use: 36 inch (915 mm), out-swinging.
- 4. Height: 55 inch (1397 mm).
- D. Panels:
 - 1. Thickness: 1 inch (25 mm).
 - 2. Height: 55 inch (1397 mm).
- E. Pilasters:
 - 1. Thickness: 1 inch (25 mm).
 - 2. Width: As required to fit space; minimum 3 inch (76 mm).
- F. Screens: Without doors; to match compartments; mounted to wall with two panel brackets.
- 2.3 ACCESSORIES
 - A. Pilaster Shoes: Formed ASTM A666, Type 304 stainless steel with No. 4 finish, 3 in (75 mm) high, concealing floor fastenings.
 - B. Head Rails: Hollow anodized aluminum, 1 inch by 1-1/2 inch (25 mm by 38 mm) size, with anti-grip profile and cast socket wall brackets.
 - C. Pilaster Brackets: Satin stainless steel.
 - D. Wall Brackets: Continuous type, satin stainless steel.
 - E. Attachments, Screws, and Bolts: Stainless steel, tamper proof type.
 - F. Hardware: Satin stainless steel:
 - 1. Pivot hinges, gravity type, adjustable for door close positioning; two per door.
 - 2. Door Latch: Slide type with exterior emergency access feature.
 - 3. Door strike and keeper with rubber bumper; mounted on pilaster in alignment with door latch.
 - 4. Coat hook with rubber bumper; one per compartment, mounted on door.
 - 5. Provide door pull for outswinging doors.

PART 3 EXECUTION

- 3.1 EXAMINATION
 - A. Verify that field measurements are as indicated.
 - B. Verify correct spacing of and between plumbing fixtures.
 - C. Verify correct location of built-in framing, anchorage, and bracing.
- 3.2 INSTALLATION
 - A. Install partitions secure, rigid, plumb, and level in accordance with manufacturer's instructions.
 - B. Maintain 3/8 inch to 1/2 inch (9 mm to 13 mm) space between wall and panels and between wall and end pilasters.
 - C. Attach panel brackets securely to walls using anchor devices.
 - D. Attach panels and pilasters to brackets. Locate head rail joints at pilaster center lines.

3.3 TOLERANCES

- A. Maximum Variation From True Position: 1/4 inch (6 mm).
- B. Maximum Variation From Plumb: 1/8 inch (3 mm).
- 3.4 ADJUSTING
 - A. Adjust and align hardware to uniform clearance at vertical edge of doors, not exceeding 3/16 inch (5 mm).
 - B. Adjust hinges to position doors in partial opening position when unlatched. Return out-swinging doors to closed position.
 - C. Adjust adjacent components for consistency of line or plane.

END OF SECTION

SECTION 10 2800 TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 GENERAL

- 1.1 SECTION INCLUDES
 - A. Commercial toilet accessories.
 - B. Electric hand/hair dryers.
 - C. Utility room accessories.

1.2 RELATED REQUIREMENTS

- 1.3 REFERENCE STANDARDS
 - A. ADA Standards Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
 - B. ASTM A666 Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.
 - C. ASTM C1036 Standard Specification for Flat Glass; 2011.
 - D. ASTM C1503 Standard Specification for Silvered Flat Glass Mirror; 2008 (Reapproved 2013).
 - E. TAS 2012 Texas Accessibility Standards (TAS); 2012.
- 1.4 ADMINISTRATIVE REQUIREMENTS
 - A. Coordinate the work with the placement of internal wall reinforcement and reinforcement of toilet partitions to receive anchor attachments.
- 1.5 SUBMITTALS
 - A. See Section 01 3000 ADMINISTRATIVE REQUIREMENTS, for submittal procedures.
 - B. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.
 - C. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention.

PART 2 PRODUCTS

- 2.1 MANUFACTURERS
 - A. Commercial Toilet, Shower, and Bath Accessories:
 - 1. Bobrick Washroom Equipment, Inc.: www.bobrick.com.
 - 2. Substitutions: Section 01 6000 Product Requirements.
 - B. Electric Hand/Hair Dryers:
 - 1. Dyson: www.dyson.com.
 - 2. Substitutions: Section 01 6000 Product Requirements.
- 2.2 MATERIALS
 - A. Accessories General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.
 1. Grind welded joints smooth.
 - B. Stainless Steel Sheet: ASTM A666, Type 304.
 - C. Mirror Glass: Annealed float glass, ASTM C1036 Type I, Class 1, Quality Q2, with silvering, protective and physical characteristics complying with ASTM C1503.
 - D. Fasteners, Screws, and Bolts: Hot dip galvanized; tamper-proof; security type.
- 2.3 FINISHES
 - A. Stainless Steel: Satin finish, unless otherwise noted.
- 2.4 Commercial Toilet Accessories
 - A. TA-1 Toilet Tissue Dispenser: Satin-finish stainless steel unit with stainless steel dispensing mechanism. Door has flat face with protruding tumbler lock. Holds two rolls up to 5 1⁄4" (135mm) diameter (1800 sheets). Extra roll automatically drops in place when bottom roll is depleted. Theft-resistant, heavy-duty spindles. Unit 6 1⁄16" W, 11" H, 5 15⁄16" D (155 x 280 x 150mm).

- B. TA-6A Grab Bar, 36 inches: 36" (915mm) long, 1-1/2" (38mm) diam. tubing. Constructed of 18-gauge (1.2mm), type 304 satin-finish stainless steel tubing. Concealed mounting flange 1/8" (3mm) thick, type 304 stainless steel plate, 2" W x 3 1/8" H (50 x 80mm), with screw holes for concealed anchors. Cover is 22-gauge (0.8mm), type 304 stainless steel with satin finish, 3 1/4" (85mm) diameter. Cover snaps over mounting flange to conceal screws.
 1. Push/Pull Point Load: 250 pound-force (1112 N), minimum.
- C. TA-6B Grab Bar, 42 inches: 42" (1065mm) long, 1-1/2" (38mm) diam. tubing. Constructed of 18-gauge (1.2mm), type 304 satin-finish stainless steel tubing. Concealed mounting flange 1/8" (3mm) thick, type 304 stainless steel plate, 2" W x 3 1/8" H (50 x 80mm), with screw holes for concealed anchors. Cover is 22-gauge (0.8mm), type 304 stainless steel with satin finish, 3 1/4" (85mm) diammeter. Cover snaps over mounting flange to conceal screws.
 1. Push/Pull Point Load: 250 pound-force (1112 N), minimum.
- D. TA-7- Liquid Soap Dispenser: Vertical tank is satin-finish stainless steel. Valve dispenses all-purpose hand soaps. Capacity: 40 □ fl oz (1.2 □ L). Soap refill window. Concealed wall fastening. Hinged filler-top requires special key to open. Vandalresistant. Unit 4 3⁄4" W, 8 1⁄8" H (120 x 205mm); wall to push-button, 3 1⁄2" (90mm).
- E. TA-8 Mirror, 18" x 36": 18" W x 36" H (457 x 910 mm). One-piece, roll-formed 3/4" x 3/4" (19 x 19mm) angle-frame. Type 304 stainless steel angle with satin finish. Corners heliarc welded, ground and polished smooth. Beveled frame edge at mirror for improved appearance. No. 1 quality, 1/4" (6mm) glass mirror; warranted against silver spoilage for 15 years. Galvanized steel back. Secured to concealed wall hanger with theft-resistant mounting.

2.5 Electric Hand/Hair Dryers

- A. **TA-3** Electric Hand Dryers: Basis of Design: Dyson Airblade V Electric Hand Dryer Model AB12.
 - 1. Mounting: Surface mounted on ABS/PBT plastic backplate/mounting bracket; protrudes four inches from wall, no recessing required; ADA compliant.
 - 2. Construction: Polycarbonate casing with anti-microbial additive in paint. Anti-microbially integrated external plastics and seals. Anti-tamper M4 exterior pin-hex screws. Water ingress protection to IP24.
 - 3. Color Finish: Sprayed nickel finish.
 - 4. Filtration: 99.97 percent particulate efficiency HEPA filter with anti-microbial coating.
 - 5. Operation: Touch-free infra-red activation.
 - a. Hand dry time: 12 seconds
 - b. Airspeed at nozzle: 420 mph
 - c. Operating Airflow: Up to 28 l/s.
 - d. Rated Operating Noise Power: 84 db(A)
 - 6. Motor: Dyson Digital Motor (DDM), V4 switched reluctance brushless DC type; 92,000 rpm motor speed; less than 0.5 watt standby power consumption.
 - 7. Electrical Requirements: 110-120 V AC, 12 A, 1400 W.
 - 8. Operating Temperature Range: 0 40 degrees C.
 - 9. Standby Power Consumption: Less than 0.5 W.
- 2.6 Utility Room Accessories
 - A. TA-9 Mop Holder and Shelf: Shelf is 18□gauge (1.2mm), type 304 stainless steel, satin finish; 36" Long, 6" H, 8" D (915 x 150 x 205mm). Four anti-slip mop holders have spring-loaded rubber cam that grips handles 7⁄8" to 1 1⁄4" (20–30mm) diameter. Holds mops 8" (205mm) from wall. Three stainless steel rag hooks. Rod for wet rags below shelf.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify exact location of accessories for installation.
- C. For electrically-operated accessories, verify that electrical power connections are ready and in the correct locations.
- D. Verify that field measurements are as indicated on drawings.

E. See Section 06 1000 for installation of blocking, reinforcing plates, and concealed anchors in walls.

3.2 PREPARATION

- A. Deliver inserts and rough-in frames to site for timely installation.
- B. Provide templates and rough-in measurements as required.

3.3 INSTALLATION

- A. Install accessories in accordance with manufacturers' instructions in locations indicated on the drawings.
- B. Install plumb and level, securely and rigidly anchored to substrate.
- C. Mounting Heights: As required by TAS (accessibility regulations), unless otherwise indicated.

3.4 PROTECTION

A. Protect installed accessories from damage due to subsequent construction operations.

END OF SECTION

TOILET, BATH, AND LAUNDRY ACCESSORIES

SECTION 22 0006 PLUMBING DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Demolition and removal of selected portions of building or structure.
 - 2. Demolition and removal of selected site elements.
 - 3. Salvage of existing items to be reused or recycled.

1.2 DEFINITIONS

- A. Remove or Demolish: Detach items from existing construction and legally dispose of them off-site, unless indicated to be removed and salvaged or removed and reinstalled.
- B. Remove and Salvage: Detach items from existing construction and deliver them to Owner cleaned, packaged, and ready for reuse.
- C. Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.
- D. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.3 MATERIALS OWNERSHIP

- A. 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 representative, who will establish special procedures for removal and salvage.

1.4 SUBMITTALS

- A. 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.
 - 2. Interruption of utility services. Indicate how long utility services will be interrupted.
 - 3. Coordination for shutoff, capping, and continuation of utility services (including but not limited to: Gas, Water, Fire Suppression, Chilled Water, Hot Water, Air Conditioning, etc).
 - 4. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.
 - 5. Means of protection for items to remain and items in path of waste removal from building.
- B. Inventory: After selective demolition is complete, submit a list of items that have been salvaged.

1.5 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Standards: Comply with ANSI A10.6 and NFPA 241.
- C. Pre-demolition Conference: Conduct conference at Project site to comply with requirements in Section "Project Management and Coordination." Review methods and procedures related to selective demolition including, but not limited to, the following:
 - 1. Inspect and discuss condition of construction to be selectively demolished.
 - 2. Review structural load limitations of existing structure.
 - 3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
 - 4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
 - 5. Review areas where existing construction is to remain and requires protection.

1.6 PROJECT CONDITIONS

- A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.
- B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
- C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- D. Hazardous Materials: It is unknown whether hazardous materials will be encountered in the Work.
 - 1. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Owner will remove hazardous materials under a separate contract.
- E. Storage or sale of removed items or materials on-site is not permitted.
- F. 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.

1.7 WARRANTY

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped.
- B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
- C. Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.
- D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Services/Systems: Maintain services/systems indicated to remain and protect them against damage during selective demolition operations.
- B. Service/System Requirements: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.
 - 1. Arrange to shut off indicated utilities with utility companies.
 - 2. If services/systems are required to be removed, relocated, or abandoned, before proceeding with selective demolition provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
 - 3. Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing.
 - a. Where entire wall is to be removed, existing services/systems may be removed with removal of the wall.

3.3 PREPARATION

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

3.4 SELECTIVE DEMOLITION, GENERAL

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
 - 1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
 - 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 firesuppression devices during flame-cutting operations.
 - 3. Maintain adequate ventilation when using cutting torches.
 - 4. Dispose of demolished items and materials promptly.
 - Removed and Salvaged Items:
 - 1. Clean salvaged items.
 - 2. Pack or crate items after cleaning. Identify contents of containers.
 - 3. Store items in a secure area until delivery to Owner.
 - 4. Transport items to Owner's storage area designated by Owner.

- 5. Protect items from damage during transport and storage.
- C. Removed and Reinstalled Items:
 - 1. Clean and repair items to functional condition adequate for intended reuse. Paint equipment to match new equipment.
 - 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.
- D. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.
- E. Contractor shall terminate demolished pipe and/or ductwork. System shall be capped and insulated per new work specification.
- F. Contractor shall remove any abandoned piping and/or ductwork in area of construction during the demolition process.
- G. Unforeseen Conditions
 - 1. Any unforeseen utilities found during construction that directly affect any trade must be brought to the engineer's attention via RFI.
 - 2. All existing conditions must be clearly annotated on the As-Built drawings.
- H. Repair any walls, floors or roofs that piping, ducts or equipment have been removed from (or through). Patch with similar materials to match finish and color (paint to match). If paint cannot be matched, repaint entire wall or surface.

3.5 DISPOSAL OF DEMOLISHED MATERIALS

- A. General: Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.
 - 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.
- B. Burning: Do not burn demolished materials.
- C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

END OF SECTION

SECTION 22 0100 SPECIAL CONDITIONS FOR ALL PLUMBING WORK

PART 1- GENERAL

1.1 DESCRIPTION OF WORK

- A. This section covers the general provisions of the plumbing specifications applicable to the following systems:
 - 1. Plumbing.
- B. The use of the word plumbing in the body of the various specifications sections shall be interpreted to include all the aspects of all of the systems referenced in the Plumbing Specifications.

1.2 DRAWINGS

- A. These specifications are accompanied by drawings of the building and details of the installations showing the locations of equipment, piping, etc. The drawings and these specifications are complementary to each other; requirements described in one or the other shall be considered binding as if described in both.
- B. If any departures from the drawings are deemed necessary by the Contractor, details of such departures and the reasons therefore shall be submitted to the Owner's Representative for approval. No departures shall be made without prior written approval by the Owner's Representative.
- C. There are intricacies of construction which are impractical to specify or indicate in detail; means and methods for performing such work shall adhere to commonly accepted industry standards.
- D. It is the Contractor's responsibility to properly use all information found on the Architectural, Structural, Mechanical, Plumbing and Electrical drawings and applicable shop drawings where such information affects his work.
- E. For new buildings, all final dimensions shall be scaled from the drawings, unless otherwise noted. For work associated with existing buildings (renovations and additions), all final dimensions shall be field verified.

1.3 CONSTRUCTION REQUIREMENTS

- A. The architectural, civil, structural, mechanical, electrical, plumbing, and fire protection drawings, and specifications are all part of the Contract Documents. In many instances there are details described in another trade's drawings that are not necessarily included or referenced in the plumbing drawings. It is the Contractor's responsibility to review in detail all parts of the Contract Documents prior to submitting a bid. Failure to comply with this requirement shall not relieve the Contractor of responsibility or be used as cause for additional compensation because architectural, structural, or electrical details were not included in the plumbing drawings.
- B. It is the intent of the Contract Documents to provide complete and fully functional installation in every respect. Material and/or construction details not specifically described in the Contract Documents, but commonly considered incidental to the industry, are required by the Contractor.
- 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 comply with Codes, to facilitate the work of other trades, to conform to the details

of the installation supplied by the manufacturer of the equipment to be installed, and thereby to provide an integrated satisfactory operating installation.

- D. The plumbing, electrical and mechanical drawings are schematic in nature and do not show every connection in detail or every pipe or conduit in its exact location. These details are subject to the requirements of ordinances and structural and architectural conditions.
- E. 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 laid out so that it will be concealed in furred chases and above suspended ceilings, etc. in finished portions of the building, unless specifically noted to be exposed. Work shall be installed to avoid compromising structural members; therefore, inserts to accommodate hangers shall be set before concrete is poured, and proper openings through floor, walls, beams, etc. shall be provided as hereinafter specified or as otherwise indicated or required. All work shall be installed parallel or perpendicular to building lines unless otherwise noted.
- F. When the plumbing drawings do not give exact details as to the elevation of pipe or equipment, physically arrange the systems to fit in the space available at the elevations intended with the proper grades for the functioning of the system involved. Piping and exposed conduit, are generally intended to be installed true and square to the building construction, and located as high as possible against the structure in a neat and workmanlike manner. The plans do not show all required offsets, control lines, pilot lines, and other location details. Work shall be concealed in all finished areas. Piping specified to be insulated shall be supported in a manner that will allow the insulation to be installed without gaps. Insulated piping in concealed areas shall be offset with fittings as necessary to permit installation of insulation. Bending of pipes or installing pipes in a strain to insulate will not be permitted.
- G. Final placement of serviceable equipment shall be carefully coordinated with all other trades to ensure sufficient clearance for maintenance according to manufacturer's recommendations. Lubricating orifices and adjustable components shall be easily accessible. Piping, conduit, valve stems, cabling and other building systems shall not interfere with service space.
- H. Location of Exposed Devices
 - 1. All exposed devices (sprinkler heads, plumbing rough-ins, lights, outlets, communication devices, etcetera) shall be referenced to fixed data points that are coordinated with all trades; shall be located to present symmetrical arrangements with respect to the fixed data point; and shall facilitate the proper arrangements of acoustical ceiling tiles. Fixed data points shall include such features as wall and ceiling lines, soffits, balanced border widths, masonry joints, etc. Devices located in acoustical ceiling tiles shall occur symmetrically in tile joints or in the centers of whole tiles. The final determination of the exact location of each outlet and the arrangements to be followed shall be acceptable to the Owner's Representative.
 - 2. The drawings schematically indicate locations of the exposed devices. Final locations shall be determined by carefully coordinating the drawings pertaining to each trade. Where conflicts are identified, Owner's Representative shall determine final location. The Owner reserves the right to make any reasonable change in location of any device before installation, without additional cost to the Owner or the Architect.

1.4 QUALIFICATIONS

- A. Contractor must have minimum of five years experience installing commercial, plumbing and piping systems similar to those described in these Contract Documents.
- B. Contractor must be licensed and hold a current contracting license that has been valid for a minimum of five years in the State of Texas.

C. Contractor must be able to bond work for payment and performance of work being bid. Contractor's bonding agency shall have a Best's insurance rating of A or A+.

1.5 MATERIAL AND EQUIPMENT REQUIREMENTS

- A. Manufacturer's Instructions: The manufacturer's published instructions shall be followed for preparing, assembling, installing, erecting, and cleaning manufacturer materials or equipment, unless otherwise indicated. The Contractor shall promptly notify the Owner's Representative in writing of any conflict between the requirements of the Contract Documents and the manufacturer's direction and shall obtain the clarification of the Owner's Representative before proceeding with the work. Should the Contractor perform any such work that does not comply with the manufacturer's directions or such clarification by the Owner's Representative, he shall bear all costs arising in connection with the correction of the deficiencies.
- B. Storage at Site: The Contractor shall not receive material or equipment at the jobsite until there is suitable space provided to properly protect equipment from rust, drip, humidity, and dust damage and from surrounding work.
- C. Capacities shall be not less than those indicated and shall be such that no component or system becomes inoperative or is damaged because of startup or other overload conditions.
- D. Conformance to 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, the Contractor shall submit proof that the items furnished under this section of the specifications conform to such requirements. The label of 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.
- E. Nameplates: Each major component of equipment shall have the manufacturer's name, address, and model-identification number on a plate securely attached to the item of equipment. All data on nameplates shall be legible at the time of Final Inspection.
- 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. 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 inch 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 coatings 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.
- G. Protection from Moving Parts: Belts, pulleys, chains, gears, couplings, projecting setscrews, keys, and other rotating parts located so that any person can come in close proximity thereto, shall be fully enclosed or properly guarded.
- H. Drive Guards: For machinery and equipment, provide guards as shown in AMCA 410 for belts, chains, couplings, pulleys, sheaves, shafts, gears, and other moving parts regardless of height above the floor. Drive guards may be excluded where motors and drives are inside factory-fabricated air handling units casings. Guards shall be constructed of sheet steel, cast iron, expanded metal, or wire mesh rigidly secured so as to be removable without disassembling pipe duct or electrical connection to equipment. Provide a 1-inch diameter hole in each drive guard at each shaft center to allow access for speed measurement.

- I. Verifications 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 thoroughly familiarize himself with all details of the work and working conditions, to verify all dimensions in the field, and to advise the Owner's Representative 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, Architect, or Engineer.
- J. Standard Products: Materials and equipment to be provided shall be the standard catalog products of manufacturers regularly engaged in the manufacture of products conforming to these specifications, and shall essentially duplicate materials and equipment that have been in satisfactory use at least two years.
- K. Spare Parts Data: As soon as practicable after approval of materials and equipment and, if possible, not later than four months prior to the date of beneficial occupancy, the Contractor shall furnish spare parts data for each different item of equipment listed. The data shall include a complete list of parts and supplies with current unit prices and sources of supply, a list of parts and supplies that are either normally furnished at no extra cost with the purchase of the equipment or specified hereinafter to be furnished as part of the Contract, and a list of additional items recommended by the manufacturer to assure efficient operation for a period of 120 days at the particular installation. The foregoing shall not relieve the Contractor of any responsibilities under the warranty specified.

1.6 INSPECTION OF THE SITE

A. The Contractor shall visit the site, verifying all existing items indicated on drawings and/or specified, and familiarize himself with the existing work conditions, hazards, grades, actual formations, soil conditions, structures, utilities, equipment, systems, facilities, and local requirements. The submission of bids shall be deemed evidence of such visits. All proposals shall take these existing conditions into consideration, and the lack of specific information shall not relieve the Contractor of any responsibility.

1.7 UTILITY LOCATIONS AND ELEVATIONS

A. Locations and elevations of the various utilities included within the scope of this work have been obtained from substantially reliable sources and are offered separately from the Contract Documents, as a general guide only, without guarantee as to accuracy. Examine the site, the locations, and availability of all utilities and services required for their relation to the work. Verify the location of all existing site utilities with each responsible utility company or applicable party. The Contractor shall repair all damage to existing utilities, whether indicated on the drawings or not, at his sole expense.

1.8 PERMITS, UTILITY CONNECTIONS, AND INSPECTIONS

- A. Permitting Fees: Contractor shall pay for all fees associated with permits required by municipal authorities having jurisdiction.
- B. Tapping and Impact Fees: Contractor shall pay for all fees associated with tapping into municipal utility mains, including sanitary sewer, natural gas and domestic water. Impact fees will be paid for by the Owner.
- C. Compliance: The Contractor shall comply in every respect with all requirements of local authorities having jurisdiction, including building inspections, fire marshal, local ordinances and codes, 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 a higher quality than the requirements of the above-specified authorities. Where requirements of the specifications and drawings are below the requirements of the above offices having

jurisdiction, the Contractor shall make installations in compliance with the requirements of the above authorities.

- D. Utilities: The Contractor shall coordinate with the various utility companies involved in this project and shall provide required utility relocations, extensions, modifications, and/or changes (complete in all respects) as described in the Contract Documents. Contractor shall verify the location of all existing utilities with the applicable Utility Company. The Contractor shall be responsible for all damages to existing utilities, whether indicated on drawings or not, and repair all damage to existing utilities as acceptable to the affected Utility Company.
- E. Certification: Prior to final acceptance, the Contractor shall furnish a certificate of acceptance from the inspection departments having jurisdiction over the work for any and all work installed under this Contract. Any additional labor costs incurred as a result of a substitution shall be the Contractor's responsibility.

1.9 EXISTING FACILITIES

- A. The Contractor shall be responsible for loss or damage to the existing facilities caused by him and his workmen, 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 performed 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 same 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. This is to include but is not limited to temperature controls system devices, electrical switches, relays, fixtures, piping, conduit, etc.
- 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.

1.10 DEMOLITION AND RELOCATION

A. The Contractor shall modify, remove, and/or relocate all materials and items so indicated on the drawings or required by the installation of new facilities. All removals and/or dismantling shall be conducted in a manner as to produce maximum salvage. Salvage materials shall remain the property of the Owner, and shall be delivered to such destination or otherwise disposed of as directed by the Owner. Materials and/or items scheduled for relocation and which are damaged during dismantling or reassembly operations shall be repaired and restored to good operative condition. The Contractor may, at his discretion, and upon the approval of the Owner, substitute

new materials and/or items of like design and quality in lieu of materials and/or items to be relocated.

- B. All items which are to be relocated shall be carefully removed in reverse to original assembly or placement and protected until relocated. The Contractor shall clean and repair and provide all new materials, fittings, and appurtenances required to complete the relocations and to restore to good operative order. All relocations shall be performed by workmen skilled in the work and in accordance with standard practice of the trades involved.
- C. When items scheduled for relocation and/or reuse are found to be in damaged condition before work has been started on dismantling, the Contractor shall call the attention of the Owner to such items and receive further instructions before removal. Items damaged in repositioning operations are the Contractor's responsibility and shall be repaired or replaced by the Contractor as approved by the Owner, at no additional cost to the Owner.
- D. Service lines and wiring to items to be removed, salvaged, or relocated shall be removed to points indicated on the drawings, specified, or acceptable to the Owner. Service lines and wiring not scheduled for reuse shall be removed to the points at which reuse is to be continued or service is to remain. Such services shall be sealed, capped, or otherwise tied off or disconnected in a safe manner acceptable to the Owner. All disconnections or connections into the existing facilities shall be done in such a manner as to result in minimum interruption of services to adjacent occupied areas. Services to existing areas or facilities which must remain in operation during the construction period shall not be interrupted without prior specific approval of the Owner as hereinbefore specified.

1.11 SUBSTITUTION OF MATERIALS AND EQUIPMENT

A. No substitution of materials or equipment herein specified or called for on the drawings will be permitted, except by written permission of the Owner's Representative. Where several makes of equipment or material are mentioned, any item named may be bid upon provided it meets space, capacity specifications, and other requirements.

1.12 SUBMITTALS

- A. Submittals for Review:
 - 1. As soon as practical or within 30 days after the date of contract award or notice to proceed, and before purchasing or starting installation of any materials or equipment, the Contractor shall submit for review sufficient material and equipment data to indicate that all requirements of the specifications have been met and samples shall be furnished when requested. All manufacturer's data used as part of the submittal shall have all non-applicable features crossed out or deleted in a manner that will clearly indicate exactly what is to be furnished.
 - 2. Four (4) copies of the submittal list and detailed submittals (for the Owner's and A/E's use) shall be submitted to the Owner's Representative. The Contractor is requested to include a minimum of three (3) additional copies for insertion in the project's Owner's Manuals at the completion of the project, and the number of additional copies the Contractor requires for his and his subcontractor's use during the project's construction. The detailed submittals shall be accompanied by the same number of sets of pictorial and descriptive data derived from the manufacturer's catalogs and sales literature, or incorporated in the shop drawings. The Contractor may provide a detailed submittal on any item even though not required by the Owner's Representative.
- B. Format
 - Submittals shall be bound in a BLACK hardback three-ring binder with clear-view sleeves on the spine and front. Binders larger than 3-inches shall be divided into two volumes. The front sleeve shall have a cover sheet inserted with the title "PLUMBING SUBMITTALS" centered in large print. Below the title shall be printed the name of the project, the date, the

project location, the name and address of the contractor, the name and address of the subcontractor and the name and address of the engineer(s) in smaller print.

- 2. Provide a Table of Contents at the beginning of the binder that summarizes the information being submitted according to specification section.
- 3. Submittals shall be tab divided by specification section; **all sections** identified in the project specifications shall have a tab. When no information is being provided concerning a particular specification section, insert a single dated sheet that explains the circumstances.
- 4. Loose-leaf or piecemeal submittals are not acceptable and subject to rejection unless prior approval has been granted by the Engineer.
- 5. Email/Digital Submittals are not acceptable and subject to rejection unless prior approval has been granted by the Engineer.

C. Content:

- 1. The Contractor shall prepare or cause to be prepared shop drawings, product data, materials and equipment lists, diagrams, data, samples, and other submittals as required by the contract documents, hereinafter referred to as "Submittal Data." The Contractor shall review and approve all submittal data for compliance with the contract documents, manufacturer's recommendations, adequacy, clearances, code compliance, safety, and coordination with associated work.
- 2. The Contractor shall submit approved submittal data to the Owner's Representative for review and comment as to general conformance with the design concept and general compliance with information given in the contract documents. Owner's Representative's review shall not include review of quantities, dimensions, weights or gauges, fabrication processes, construction methods, coordination with other trades or work, or construction safety and precautions, all of which are the sole responsibility of the Contractor.
- 3. The Contractor shall clearly and specifically identify and call to the attention of the Owner's Representative any deviation from the contract documents for which Owner acceptance is desired. The responsibility for such a deviation accepted by the Owner shall remain with the Contractor.
- 4. Timeliness: The burden of timeliness in the complete cycle of submittal data is on the Contractor. The Contractor shall allow a minimum of two (2) weeks' time frame for review of each submission by the Owner's Representative. The Contractor is responsible for allowing sufficient time in the construction schedule to cover the aforementioned cycles of data processing, including time for all re-submission cycles on nonconforming 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 justify any request for scheduled construction time extensions or extra compensation.
- 5. Work performed in accordance with approved submittal date that is not in accordance with the Contract Documents and did not have the specific acceptance of the Owner's Representative shall be replaced at Contractor's cost.
- D. Re-submittals
 - Re-submit entire submittal in accordance with afore mentioned format and content requirements. Loose-leaf or piecemeal re-submittals are not acceptable. New and/or revised data for each section shall be prefaced with a colored (yellow, pink, orange, etc) cover sheet that identifies (in a word or two) the materials and/or equipment being resubmitted. Typeset the words "REVISED SUBMITTAL NO. 1 (or 2, 3 as applicable)" centered at the bottom of the cover sheet.
 - 2. Subsequent re-submittals (second and third, if necessary) shall have different colored cover sheets to distinguish between the various re-submittals.
 - Include a cover letter at front of binder that specifically responds to each "REVISE AND RE-SUBMIT COMMENT" or "REJECTED" comment by number. Example responses would include the following:
 - a. RESPONSE: "Please see attached re-submittal."
 - b. RESPONSE: "Will be re-submitted at a latter date."
 - c. RESPONSE: "Requirement for (xxxxxx) was deleted in Addendum No. 2."

- d. RESPONSE: "Exception requested based on Section xx, Paragraph x.x.x.
- E. These paragraphs related to Plumbing submittal data supersede any conflicting requirements contained in Division 01 sections.

1.13 CONTRACTOR CERTIFICATION OF SUBMITTAL DATA

A. The Contractor shall provide the following notarized certificate with all submittal data furnished to the Owner's Representative for review and comment.

Project Title:

Description of Submittal Data:

This is to certify that the above-described submittal data has been reviewed and is approved for compliance with the Contract Documents, manufacturer's recommendation, adequacy, clearances, code compliance, safety, and coordination with other trades and/or work except as follows: (list "none" or itemize and explain). In addition, the Contractor shall submit to the Owner's Representative 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 and are asbestos free."

Name and Company

Notary

1.14 ACCEPTANCE OF MATERIALS AND EQUIPMENT

- A. All equipment installed on this project shall have **local (within 125 miles)** representation, local factory-authorized service, and a local stock of repair parts. This requirement is essential and will be strictly reviewed by the Owner's Representative prior to concurrence with the Contractor's approval for all submittals covered by Plumbing Division of this Specification.
- B. NOTICE: The Contractor is responsible for providing materials and equipment that conform to the requirements of the project manual in every respect unless a deviation has been "accepted" in writing. Removal of any nonconforming materials and equipment and the replacement with conforming materials and equipment shall be at the Contractor's sole expense, regardless of when nonconformance was discovered.
- C. Approval of materials and equipment shall be based on manufacturer's published data and shall be tentatively subject to the submission of complete shop drawings which comply with the contract documents. Approval is also dependent upon the existence of adequate and acceptable clearances for entry, servicing, and maintenance.
- D. Approval of materials and equipment under this provision shall not be construed as authorizing any deviations from the specifications, unless the attention of the Owner's Representative has been directed in writing to the specific deviations. Data submitted shall not contain unrelated information unless all pertinent information is properly identified.
E. Physical Size of Equipment: Space is critical; therefore, equipment of larger sizes than shown, even though of approved manufacturer, will not be acceptable unless it can be demonstrated that ample space exists for proper installation, operation, and maintenance.

1.15 SITE OBSERVATION

A. Site observation by the Architect, Engineer, and/or Owner's Representative 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.

1.16 SUPERVISION

- A. In addition to the Superintendent required under the conditions of the contract, each subcontractor shall keep a competent superintendent or foreman on the job at all times.
- B. It shall be the responsibility of each superintendent to study all plans 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 jobsite by the superintendents involved. Where interferences cannot be resolved without major changes to the plans, the matter shall be referred to the Owner's Representative for comments.

1.17 OPERATION PRIOR TO COMPLETION

- A. When any piece of 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 written permission of the Owner's Representative to do so. The warranty period shall not commence, however, 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 filter media, properly adjust, and complete all deficiency list items before final acceptance by the Owner. The date of acceptance and the start of the warranty may not be the same date.

1.18 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 Owner's Representative, in writing, of any conflict between the requirements of the contract documents and the manufacturer's directions, and shall obtain the Owner's Representative's comments before proceeding with the work. Should the Contractor perform any such work that does not comply with the manufacturer's directions or applicable comments from the Owner's Representative, he shall bear all costs arising in connection with the correction of such deficiencies.

1.19 CHECKING AND TESTING MATERIALS AND/OR EQUIPMENT

A. Before final acceptance of the work, 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. 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 Owner's Representative 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 and are asbestos free."

B. Check inspections shall include plumbing, heating, air conditioning, ventilating, mechanical control and electrical equipment, and such other items hereinafter specified or specifically designated by the Owner's Representative.

1.20 OPERATING AND MAINTENANCE INSTRUCTION

- A. The Contractor shall prepare for the owner's manual hereinafter specified complete sets of operating and maintenance instructions, system piping, valving, control and interlock diagrams, manuals, parts lists, etc. for each item of equipment. These are to be assembled as hereinafter specified for owner's manual.
- B. In addition, the Contractor shall provide the service of a competent engineer or a technician acceptable to the Owner's Representative to instruct a representative of the Owner in the complete and detailed operation of all equipment and systems. These instructions shall be provided for a period of sufficient duration to fully accomplish the desired results. Upon completion of these instructions, a letter of release will be required, acknowledged by the Owner, stating the dates of instruction and personnel to whom instructions were given.
- C. Additional diagrams, operating instructions, etc. shall be provided as specified hereinafter in the other sections of these specifications.

1.21 MATERIAL AND EQUIPMENT SCHEDULES

A. Contractor shall refer to both drawings and specification for schedules. Where reference is made to items "scheduled on drawings" or "scheduled in specifications," same shall include schedules contained in both the drawings and the specifications. The Contractor's attention is directed to the various specification sections and drawings for schedules.

1.22 APPLICABLE CODES AND STANDARDS

- A. 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, except as may be hereinafter specifically modified in these specifications and associated drawings.
 - National Fire Protection Association Standards (NFPA): NFPA 10 - Portable Fire Extinguishers NFPA 54 - National Fuel and Gas Code NFPA 70 - National Electrical Code NFPA 90A - Air Conditioning Systems NFPA 101 - Life Safety Code NFPA 255 - Method of Test of Surface Burning Characteristics of Building Materials Local and State Health Code (TDSH)
 - American National Standards Institute (ANSI): 15-78 - Safety Code for Mechanical Refrigeration C.2 - 1984 National Electrical Safety Code A117.1 - Handicapped Code
 - 3. American Society of Mechanical Engineers (ASME): Section IV, V, CSD-1
 - 4. Air Conditioning and Refrigeration Institute Standards (ARI): All standards related to refrigeration and air conditioning equipment and piping furnished under these specifications.
 - 5. American Water Works Association (AWWA): All applicable manuals and standards.
 - 6. Sheet Metal and Air Conditioning Contractors National Associate, Inc, (SMACNA): All applicable manuals and standards.

- 7. Air Moving and Conditioning Association (AMCA): All applicable manuals and standards.
- 8. American Society of Testing Materials (ASTM): All applicable manuals and standards.
- 9. National Electrical Manufacturers' Association (NEMA): All applicable manuals and standards.
- 10. Occupational Safety and Health ACT (OSHA): National Sanitation Foundation - Standard No. 2
- American Society of Heating, Refrigeration, and Air conditioning Engineers (ASHRAE): 90-80 Energy Conservation in New Building Design 2001 ASHRAE Handbook of Fundamentals
- 12. Americans with Disabilities Act, 1990
- 13. American Gas Association (AGA)
- 14. Underwriters Laboratories, Inc. (ÚL)
- 15. Manufacturer's Standardization Society of the Valve and Fitting Industry (MSS)
- 16. Applicable State Building Codes (International Building Codes, as amended):
- 17. Applicable State Mechanical Code (International Mechanical Code, as amended).
- 18. Applicable State Plumbing Code (International Plumbing Code, as amended).
- 19. Applicable State Energy Code (International Energy Conservation Code, as amended).
- B. All materials and workmanship shall comply with all applicable city, state, and national codes, specifications, and industry standards. All materials shall be listed by the Underwriters Laboratories, Inc. as conforming to its standards and so labeled in every case where such a standard has been established for the particular type of material in question.
- C. 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 Owner's Representative 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 1 of these contract documents, providing no work or 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.

1.23 DEFINITIONS

- A. Refer to the condition of the contract for Division 1 for additional requirements regarding definitions.
- B. Where "as required" or "as necessary" 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."
- C. Where "and/or" is used in these specifications or on the drawings, it shall mean "that situations exist where either one or both conditions occur or are required and shall not be interpreted to permit an option on the part of the Contractor.

1.24 FINAL INSPECTION

- A. Refer to Division 1 for additional requirements for final inspection.
- B. It shall be the responsibility of the Contractor to personally conduct a careful inspection, assuring himself that the work on the project is ready for final acceptance and developing his own "punchlists," before calling upon the Owner's Representative to make a final inspection. Failure

of the Contractor to conduct such inspections and provide the Owner's Representative with a copy of his "punchlists" prior to the final inspection shall be adequate cause for the Owner's Representative to cancel any Contractor-requested final inspection.

- C. In order not to delay final acceptance of the work, the Contractor shall conduct his own "final inspections" prior to requesting the Owner's Representative to "final" the project; will have all necessary bonds, guarantees, receipts, affidavits, etc. called for in the various articles of this specification prepared and signed in advance; and together with a letter of transmittal listing each paper included, shall deliver the same to the Owner's Representative at or before the time of said final inspection. The Contractor is cautioned to check over each bond, receipt, etc. before preparing same for submission to see that the terms check with the requirements of the specifications.
- D. The final inspection will be made jointly by the Owner's Representative and the Owner.

1.25 REQUIREMENTS FOR FINAL ACCEPTANCE

- A. Requirements for final acceptance shall include but not be limited to the Contractor accomplishing the following:
 - 1. Construction: Complete all construction.
 - 2. Deficiency Lists: Correct all deficiencies listed at time of Substantial Completion.
 - a. Owner's Manual: Submit at least 30 days prior to final acceptance on (1) copy of the owner's manual for the Owner's Representative's review and comments. Following acceptance, prepare three (3) copies of bound and indexed owner's manual, to be delivered System operating instructions.
 - b. System control drawings.
 - c. System interlock drawings.
 - d. System maintenance instructions.
 - e. Manufacturers', suppliers', and subcontractors' names, addresses, and telephone numbers, both local representatives and manufacturers' service headquarters.
 - f. Equipment operating and maintenance instructions and parts lists.
 - g. Manufacturer's' certifications (see Checking and Testing Materials and/or Equipment, this section).
 - h. Contractor's warranty.
 - i. Acceptance certificates of authorities having jurisdiction.
 - j. Log of all tests made during course of work.
 - k. Owner's acknowledgment of receipt of instruction, enumerating items in owner's manual.
 - I. List of manufacturers' guarantees executed by the Contractor.
 - m. Certified performance curves.
 - n. Balance and performance test reports.
 - o. Owner's acknowledgment of items of equipment or accessories indicated or specified to be turned over to Owner.
 - p. Verbal, as herein specified.
 - q. Posted, framed under glass or plastic laminated:
 - 3. At the time of final acceptance, which shall include but not be limited to the following:
 - 4. Instructions:
 - a. System operating instructions.
 - b. System control drawings.
 - c. System interlock drawings.
 - 5. Record Drawings: Deliver the specified record drawings to the Owner's Representative.

1.26 RECORD DRAWINGS

- A. The Contractor shall maintain a set of contract drawings (black-line prints) at the jobsite on which he shall indicate the installed (as-built) locations of the following:
 - 1. Equipment
 - 2. Main lines of piping and ductwork.

- 3. Dimensional locations (including depth) of all underground piping, valves and conduits.
- B. Drawings shall be used for construction reference and shall not leave the field office of the jobsite.
- C. Drawings shall include all addenda, ASI's, Change Orders, and existing conditions and equipment that are not reflected in the original contract drawings.
- D. Upon completion of work, the Contractor shall obtain CAD files of the contract drawings from the Owner's Representative and transfer the above as-built information into these files. The as-built files shall be permanently marked "RECORD DRAWINGS" and printed on full-size Mylar sheets. Upon completion, the CAD files shall be transferred to CD in AutoCAD 2007 format. Both the CAD files CD and Mylar drawings shall be submitted to the Owner's Representative as part of the Close-out Submittals.
- E. Refer to Division 1 paragraph entitled "Record Documents" for additional requirements.

1.27 ALLOWANCES

A. Refer to Division 1 for allowances.

1.28 ALTERNATE PROPOSALS

A. Alternate proposals are summarized in Division 1 and on the bid proposal form. Refer to all sections of the specifications and the drawings to determine the exact extent and scope of the various alternate proposals as each pertains to the work of the various trades.

1.29 WARRANTY

- A. General: All work performed (including equipment and materials furnished) under the various sections of these specifications shall be 100% warranted, for a period of one (1) year from the date of final acceptance thereof, against defective materials, design, and unauthorized substitution. Upon receipt of note of failure of any part of the guaranteed equipment and/or facilities during the guaranty period, the affected part(s) or facilities shall be replaced promptly with new parts, etc. by and at the expense of the Contractor. Further, the Contractor shall properly obtain, execute, and forward any and all manufacturer's warranties on equipment furnished under the Contract. Refer to Division 1 for additional requirements.
- B. Extended Period: The Contractor shall provide all extended time warranties available from the manufacturer of the equipment provided as standard at no additional cost. This includes all extended warranties where specified with certain equipment as directed in other sections of this Specification.

PART 2 - PRODUCTS

2.1 MATERIALS AND WORKMANSHIP

- A. All materials, unless otherwise specified, shall be 51% manufactured in the United States, new, free from all defects, and of the best quality. Foreign goods specifically approved for use by the Owner's Representative prior to bidding may be furnished.
- B. 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 present a neat, precise appearance.

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C. The responsibility for the furnishing and installation of the proper plumbing equipment and/or material as intended rests entirely upon the Contractor. The Contractor shall request advice and supervisory assistance from the representative of specific manufacturers during the installation.

2.2 FLAME SPREAD AND SMOKE DEVELOPED PROPERTIES OF MATERIALS

A. Duct coverings, duct linings, vapor barrier facings, tapes, adhesives, core materials, insulation, jackets, piping (of any sort), and other materials in concealed locations, including any aboveceiling area, shall have a flame spread rating not over 25 without evidence of continued progressive combustion and a smoke developed rating no higher than 50. Flame spread and smoke developed ratings shall be in accordance with NFPA Standard No. 255.

2.3 BEARINGS

A. All ball bearings shall be of radial and/or thrust type, and enclosed in a dust and moisture-proof housing.

2.4 MOTORS

A. The Contractor shall provide all motors required for equipment supplied under each portion of the work. Motors shall be built in accordance with the latest ANSI, IEE, and NEMA standards, shall be fully coordinated with the equipment served, shall be of sizes and electrical characteristics scheduled.

2.5 STARTING EQUIPMENT

A. Each motor shall be provided with proper starting equipment. This equipment, unless hereinafter specified or scheduled to the contrary, shall be provided by the trade furnishing the motor. All motor starting equipment provided by any one trade shall be of the same manufacture unless such starting equipment is an integral part of the equipment on which the motor is mounted.

2.6 FIRE AND SMOKE PARTITION, WALL, AND/OR FLOOR PENETRATIONS

- A. Pipe, ductwork, conduit, etc. shall pass through fire- or smoke-rated floors, partitions, walls, or other barriers within a UL-listed assembly which shall maintain the rating of the applicable wall, floor, partition, or barrier.
- B. The Contractor shall review the architectural and structural drawings and determine the location of the fire-rated building elements. Where these elements are penetrated, UL-listed fire-rated penetration assemblies approved by the local authority shall be provided in accordance with the manufacturer's instructions to obtain the required rating.

2.7 FOUNDATIONS / HOUSEKEEPING PADS

- A. General: All special foundations and supports required for the proper installation of equipment and pipe shall be provided as hereinafter specified and under the section of the specifications covering the equipment, unless otherwise indicated on the drawings.
- B. All equipment shall receive concrete housekeeping pads unless otherwise noted. Equipment to be receive pads are to include (but not limited to): boilers, water heaters, water softeners, expansion / compression tanks, filter feeders, water treatment equipment, air compressors, pumps (in addition to inertia bases where required), surge tanks, deareators, etc.
- C. Concrete foundations for the support of equipment such as floor-mounted pumps, equipment, etc. shall be not less than 3 inches high and not less than 4 inches larger (in both directions) than supported unit, unless otherwise noted and shall be poured in forms built of new dressed lumber.

All corners of the foundations shall be neatly chaffered by means of sheet metal or triangular wood strips nailed to the form. Pads shall not be laid out directly against walls or structures. 2 inches shall be left available for pad form work. Foundation bolts shall be placed in the forms when the concrete is poured, the bolts being correctly located by means of templates. Allow 1 inch below the equipment bases for alignment and grouting (where applicable). Foundations for equipment located on the exterior of the building shall be provided as indicated. Foundations shall be constructed in accordance with approved shop drawings and shall be reinforced with #4 bars at 12 inches on center both ways (minimum).

D. Pipe and Conduit Support: All pipes and conduits throughout the building, both horizontal and vertical, shall be adequately supported from the construction to line of grade, with proper provision for expansion, contraction, vibration elimination, and anchorage. Vertical pipes and conduits shall be supported from floor lines with riser clamps sized to fit the lines and to adequately support their weight. At the bases of lines, where required for proper support, provide anchor base fittings or other approved supports.

PART 3 - EXECUTION

3.1 SPACE AND EQUIPMENT ARRANGEMENT

- A. The size of equipment indicated on the drawings is based on the dimensions of a particular manufacturer. While other manufacturers will be acceptable, it is the responsibility of the Contractor to determine whether the equipment he proposes to furnish will fit in the space. Shop drawings shall be prepared when required by the Owner's Representative 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.

3.2 LARGE APPARATUS

A. Any large piece of apparatus which is to be installed in any space in the building, and which is too large to permit access through 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.

3.3 PROTECTION

- A. The Contractor shall 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 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 uncompleted building with tarpaulins or other protective covering. 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. The Contractor shall protect existing facilities, the work of others, and the premises from any and all damages that may be made possible by the execution of work.
- 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.

3.4 COOPERATION BETWEEN TRADES AND WITH OTHER CONTRACTORS

- A. Each trade, subcontractor, and/or Contractor must work in harmony with the various 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.
- B. It shall be the responsibility of each trade to cooperate fully with the other trades on the job to help keep the jobsite in a clean and safe condition. At the end of each day's work, each trade shall properly store all of its tools, equipment, and materials and shall clean its debris from the job. Upon the completion of the job, each trade shall immediately remove all of its tools, equipment, any surplus materials, and all debris caused by its portion of the work.

3.5 PRECEDENCE OF MATERIALS AND COORINATION OF WORK

- A. These specifications and the accompanying drawings are intended to cover systems which will not interfere with the structural design of the building, which will fit into the several available spaces, and which will ensure complete and satisfactory systems. Each subcontractor and/or trade shall be responsible for the proper fitting of his material and apparatus into the building.
- B. The work of the various trades shall be performed in the most direct and workmanlike manner without hindering or handicapping the work of other trades. Piping interferences shall be handled by giving precedence to pipe lines which require a stated grade for proper operation. Where space requirements conflict, the following order or precedence shall, in general, be observed:
 - 1. Building lines.
 - 2. Structural members.
 - 3. Light fixtures.
 - 4. Soil and drain piping.
 - 5. Condensate drains.
 - 6. Vent piping.
 - 7. Supply, return, and outside air ductwork.
 - 8. Exhaust ductwork.
 - 9. Fire protection piping.
 - 10. Domestic water (cold and hot).
 - 11. Refrigerant piping.
 - 12. Electrical conduit.
- C. Coordinate all major elements, components, and systems of plumbing equipment and materials in relationship with other systems, installations, and building components. Coordinate space requirements for installation and access. Verify the following:
 - 1. Clearance for servicing and maintaining equipment, accessories, and specialties, including space for disassembly required for periodic maintenance.
 - 2. Equipment and accessory service connections and support details.
 - 3. Fire-rated wall and floor penetrations.
 - 4. Scheduling, sequencing, movement and positioning of large equipment into building during construction.
 - 5. Access panel and door locations.
 - 6. Clearances between building openings and VTR's/Flues.
- D. The light fixture grid layout as indicated on the drawings must be maintained. This Contractor shall refer to all light fixture plans and details indicated on the drawings and shall coordinate the location of dampers, supply grilles, return air grilles, sprinkler heads, etc. with the location of the light fixtures to assure proper access to all items in a manner acceptable to the Owner's Representative.
- E. The electrical trades shall locate all junction boxes, pull boxes, conduits, etc. to avoid interference with the diffusers, dampers, grilles, etc. hereinbefore mentioned. The mechanical trades shall

furnish to all other trades copies of approved ductwork shop drawings to assist in the coordination of the rough-in and installation of all items of work.

3.6 CONNECTIONS FOR OTHERS

- A. This Contractor shall rough-in for and make all water, sewer, electrical, etc. connections to all fixtures, equipment, machinery, etc. provided by others in accordance with detailed roughing-in drawings provided by the equipment suppliers, by actual measurements of the equipment connections, or as detailed.
- B. After the equipment is set in place, this Contractor shall make all final connections and shall provide all required pipe, fittings, valves, traps, connectors, etc.
- C. Provide all air gap fittings required, using materials hereinbefore specified. In each water line serving an item of equipment or piece of machinery, provide a shutoff valve. On each drain without integral trap provide a suitable trap.
- D. All pipe fittings, valves, traps, etc. exposed in finished areas and connected to chrome-plated lines provided by others shall be chrome-plated to match.
- E. Provide all transition pieces, etc. required for a complete installation of equipment provided by others.

3.7 INSTALLATION METHODS

- A. Where to Conceal: All pipes and conduits shall be concealed in pipe chases, walls, furred spaces, below suspended floors, 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 and conduit may be run exposed. All exposed piping and conduit shall be run in the neatest, most inconspicuous manner, and parallel or perpendicular to the building lines.
- C. Support: All piping and conduit 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 and below concrete beams or other deep projections, pipe and conduit 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 Owner's Representative for each penetration.
- E. All pipe, conduits, etc. shall be cut accurately to measurements established at the building and shall be worked into place without springing or forcing. All ducts, pipes, and conduits run exposed in machinery and equipment rooms shall be installed parallel to the building lines, except that they shall be sloped to obtain the proper pitch. Piping and ducts run in furred ceilings, etc. shall be similarly installed, except as otherwise shown. Conduits in furred ceilings and in other concealed spaces may be run at angles to the construction but shall be neatly grouped and racked indicating good workmanship. All conduit and pipe openings shall be kept closed until the systems are closed with final connections.
- F. Special Requirements:
 - 1. There shall be no pipe joints nearer than 12 inches to a wall, ceiling, or floor penetration unless pipe joint is a welded or mechanically-coupled-type joint.
 - 2. The Contractor shall study all construction documents and carefully lay out all work in advance of fabrication and erection in order to meet the requirements of the extremely limited spaces. Where conflicts occur the Contractor shall meet with all involved trades and the Owner's Representative and resolve the conflict prior to erection of any work in the area involved.

- 3. Prior to the installation of any ceiling material, gypsum, plaster, or acoustical board, the Contractor shall notify the Owner's Representative so that arrangements 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 up to ten (10) working days, but in no case less than five (5) working days.
- 4. The purpose of this inspection is to verify the completeness and quality of the installation of the air conditioning systems, the plumbing systems, and any other special above-ceiling systems such as pneumatic tube. The ceiling supports (tee bar or lath) should 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 material shall be installed until the deficiencies listed from this inspection have been corrected to the satisfaction of the Owner's Representative.

3.8 CUTTING AND PATCHING

- A. General: Cut and patch walls, floors, etc. resulting from work in existing construction or where made necessary 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 Owner's Representative. Impact-type equipment will not be used except where specifically acceptable to the Owner's Representative. Openings in concrete for pipes, conduits, outlet boxes, etc. shall be core drilled to exact size. Determine location of embedded conduit and reinforcing bars prior to cutting.
- 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 Owner's Representative.
- E. Plaster: All plumbing work in area containing plaster shall be completed prior to the application of the finish plaster coat. Cutting of finish plaster coat will not be permitted.
- F. Weakening: No cutting, boring, or excavating which will weaken the structure shall be undertaken.

3.9 ROOF PENETRATIONS AND FLASHING

A. Pipe and conduit ducts, pitch pockets, curb bases, and flashing compatible with the roofing installation shall be provided for roof penetrations. Provide framing or other support around all openings through roof as required to preserve the structural integrity of the roof system and make the penetration weathertight.

3.10 EXCAVATING AND BACKFILLING

- A. Perform trenching, excavating, backfilling for plumbing work as set forth below.
- B. Depth of excavation varies with invert of pipe. Excavation to be carried to a depth of at least 6 inches below bottom of pipe elevation. Fill below pipe (6 inches), around pipe, and a minimum of 12 inches above pipe with sand of Class "B" crushed stone tamped firm and even. Separate topsoil during excavation. Final layer of dirt for exterior installations to be (6 inches minimum) to be topsoil. Backfilling shall be done to exclude use of rock or stone above sand or Class "B" crushed stone.

3.11 TESTS AND INSPECTIONS

- A. General: The Contractor shall make all tests deemed necessary by the inspection departments of the engineer and the authority having jurisdiction, Board of Underwriters, etc. He shall provide all equipment, materials, and labor for making such tests. Fuel and electrical energy for system operational tests following beneficial occupancy by the Owner will be paid for by the Owner.
- B. Other: Additional tests specified hereinafter under the various specifications sections shall be made.
- C. Notification: The Owner's Representative shall be notified at his office 36 hours prior to each test and other specifications requirements requiring action on the part of the Owner, Architect, Engineer, and/or Owner's Representative.
- D. Test Logs: All tests which the Contractor conducts 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 any other pertinent data. Data shall be delivered to the Owner's Representative as specified under "Requirements for Final Acceptance.
- E. Inspections: In general, an inspection by the Owner's Representative shall be required prior to closing up any work and prior to beneficial occupancy or final project completion. The closing up of work includes, but is not limited to, pipe and conduit installations prior to backfilling; mechanical, plumbing electrical, and fire protection work prior to placement of concrete; or closing up walls and overhead mechanical, plumbing, electrical and fire protection work prior to installation of the ceiling.

3.12 CLEANING AND PAINTING

- A. Thoroughly clean and touch up the finish on all parts of the materials and equipment. Exposed parts in equipment rooms, and all other spaces except sealed chases and attics shall be thoroughly cleaned of cement, plaster, and other materials, and all oil and grease spots shall be removed. Such surfaces shall be carefully wiped and all cracks and corners scraped out.
- B. All other painting shall be accomplished under the Painting Section of Division 9 of the specifications.

3.13 DISCHARGE OF WASTES FROM CONSTRUCTION SITE

- A. The Contractor shall comply with all applicable provisions of local, state, and federal laws regarding the discharge of wastes into sewer and waterways. Special caution shall be exercised to prevent the discharge of wastes which contain oil, tar, asphalt, roofing compound, kerosene, gasoline, paint, mud, cement, lime, or other materials which would degrade the water quality of the receiving water course. The Contractor shall construct and maintain oil interceptors, settling basins, acid neutralization tanks, and/or other effective pollution countermeasures, as required by the Texas Water Quality Board.
- B. On LEED and CHPS projects, contractor is responsible for tracking waste leaving the jobsite. All waste on these projects to be sorted and processed during construction.

END OF SECTION

SECTION 22 0500 BASIC PLUMBING MATERIALS AND METHODS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following basic plumbing materials and methods to complement other Plumbing Sections.
 - 1. Piping materials and installation instructions common to most piping systems.
 - 2. Concrete base construction requirements.
 - 3. Escutcheons.
 - 4. Dielectric fittings.
 - 5. Dielectric isolation tape
 - 6. Flexible connectors.
 - 7. Mechanical sleeve seals.
 - 8. Nonshrink grout for equipment installations.
 - 9. Field-fabricated metal and wood equipment supports.
 - 10. Installation requirements common to equipment specification sections.
 - 11. Mechanical demolition.
 - 12. Cutting and patching.
 - 13. Touchup painting and finishing.
 - 14. Access Doors
- B. Pipe and pipe fitting materials are specified in Plumbing piping system Sections, if applicable.

1.2 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawl spaces, 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 in duct shafts.
- 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 unheated shelters.
- F. The following are industry abbreviations for plastic materials:
 - 1. ABS: Acrylonitrile-butadiene-styrene plastic.
 - 2. CPVC: Chlorinated polyvinyl chloride plastic.
 - 3. NP: Nylon plastic.
 - 4. PE: Polyethylene plastic.
 - 5. PVC: Polyvinyl chloride plastic.
- G. The following are industry abbreviations for rubber materials:
 - 1. CR: Chlorosulfonated polyethylene synthetic rubber.
 - 2. EPDM: Ethylene propylene diene terpolymer rubber.

1.3 SUBMITTALS

- A. Product Data: For dielectric fittings, flexible connectors, access doors, solder/brazing material and mechanical sleeve seals.
- B. Shop Drawings: Detail fabrication and installation for metal and wood supports and anchorage for mechanical materials and equipment.
- C. Coordination Drawings: Detail major elements, components, and systems of plumbing equipment and materials in relationship with other systems, installations, and building components. Show space requirements for installation and access. Indicate if sequence and coordination of installations are important to efficient flow of the Work. Include the following:
 - 1. Clearances for servicing and maintaining equipment, accessories, and specialties, including space for disassembly required for periodic maintenance.
 - 2. Equipment and accessory service connections and support details.
 - 3. Fire-rated wall and floor penetrations.
 - 4. Scheduling, sequencing, movement, and positioning of large equipment into building during construction.
 - 5. Access panel and door locations

1.4 QUALITY ASSURANCE

- A. All materials, unless otherwise specified, shall be 51% manufactured in the United States, new, free from all defects, and of the best quality. Foreign goods specifically approved for use by the Owner's Representative prior to bidding may be furnished.
- B. 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 present a neat, precise appearance.
- C. Comply with ASME A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.
- D. Equipment Selection: Equipment of higher electrical characteristics, physical dimensions, capacities, and ratings may be furnished provided such proposed equipment is approved in writing and connecting mechanical and electrical services, circuit breakers, conduit, motors, bases, and equipment spaces are increased. Additional costs shall be approved in advance by appropriate Contract Modification for these increases. If minimum energy ratings or efficiencies of equipment are specified, equipment must meet design and commissioning requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and prevent entrance of dirt, debris, and moisture.
- B. Protect stored pipes and tubes from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor, if stored inside.
- C. Protect flanges, fittings, and piping specialties from moisture and dirt.
- D. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.
- 1.6 SEQUENCING AND SCHEDULING

- A. Coordinate plumbing equipment installation with other building components.
- B. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction to allow for plumbing installations.
- C. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components, as they are constructed.
- D. Sequence, coordinate, and integrate installations of plumbing materials and equipment for efficient flow of the Work. Coordinate installation of large equipment requiring positioning before closing in building.
- E. Coordinate connection of plumbing systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies.
- F. Coordinate requirements for access panels and doors if plumbing items requiring access are concealed behind finished surfaces.
- G. Coordinate installation of identifying devices after completing covering and painting, if devices are applied to surfaces. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2- PRODUCTS

2.1 MANUFACTURERS

2.

4.

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Dielectric Tape:
 - a. Holdrite (#272-4).
 - Metal, Flexible Connectors:
 - a. Flexicraft Industries.
 - b. Flex-Weld, Inc.
 - c. Grinnell Corp.; Grinnell Supply Sales Co.
 - d. Mercer Rubber Co.
 - e. Metraflex Co.
 - f. Uniflex, Inc.
 - 3. Rubber, Flexible Connectors:
 - a. General Rubber Corp.
 - b. Mercer Rubber Co.
 - c. Metraflex Co.
 - d. Red Valve Co., Inc.
 - e. Uniflex, Inc.
 - Mechanical Sleeve Seals:
 - a. Calpico, Inc.
 - b. Metraflex Co.
 - c. Thunderline/Link-Seal.

2.2 PIPE AND PIPE FITTINGS

- A. Refer to individual Specification piping Sections for pipe and fitting materials and joining methods, if applicable.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 JOINING MATERIALS

- A. Refer to individual Specification piping Sections for special joining materials not listed below, if applicable.
- B. 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.
 - 2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
- C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- D. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
- E. Solder Filler Metals: ASTM B 32.
 - 1. ASTM B 32, 95/5 lead-free alloys. Include water –flushable and soluble flux according to ASTM B 813.
- F. Brazing Filler Metals: AWS A5.8.
 - 1. BCuP Series: Copper-phosphorus alloys.
 - 2. BAg1: Silver alloy.
- G. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- H. Solvent Cements: Manufacturer's standard solvent cements for the following:
 - 1. CPVC Piping: ASTM F 493.
 - 2. PVC Piping: ASTM D 2564, medium bodied (bond). Include purple primer according to ASTM F 656.
- I. Plastic Pipe Seals: ASTM F 477, elastomeric gasket.
- J. Flanged, Ductile-Iron Pipe Gasket, Bolts, and Nuts: AWWA C110, rubber gasket, carbonsteel bolts and nuts.
- K. Couplings: Iron-body sleeve assembly, fabricated to match OD of plain-end, pressure pipes.
 - 1. Sleeve: ASTM A 126, Class B, gray iron.
 - 2. Followers: ASTM A 47 malleable iron or ASTM A 536 ductile iron.
 - 3. Gaskets: Rubber.
 - 4. Bolts and Nuts: AWWA C111.
 - 5. Finish: Enamel paint.

2.4 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials or ferrous material body with separating nonconductive insulating material suitable for system fluid, pressure, and temperature, to prevent galvanic action and stop corrosion. Unions in first paragraph below are available in at least NPS 1/2 to NPS 2.
- B. 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. EPCO Sales, Inc.
- d. Hart Industries International, Inc.
- e. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
- f. Zurn Plumbing Products Group; Wilkins Water Control Products.
- 2. Description:
 - a. Pressure Rating: 250 psig at 180 deg F.
 - b. End Connections: Solder-joint copper alloy and threaded ferrous.
 - c. Flanges in first paragraph below are available in at least NPS 1-1/2 to NPS 4.
- C. Dielectric Flanges:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Capitol Manufacturing Company.
 - b. Central Plastics Company.
 - c. EPCO Sales, Inc.
 - d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - 2. Description:
 - a. Factory-fabricated, bolted, companion-flange assembly.
 - b. Pressure Rating: 175 psig minimum.
 - c. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.
- D. Dielectric-Flange Kits:

1.

- Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Advance Products & Systems, Inc.
 - b. Calico, Inc.
 - c. Central Plastics Company.
 - d. Pipeline Seal and Insulator, Inc.
- 2. Description:
 - a. Nonconducting materials for field assembly of companion flanges.
 - b. Pressure Rating: 150 psig.
 - c. Gasket: Neoprene or phenolic.
 - d. Bolt Sleeves: Phenolic or polyethylene.
 - e. Washers: Phenolic with steel backing washers.
- E. Dielectric Couplings:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Calpico, Inc.
 - b. Lochinvar Corporation.
 - 2. Description:
 - a. Galvanized-steel coupling.
 - b. Pressure Rating: 300 psig at 225 deg F.
 - c. End Connections: Female threaded.
 - d. Lining: Inert and noncorrosive, thermoplastic.
- F. Dielectric Nipples:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Perfection Corporation; a subsidiary of American Meter Company.
 - b. Precision Plumbing Products, Inc.
 - c. Victaulic Company.
 - 2. Description:

- a. Electroplated steel nipple complying with ASTM F 1545.
- b. Pressure Rating: 300 psig at 225 deg F.
- c. End Connections: Male threaded or grooved.
- d. Lining: Inert and noncorrosive, propylene.

2.5 DIELECTRIC ISOLATION TAPE

- A. Tape to eliminate dissimilar metal contact: (equal to Holdrite #272-4)
 - 1. White Polyester Felt. Pressure sensitive adhesive rubber base (one side only).
 - 2. 4" width.

2.6 FLEXIBLE CONNECTORS

- A. General: Fabricated from materials suitable for system fluid and that will provide flexible pipe connections. Include 125-psig minimum working-pressure rating, unless higher working pressure is indicated, and ends according to the following:
 - 1. 2-Inch NPS and Smaller: Threaded.
 - 2. 2-1/2-Inch NPS and Larger: Flanged.
 - 3. Option for 2-1/2-Inch NPS and Larger: Grooved for use with keyed couplings.
- B. Bronze-Hose, Flexible Connectors: Corrugated, bronze, inner tubing covered with bronze wire braid. Include copper-tube ends or bronze flanged ends, braze welded to hose.
- C. Rubber, Flexible Connectors: CR or EPDM elastomer rubber construction, with multiple plies of NP fabric, molded and cured in hydraulic presses. Include 125-psig minimum working-pressure rating at 220 deg F. Units may be straight or elbow type, unless otherwise indicated.

2.7 MECHANICAL SLEEVE SEALS

- A. Description: Modular sealing element unit, designed for field assembly, used to fill annular space between pipe and sleeve.
 - 1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe materials and size of pipe.
 - 2. Pressure Plates: Stainless steel.
 - 3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

2.8 PIPING SPECIALTIES

- A. Sleeves: The following materials are for wall, floor, slab, and roof penetrations:
 - 1. Steel Sheet Metal: 0.0239-inch minimum thickness, galvanized, round tube closed with welded longitudinal joint.
 - 2. Steel Pipe: ASTM A 53, Type E, Grade A, Schedule 40, galvanized, plain ends.
 - 3. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
 - 4. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
 a. Underdeck Clamp: Clamping ring with set screws.
 - 5. Sleeve Fasteners: Manufactured, steel clips for securement during pour. Equal to Bline, BD40, BE-5-8 or BE-9-12.
- B. Escutcheons: Manufactured wall, ceiling, and floor plates; deep-pattern type if required to conceal protruding fittings and sleeves.
 - 1. ID: Closely fit around pipe, tube, and insulation of insulated piping.

- 2. OD: Completely cover opening.
- 3. Cast Brass: One piece, with set screw. (split face acceptable for existing piping)
 - a. Finish: Polished chrome-plate.

2.9 GROUT

- A. Nonshrink, Nonmetallic Grout: ASTM C 1107, Grade B.
 - 1. Characteristics: Post-hardening, volume-adjusting, dry, hydraulic-cement grout, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 - 2. Design Mix: 5000-psig, 28-day compressive strength.
 - 3. Packaging: Premixed and factory packaged.

2.10 ACCESS DOORS

- A. General: Provide access doors for all serviceable mechanical appurtenances (valves, trap primers, shock arresters, actuators, sensors, etcetera) in inaccessible locations. Such locations include gypsum, brick and CMU ceilings and walls.
- B. Location of panels shall be carefully coordinated with other Exposed Devices as described in earlier paragraphs.
- C. Manufacturers shall be Milcor, Mifab, or approved equal. Unless indicated otherwise, use panels equal to Milcor Style M for masonry and drywall construction, equal to Milcor Style K for plastered masonry walls and ceilings. Stainless steel panels shall be used in ceramic tile or glazed structural tile.
- D. Minimum construction features include 16-gage frame and door, continuous hinges, camstyle latch and 10"x10" unobstructed opening size.
- E. UL labeled when in fire-rated construction, one and one-half hour rating.
- F. Access doors located outside, in restrooms or in a moisture-laden environment (dressing area, shower area, lockers, etcetera) shall be stainless steel construction.
- G. Equipment access doors shall be of sufficient size to remove/replace equipment and provide routine maintenance as necessary, unless otherwise noted. Doors shall be set flush with adjacent finish surfaces. All access doors shall be provided with cylinder locks. All access doors (MEP) shall have one (1) common key.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS AND APPLICATIONS

- A. General: Install piping as described below, unless piping Sections specify otherwise. Individual piping Sections specify unique piping installation requirements.
- B. General Locations and Arrangements: 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 Coordination Drawings.
- C. All piping to be installed in compliance with current NEC required clearances.

- D. Install manufactured isolation clamps at all dissimilar metal pipe supports. Install dielectric isolation tape (engineer approved) only when a manufactured isolation clamp is not available.
- E. Install piping at indicated slope.
- F. Install components with pressure rating equal to or greater than system operating pressure.
- G. Install piping in concealed interior and exterior locations, except in equipment rooms and service areas.
- H. Install piping free of sags and bends.
- I. Install exposed interior and exterior piping at right angles or parallel to building walls. Diagonal runs are prohibited, unless otherwise indicated.
- J. Install piping tight to slabs, beams, joists, columns, walls, and other building elements. Allow sufficient space above removable ceiling panels to allow for ceiling panel removal.
- K. Install piping to allow application of insulation plus 1-inch clearance around insulation.
- L. Locate groups of pipes parallel to each other, spaced to permit valve servicing.
- M. Install fittings for changes in direction and branch connections.
- N. Install couplings according to manufacturer's written instructions.
- O. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping" for firestop materials and installations.
 - 1. Fire-stop all sleeves at floor penetrations of multistory buildings including underfloor penetrations.
- P. Verify final equipment locations for roughing-in.
- Q. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.
- R. Piping Joint Construction: Join pipe and fittings as follows and as specifically required in individual piping specification Sections:
 - 1. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
 - 2. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
 - 3. Soldered Joints: Construct joints according to AWS's "Soldering Manual," Chapter "The Soldering of Pipe and Tube"; or CDA's "Copper Tube Handbook."
 - 4. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."
 - 5. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - a. Note internal length of threads in fittings or valve ends, and proximity of internal seat or wall, to determine how far pipe should be threaded into joint.
 - b. Apply appropriate tape or thread compound to external pipe threads, unless dry seal threading is specified.
 - c. Align threads at point of assembly.
 - d. Tighten joint with wrench. Apply wrench to valve end into which pipe is being threaded.

- e. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- 6. Welded Joints: Construct joints according to AWS D10.12, "Recommended Practices and Procedures for Welding Low Carbon Steel Pipe," using qualified processes and welding operators according to "Quality Assurance" Article.
- 7. Flanged Joints: Align flange surfaces parallel. Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly using torque wrench.
- 8. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join pipe and fittings according to the following:
 - a. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
 - b. CPVC Piping: ASTM D 2846 and ASTM F 493.
 - c. PVC Pressure Piping: ASTM D 2672.
 - d. PVC Nonpressure Piping: ASTM D 2855.
- 9. Plastic Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657 procedures and manufacturer's written instructions.
 - a. Plain-End Pipe and Fittings: Use butt fusion.
 - b. Plain-End Pipe and Socket Fittings: Use socket fusion.

3.2 ESCUTCHEON REQUIREMENTS

- A. Install escutcheons at pipe penetrations of walls, ceilings, and floors in finished areas.
 - 1. Escutcheons for New Piping:
 - a. Piping exposed through floors and walls in finished areas: One piece, cast brass with polished chrome-plated finish with set screw. Deep escutcheons to be provided where standard depth will not fit.
 - b. Escutcheons shall cover entire hole penetration.
 - c. Escutcheon to be appropriately sized for pipe.
 - 2. Escutcheons for Existing piping:
 - a. Piping exposed through floors and walls in finished areas: Split plate, cast brass with polished chrome-plated finish with set screw. Deep escutcheons to be provided where standard depth will not fit.
 - b. Escutcheons shall cover entire hole penetration.
 - c. Escutcheon to be appropriately sized for pipe.
 - 3. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

3.3 PIPE SLEEVE INSTALLATION REQUIREMENTS

- A. Pipe sleeves are required at all through wall and floor penetrations.
 - 1. Sleeves are to be of the following material:
 - a. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc-coated, with plain ends.
 - 2. Sleeves are required for all through floor and wall penetrations. Sleeves to be set and poured in place (in slab applications), secure all sleeves with fasteners.
 - 3. Sleeves to extend 2 inches past face of floor or wall. Pipe sleeve in finished areas to be flush with wall or floor for installation of escutcheon.
 - 4. Install sleeves in new partitions, slabs, and walls as they are built.

- 5. For interior wall penetrations, seal annular space between sleeve and pipe or pipe insulation using joint sealants appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants" for joint sealants.
- 6. For exterior wall penetrations above grade, seal annular space between sleeve and pipe using joint sealants appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants" for joint sealants.
- 7. For exterior wall penetrations below grade, seal annular space between sleeve and pipe using sleeve seals specified in this Section.
- 8. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation unless otherwise indicated. Seal annular space with water tight sealant. (equal to NP-1). All sleeves and penetrations to maintain rating of wall / floor. Seal pipe penetrations with fire-stopping materials.
- 9. Install sleeve materials according to the following applications:
 - a. Sleeves for Piping Passing through Concrete Floor Slabs: galvanized steel pipe.
 - b. Sleeves for Piping Passing through Concrete Floor Slabs of Mechanical Equipment Areas or Other Wet Areas: Galvanized-steel pipe sleeves.
 - 1) Extend sleeves 2 inches above finished floor level.
 - 2) For pipes penetrating floors with membrane waterproofing, extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches (50 mm) above finished floor level. Comply with requirements in Division 07 Section "Sheet Metal Flashing and Trim" for flashing.
- 10. Sleeves for Piping Passing through Gypsum-Board Partitions:
 - a. Galvanized-steel pipe sleeves.
 - b. Exception: Sleeves are not required for water supply tubes and waste pipes for individual plumbing fixtures if escutcheons will cover openings.
- 11. Sleeves for Piping Passing through Concrete Roof Slabs: Reference details.
- 12. Sleeves for Piping Passing through Exterior Concrete Walls:
 - a. Galvanized-steel pipe sleeves.
 - b. Install sleeves that are large enough to provide 1-inch annular clear space between sleeve and pipe or pipe insulation when sleeve seals are used.
- 13. Sleeves for Piping Passing through Interior Concrete Walls:
- a. Galvanized-steel pipe sleeves.
- 14. Mechanical sleeve seals
 - a. Install sleeve seals in sleeves in exterior concrete walls at water-service piping entries into building. Sleeves must be poured in place. Installation of sleeves after wall is constructed is not acceptable.
 - b. Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble sleeve seal components and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- B. Piping Connections: Make connections according to the following, unless otherwise indicated:
 - 1. Install unions, in piping 2-inch NPS and smaller, adjacent to each valve and at final connection to each piece of equipment with 2-inch NPS or smaller threaded pipe connection.
 - 2. Install flanges, in piping 2-1/2-inch NPS and larger, adjacent to flanged valves and at final connection to each piece of equipment with flanged pipe connection.
 - 3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
 - 4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.4 DIELECTRIC FITTING INSTALLATION

- A. Install unions, in piping 2-inch NPS and smaller, adjacent to each valve and at final connection to each piece of equipment with 2-inch NPS or smaller threaded pipe connection.
- B. Install flanges, in piping 2-1/2-inch NPS and larger, adjacent to flanged valves and at final connection to each piece of equipment with flanged pipe connection.

3.5 EQUIPMENT INSTALLATION – COMMON REQUIREMENTS

- A. Install equipment to provide maximum possible headroom, if mounting heights are not indicated.
- B. Install equipment according to approved submittal data. Portions of the Work are shown only in diagrammatic form. Refer conflicts to Architect.
- C. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- D. Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- E. Install equipment giving right of way to piping installed at required slope.

3.6 PAINTING AND FINISHING

- A. Apply paint to exposed piping according to the following, unless otherwise indicated:
 - 1. Interior, Ferrous Piping: Use semigloss, acrylic-enamel finish. Include finish coat over enamel undercoat and primer.
 - 2. Interior, Galvanized-Steel Piping: Use semigloss, acrylic-enamel finish. Include two finish coats over galvanized metal primer.
 - 3. Interior, Ferrous Supports: Use semigloss, acrylic-enamel finish. Include finish coat over enamel undercoat and primer.
 - 4. Exterior, Ferrous Piping: Use semigloss, acrylic-enamel finish. Include two finish coats over rust-inhibitive metal primer.
 - 5. Exterior, Galvanized-Steel Piping: Use semigloss, acrylic-enamel finish. Include two finish coats over galvanized metal primer.
 - 6. Exterior, Ferrous Supports: Use semigloss, acrylic-enamel finish. Include two finish coats over rust-inhibitive metal primer.
- B. Do not paint piping specialties with factory-applied finish.
- C. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.7 ERECTION OF METAL SUPPORTS AND ANCHORAGE

- A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.
- B. Field Welding: Comply with AWS D1.1, "Structural Welding Code--Steel."

3.8 ERECTION OF WOOD SUPPORTS AND ANCHORAGE

- A. Cut, fit, and place wood grounds, nailers, blocking, and anchorage to support and anchor mechanical materials and equipment (not to be used at pipe supports).
- B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.
- C. Attach to substrates as required to support applied loads.

3.9 DEMOLITION

- A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces necessary for mechanical installations. Perform cutting by skilled mechanics of trades involved.
- B. Repair cut surfaces to match adjacent surfaces.

3.10 CUTTING AND PATCHING

- A. Disconnect, demolish, and remove Work specified in Plumbing Sections.
- B. If pipe, ductwork, insulation, or equipment to remain is damaged or disturbed, remove damaged portions and install new products of equal capacity and quality.
- C. Accessible Work: Remove indicated exposed pipe and ductwork in its entirety.
- D. Work Abandoned in Place: Cut and remove underground pipe a minimum of 2 inches beyond face of adjacent construction. Cap and patch surface to match existing finish.
- E. Removal: Remove indicated equipment from Project site.
- F. Temporary Disconnection: Remove, store, clean, reinstall, reconnect, and make operational equipment indicated for relocation.

3.11 GROUTING

- A. Install nonmetallic, nonshrink, grout for plumbing equipment base bearing surfaces, pump and other equipment base plates, and anchors. Mix grout according to manufacturer's written instructions.
- B. Clean surfaces that will come into contact with grout.
- C. Provide forms as required for placement of grout.
- D. Avoid air entrapment during placing of grout.
- E. Place grout, completely filling equipment bases.
- F. Place grout on concrete bases to provide smooth bearing surface for equipment.
- G. Place grout around anchors.
- H. Cure placed grout according to manufacturer's written instructions.

END OF SECTION

SECTION 22 0523 GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Bronze ball valves.
 - 2. Bronze swing check valves.

1.3 DEFINITIONS

- A. CWP: Cold working pressure.
- B. EPDM: Ethylene propylene copolymer rubber.
- C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.
- D. NRS: Nonrising stem.
- E. OS&Y: Outside screw and yoke.
- F. RS: Rising stem.
- G. SWP: Steam working pressure.

1.4 SUBMITTALS

A. Product Data: For each type of valve indicated and required accessories (chains, extensions, etc.).

1.5 QUALITY ASSURANCE

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- B. ASME Compliance:
 - 1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
 - 2. ASME B31.1 for power piping valves.
 - 3. ASME B31.9 for building services piping valves.
- C. NSF Compliance: NSF 61 for valve materials for potable-water service.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

- 1. Protect internal parts against rust and corrosion.
- 2. Protect threads, flange faces, grooves, and weld ends.
- 3. Set globe valves closed to prevent rattling.
- 4. Set ball and plug valves open to minimize exposure of functional surfaces.
- 5. Set butterfly valves closed or slightly open.
- 6. Block check valves in either closed or open position.
- B. Use the following precautions during storage:
 - 1. Maintain valve end protection.
 - 2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
- C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2 - PRODUCTS

- 2.1 GENERAL REQUIREMENTS FOR VALVES
 - A. Refer to valve schedule articles for applications of valves.
 - B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
 - C. Valve Sizes: Same as upstream piping unless otherwise indicated.
 - D. 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.
 - 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.
 - E. Valve Action: Close rotation shall be clockwise.
 - F. Valves in Insulated Piping: With 2-inch stem extensions and the following features:
 - 1. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation. Extension to be provided by valve manufacturer to match specific product.
 - 2. Butterfly Valves: With extended neck.
 - G. Valve-End Connections:
 - 1. Flanged: With flanges according to ASME B16.1 for iron valves (with 316 stainless steel bolts).
 - 2. Threaded: With threads according to ASME B1.20.1.

2.2 BRONZE BALL VALVES

- A. Two-Piece, Full-Port, Bronze Ball Valves with Stainless-Steel Trim:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Conbraco Industries, Inc.; Apollo Valves.
 - b. Milwaukee Valve Company.
 - c. Mueller Steam Specialty; a division of SPX Corporation.

- d. NIBCO INC.
- e. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
- 2. Description:
 - a. Standard: MSS SP-110.
 - b. SWP Rating: 150 psig.
 - c. CWP Rating: 600 psig.
 - d. Body Design: Two piece.
 - e. Body Material: Bronze.
 - f. Ends: Threaded.
 - g. Seats: PTFE or TFE.
 - h. Stem: Stainless steel, blowout-proof.
 - i. Ball: Stainless steel, vented.
 - j. Port: Full.

2.3 BRONZE SWING CHECK VALVES

- A. Class 150, Bronze Swing Check Valves with Bronze Disc:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Conbraco Industries, Inc.; Apollo Valves.
 - b. Milwaukee Valve Company.
 - c. Mueller Steam Specialty; a division of SPX Corporation.
 - d. NIBCO INC.
 - e. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - 2. Description:
 - a. Standard: MSS SP-80, Type 3.
 - b. CWP Rating: 300 psig.
 - c. Body Design: Horizontal flow.
 - d. Body Material: ASTM B 62, bronze.
 - e. Ends: Threaded.
 - f. Disc: Bronze.

PART 3 - EXECUTION

- 3.1 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.

3.2 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. Install valves with brass short nipples and brass unions at downstream side (outlet) of ball and globe valves (NPS 2 and smaller).
- C. Locate valves for easy access and provide separate support where necessary.
- D. Install valves in horizontal piping with stem at or above center of pipe.
- E. Install valves in position to allow full stem and handle movement. Valve handle to have ample clearance to be fully exercised without interference (full open and full closed) with no modifications to handle.
- F. All valves NPS 3 and smaller shall be installed within 120 inches above finished floor.
- G. Install check valves for proper direction of flow and as follows:1. Swing Check Valves: In horizontal position with hinge pin level.
- H. For all valves on insulated piping, provide insulated stem extension.
- I. Install shutoff valves immediately upstream of each dielectric fitting.
- J. Provide and install shutoff valve close to water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, and on each water supply to plumbing fixtures that do not have supply stops.
- K. Provide and install drain valves for equipment at base of each water riser, at low points in horizontal piping, and where required to drain water piping.
 - 1. Drain Valves (At low points in water mains, risers, and branches): Ball valves

3.3 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.
- B. Perform the following adjustments before operation:
 - 1. Open shutoff valves to fully open position.
 - 2. Remove and clean strainer screens. Close drain valves and replace drain plugs.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. Valve applications, use the following:
 - 1. Shutoff Service: Ball, butterfly valves.
 - 2. Butterfly Valve Dead-End Service: Flange (lug) type.
 - 3. Throttling Service: Globe valves.
 - 4. Pump-Discharge Check Valves:
 - a. NPS 2 and Smaller: Bronze swing check valves with bronze disc.
- B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.
- C. Select valves, except wafer types, with the following end connections:
 - 1. For Copper Tubing, NPS 2 and Smaller: Threaded ends.

- 2. For Copper Tubing, NPS 2-1/2 and larger: Flanged ends except where threaded valveend option is indicated in valve schedules below.
- 3. For Steel Piping, NPS 2 and Smaller: Threaded ends.
- 4. For Steel Piping, NPS 2-1/2 and larger: Flanged ends.

3.5 VALVE SCHEDULE

- A. Pipe NPS 2 and Smaller:
 - 1. Ball Valves: Two piece, full port, bronze with stainless-steel trim; with brass short nipple and brass union connection at downstream side (outlet).
 - 2. Bronze Swing Check Valves.

END OF SECTION

SECTION 22 0529 HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following hangers and supports for plumbing system piping and equipment.
 - 1. Steel pipe hangers, supports and riser clamps
 - 2. Thermal-hanger shield inserts and saddles.
 - 3. Fastener systems.
 - 4. Pipe positioning systems.
 - 5. Equipment supports.
- B. Related Sections include the following:
 - 1. All plumbing specification sections.

1.3 DEFINITIONS

- A. MSS: Manufacturers Standardization Society for The Valve and Fittings Industry Inc.
- B. 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.
- C. Weight loading for supports and hangers shall not exceed manufacturers recommended tolerances and limits.

1.5 SUBMITTALS

- A. Product Data: For the following:
 - 1. Steel pipe hangers and supports.
 - 2. Thermal-hanger shield inserts and saddles.
 - 3. Powder-actuated fastener systems.
 - 4. Pipe positioning systems.
- 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 AWS D1.1, "Structural Welding Code-steel."
- B. Welding: Qualify procedures and personnel according to the following:
 1. AWS D1.1. "Structural Welding Code-Steel".

PART 2 – PRODUCTS

2.1 MATERIALS AND WORKMANSHIP

- A. All materials, unless otherwise specified, shall be 51% manufactured in the United States, new, free from all defects, and of the best quality. Foreign goods specifically approved for use by the Owner's Representative prior to bidding may be furnished.
- B. 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 present a neat, precise appearance.

2.2 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.3 METAL COATING REQUIREMENTS:

- A. All metal products shall have the following coatings:
 - 1. Wet/damp areas: hot dipped galvanized.
 - 2. Dry or conditioned areas: pre-galvanized.

2.4 STEEL PIPE HANGERS, SUPPORTS AND RISER CLAMPS

- A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hangers and Support Applications" Article for where to use specific hanger and support types.
- B. Manufacturers:
 - 1. B-Line Systems, Inc.; a division of Cooper Industries.
 - 2. ERICO/Michigan Hanger Co.
 - 3. Grinnell Corp.
- C. Galvanized, Metallic Coatings: Pre-galvanized (minimum thickness of 0.5 mils) or hot dipped (1.4 to 3.9 thickness).
- D. Nonmetallic Coatings: Plastic coating, jacket or liner.

- E. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.
- F. Channel, rod and securement hardware:
 - 1. Channel: 12-ga.
 - 2. Rod: Sized as scheduled.
 - 3. Hardware (clamps, bolts, washers, etc): coating per area indication.

2.5 THERMAL-HANGER SHIELD INSERTS

- A. Description: 100-psig minimum, compressive-strength insulation insert with a sheet metal shield.
- B. Manufactures:
 - 1. B-line
 - 2. ERICO / Michigan Hanger CO
 - 3. Grinnell Corp
 - 4. Buckaroos
- C. Insulation –Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with vapor barrier. Wood inserts are not acceptable.
- D. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type 1 calcium silicate or ASTM C 552, Type II cellular glass.
- E. Insulation-Insert Material for Cold and Hot Piping, up to 3" diameter: Molded fiberglass block, 20 lbs/ft³ density, thermal conductivity of 0.30.

2.6 FASTENER SYSTEMS

- A. Mechanical-Expansion Anchors: Insert-wedge-type stainless steel, for use in hardened Portland cement concrete with pull-out, tension and shear capacities appropriate for supported loads and building materials where used.
 - 1. Manufacturers:
 - a. B-Line Systems, Inc.; a division of Cooper Industries.
 - b. Hilti, Inc.
 - c. Powers Fasteners.
- B. Concrete Insert: electroplated steel finish, for embedding in concrete. Steel insert nut for rod attachment.
 - 1. Manufacturers:
 - a. B-Line Systems, Inc.; a division of Cooper Industries.
 - b. Hilti, Inc.
 - c. Powers Fasteners.

2.7 PIPE POSITIONING SYSTEMS

- A. Description: IAPMO PS 42, system of metal brackets, clips and straps for positioning piping in pipe spaces for plumbing fixtures for commercial applications.
- B. Manufacturers:
 - 1. C&S Mfg. Corp.
 - 2. HOLDRITE Corp.; Hubbard Enterprises.
 - 3. Samco Stamping Inc.

2.8 EQUIPMENT SUPPORTS

- A. Description: Welded, shop or field-fabricated equipment support made from structural-steel shapes.
- 2.9 MISCELLANEOUS MATERIALS
 - A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes and bars. Galvanized only. Painted steel not acceptable.

PART 3 - EXECUTION

- 3.1 HANGERS AND SUPPORTS APPLICATIONS AND INSTALLATION
 - A. Specific hanger and support requirements are specified in Hanger Application Schedule below.
 - B. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps and attachments as required to properly support piping form building structure; attaching to metal roof decks is not permissible.
 - C. Use hangers and supports with galvanized, metallic coatings for piping. Field applied finish is not acceptable.
 - D. Use nonmetallic plastic coating, jacket or liner coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
 - E. Use padded hangers for piping that is subject to scratching.
 - F. Rod to be installed plumb. Bending rod is not acceptable. Provide and install required attachments.
 - G. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Adjustable, Heavy Duty Steel Clevis Hangers: For suspension of non-insulated or insulated stationary pipes, NPS 1/2 to NPS 30.
 - 2. Strut System Clamps: For attachment of piping to channel. NPS 1/2 to NPS 2.
 - a. Noninsulated copper piping to have dielectric insert. (dielectric tape not acceptable).
 - 3. Trapeze Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated trapeze pipe hangers.
 - a. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
 - b. Field fabricate from ASTM A 36/A 36M, steel shapes selected for lads being supported. Weld steel according to AWS D1.1.
 - 4. Install hangers for piping with the following maximum horizontal spacing and minimum rod diameters (hangers shall be spaced to prevent sagging):
 - a. NPS 2 and Smaller: 60 inches with 3/8-inch rod.
 - b. NPS 2-1/2 to 5: 60 inches with 1/2-inch rod.
 - c. NPS 6 to 8: 60 inches with 3/4-inch rod.
 - H. Vertical-Piping Riser Clamps: Unless otherwise indicated and except as specified in piping system Section, install the following types:

- 1. Required at all risers from under-floor or through floors from floor below. Risers clamps to be installed every 10 ft max. Coordinate installation with sleeves.
- I. Building and Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Wide Jaw C-Clamps: For structural shapes, with retaining clip.
 - 2. NPS 2 and smaller: mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
 - 3. NPS 2 ½ and larger: Concrete spot insert. Install building attachments within concrete slabs. Install additional attachments at concentrate loads, including valves, flanges and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- J. Insulation Piping Installation:
 - 1. Provide manufacture galvanized metal shield with locking tabs or securement band.
 - 2. For Trapeze or Clamped Systems: Thermal insert and shield shall cover entire circumference of pipe.
 - 3. For Clevis or Band Hangers: Thermal insert and shield shall cover lower 180 degrees of pipe.
 - 4. Thermal Insert Length: Extend 4 inches beyond sheet metal shield for piping operating below ambient air temperature.
- K. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures; minimum three (3) for vertical pipe sections.
- L. Pipe Positioning System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture. Refer Specification Section "Plumbing Fixtures" for plumbing fixtures.
- M. Install hangers and supports complete with necessary inserts, bolts, rods, nuts washers and other accessories.
- N. Load Distribution: Install hangers and supports so piping live and dead loads and stressed from movement will not be transmitted to connected equipment.
- O. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9 (for building services piping) are not exceeded.

3.2 EQUIPMENT SUPPORTS

A. Manufacturer's structural-steel system to suspend equipment from structure overhead or to support equipment above floor.

3.3 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1 inch.

3.4 PAINTING

A. Repair Galvanized Surfaces: Clean welds, bolted connections and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION

SECTION 22 0553 IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Equipment labels.
 - 2. Warning signs and labels
 - 3. Pipe labels.
 - 4. Valve tags.
 - 5. Warning tags.

1.3 SUBMITTALS

- 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.

PART 2 - PRODUCTS

- 2.1 EQUIPMENT LABELS
 - A. Plastic Labels for Equipment:
 - 1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, **1/8 inch** thick, and having predrilled holes for attachment hardware.
 - 2. Letter Color: White.
 - 3. Background Color: Black.
 - 4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

- 5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 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.
- B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details and schedules), plus the Specification 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 (A4) bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 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: White.
- C. Background Color: Red.
- D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3 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 two-thirds to three-fourths the size of principal lettering.
- G. Fasteners: Stainless-Steel 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.

2.3 PIPE LABELS

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
- B. Pre-tensioned Pipe Labels: Pre-coiled, semi-rigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.
- C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- D. 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 label to indicate flow direction.
- 2. Lettering Size: At least 1-1/2 inches high.

2.4 VALVE TAGS

- A. Valve Tags: Stamped or engrave with 1/4 inch letters piping system abbreviation and 1/2 inch numbers.
- B. Valve Schedules: For each piping system, on 8-1/2 by 11-inch (A4) bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of a valve (room or space), normal-operating position (open, closed or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
 - 1. Valve-tag schedule shall be included in operation and maintenance date.

2.5 WARNING TAGS

- A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, or plasticized card stock with matte finish suitable for writing.
 - 1. Size: Approximately 4 by 7 inches.
 - 2. Fasteners: Brass grommet and wire.
 - 3. Nomenclature: Large-size primary caption such as "DANGER", "CAUTION", OR "DO NOT OPERATE".
 - 4. Color: yellow background with black lettering.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces or substances that could impair band 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.
- B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

- A. Piping Color-Coding: Painting of piping is specified in Specification Section "Interior Painting".
- B. 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. On piping above removable acoustical ceilings. Omit intermediately spaced labels.
- C. Pipe Label Color Schedule:

1.

- Domestic Water Piping:
 - a. Background Color: Blue.
 - b. Letter Color: White.
- 2. Domestic Hot Water Piping:
 - a. Background Color: Red.
 - b. Letter Color: White.
- 3. Sanitary Waste and Vent and Storm Drainage Piping:
 - a. Background Color: Green.
 - b. Letter Color: White

3.4 VALVE-TAG INSTALLATION

- A. Install tags on valves and controls devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.
- B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:
 - 1. Valve-Tag Size and Shape:
 - a. Cold Water: 1-1/2 inches round.
 - b. Hot Water: 1-1/2 inches square.
 - 2. Valve-Tag Color:
 - a. Cold Water: Blue.
 - b. Hot Water: Orange.
 - 3. Letter Color:
 - a. Cold Water: Black.
 - b. Hot Water: Black
- 3.5 WARNING-TAG INSTALLATION
 - A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION

SECTION 22 0716 PLUMBING INSULATION

PART 1- GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- This Section includes plumbing insulation for equipment and pipe, including the following: Α. 1.
 - Insulation Materials:
 - a. Cellular glass.
 - Flexible Elastomeric. h
 - 2. Adhesives.
 - 3. Mastics.
 - 4. Sealants.
 - 5. Factory-applied jackets.
 - 6. Field-applied tape.
 - 7. Field-applied jackets.
 - Securements. 8.

Β. Related Sections include the following:

- Specification Section "Hangers and Supports" for high-density inserts at hangers; 1. wood inserts at hangers are not acceptable.
- 2. Specification Section "Special Conditions for All Plumbing Work".
- Specification Section "Basic Plumbing Materials and Methods". 3
- Not all items listed within this specification are used. Use only items applicable per C. application schedule.

1.3 DEFINITIONS

- Α. ASJ: All-service jacket.
- Β. CONCEALED: Covered or concealed by a ceiling (gypsum or lay-in acoustical tile) or wall.
- C. EXPOSED: Open to view; not concealed by a ceiling or wall of any sort.
- D. FSK: Foil, scrim, kraft paper.
- Ε. UNDERFLOOR: Accessible crawl space beneath lowest floor level (considered "outdoors").

1.4 SUBMITTALS

- Α. Product Data: For each type of product indicated, identify thermal conductivity, thickness, and jackets (both factory and field applied, if any). Provide submittal data on all products to be used.
- 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, and cement material containers, with appropriate markings of applicable testing and inspecting agency.
 - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.
- B. All products to be stored in a dry location, protected from the elements. All damaged insulation to be replaced.

1.7 COORDINATION

- A. Coordinate size and location of supports, hangers, and high-density insulation inserts and shields specified in Specification Section "Hangers and Supports." Coordinate with drawing details where applicable; wood inserts at hangers are not acceptable.
- B. Coordinate clearance requirements with piping Installer for piping insulation application, and equipment Installer for equipment insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.8 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.
- C. Insulation not to be installed until building is dried in.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 INSULATION MATERIALS

- A. Refer to Part 3 schedule articles for requirements about where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Flexible Elastomeric:
 - 1. Products:
 - a. Aeroflex USA Inc.; Aerocel.
 - b. Armacel LLC; AP Armaflex.
 - 2. Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.
 - 3. Minimal thermal conductivity at 75° F of 0.25 (Btu.in/hr.ft². F.)
- G. Fire Rated Wrap
 - 1. Manufacturers:
 - a. 3M
 - b. Specialty Products and Insulation Co.
 - 2. Insulation Materials: Fire rated fiber wrap insulation: 1-1/2 inch thick low bio-persistent Alka-line Earth Silicate fiber with melting point at 2200 degrees F. jacket shall be foil faced (one side) Kraft fiber paper with a concealed reinforcing scrim. (FSK) One hour rating with 1-layer of wrap, 3 inches to combustibles. Two hour rating with 2 layers of wrap, 0 inch to combustibles.
 - 3. Accessories and Attachments:
 - a. Glass Cloth and Tape: Comply with MIL-C-20079H, Type I for cloth and Type II for tape. Woven glass-fiber fabrics, plain weave, presized a minimum of 8 oz./sq.yd.
 - 1) Tape Width: 4 inches.
 - b. Bands: 3/4 inch wide, in one of the following materials compatible with jacket.
 1) Stainless Steel: ASTM A 666, Type 304; 0.020 inch thick.
 - c. Insulation Anchor Pings and Speed Washers: Galvanized steel plate, pin and washer manufactured for attachment to duct by weld. Pin length sufficient for insulation thickness indicated.
 - d. Vapor Retarders: Mastics: Materials recommended by insulation material manufacturers that are compatible with insulation materials, jackets, and substrates.
 - 4. Secured per manufacturer's requirements and AHJ.

2.3 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated. All products are to contain low V.O.C. as defined/governed by LEED IEQ 4.1 and 4.2 (Regardless of project type).
- B. Cellular-Glass, Solvent-based resin adhesive, with a service temperature range of minus 75 to plus 300 deg F.
 - 1. Products:

- a. Foamglas: Pittseal 444N or equal
- C. Flexible Elastomeric: Comply with MIL-A-24179A, Type II, Class I.
 - Products: a. K-Flex: 720 LVOC or equal
- D. Metal Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
 - 1. Products:
 - a. Design Polymerics, DP2502 (or approved equal).

2.4 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II. All products are to contain low V.O.C. as defined/governed by LEED IEQ 4.1 and 4.2 (Regardless of project type).
- B. Vapor-Barrier Mastic: Water based; suitable for outdoor use on below ambient services, or indoor vapor barrier use.
 - 1. Products:
 - a. Childers Products, Division of ITW; CP-35.
 - 2. Water-Vapor Permeance: ASTM F 1249, 0.09 perm at 55-mils film thickness.
 - 3. Service Temperature Range: Minus 20 to plus 190 deg F.
 - 4. Solids Content: ASTM D 1644, 60 percent by volume and 73 percent by weight.
 - 5. Color: White.
 - 6. VOC: 36 g/l.

2.5 SEALANTS

- A. Joint Sealants:
 - 1. Joint Sealants for Cellular-Glass Products:
 - a. Pittsburgh Corning Corporation; Pittseal 444N.
 - 2. Joint Sealant for Phenolic Products
 - a. Foster 95-50
- B. Metal Jacket:
 - 1. Products:
 - a. Foster 95-44 or equal.
 - b. Childers Products, Division of ITW; CP-76.
- C. Mineral Fiber:
 - 1. Design Polymerics DP 2502.
 - 2. Childers Products, Division of ITW; CP-35.
- D. PVC Jacket:
 - 1. Childers Products, Division of ITW; CP-35.

2.6 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
 - 1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
 - 2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.

3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.7 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, 25/50 ASTM-F 84, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
 - 1. Products:
 - a. Johns Manville; Zeston.
 - b. Proto PVC Corporation; LoSmoke.
 - 2. Adhesive: As recommended by jacket material manufacturer.
 - 3. Color: White:
 - 4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
 - a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.
 - 5. Factory-fabricated tank heads and tank side panels.
- C. Metal Jacket:
 - 1. Products:
 - a. Childers Products, Division of ITW; Metal Jacketing Systems.
 - b. PABCO Metals Corporation; Surefit.
 - c. RPR Products, Inc.; Insul-Mate.
 - 2. Aluminum Jacket: Comply with ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105 or 5005, Temper H-14.
 - a. Factory cut and rolled to size.
 - b. Finish and thickness are indicated in field-applied jacket schedules.

2.8 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136 and UL listed.
 - 1. Width: 3 inches.
 - 2. Thickness: 14.0 mils.
 - 3. Adhesion: 73 ounces force/inch in width.
 - 4. Elongation: 2 percent.
 - 5. Tensile Strength: 55 lbf/inch in width.
 - 6. Color: White
- B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136 and UL listed.
 - 1. Width: 3 inches.
 - 2. Thickness: 13 mils.
 - 3. Adhesion: 73 ounces force/inch in width.
 - 4. Elongation: 2 percent.
 - 5. Tensile Strength: 40 lbf/inch in width.
 - 6. Color: Silver

2.9 SECUREMENTS

- A. Bands:
 - 1. Products:

- a. Childers Products; Bands.
- 2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 316; 0.015 inch thick, 3/4 inch wide with wing or closed seal.
- 3. Aluminum: ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch with wing or closed seal.
- 4. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.
- B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.
 - 1. Verify that systems and equipment to be insulated have been tested and are free of defects.
 - 2. Verify that surfaces to be insulated are clean and dry.
 - 3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application. For Stainless Steel; apply a corrosion coating to insulated surfaces with an epoxy primer and an epoxy finish 5 mils thick.
- B. Verify and coordinate insulation installation with the systems and trades installing heat tracing. Comply with requirements for heat tracing that applies to insulation.

3.3 COMMON INSTALLATION REQUIREMENTS

- A. Requirements in this Article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. 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
- C. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment, and pipe system as specified in insulation system schedules.
- D. 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.
- E. Install high-density inserts at hanger locations prior to insulating; wood or block inserts are not acceptable
- F. Do not weld brackets, clips, pins or other attachment devices to piping, fittings, tanks, coils, equipment, vessel, and specialties.
- G. Keep insulation materials clean and dry before, during application, and finishing.

- H. Install insulation with tight longitudinal seams and end joints, with least number of joints practical.
- I. Install insulation so that material is not over compressed.
- J. Seal all joints, and seams, including penetrations in insulation, at supports, and other projections with insulation of same material overlapped by 2". Secure strips with outward clinching staples along both edges of strip, (spaced 1 inch on center) and seal entire joint or seam with mastic.
- K. Do not insulate, conceal, or enclose pipe hangers, channel and steel supports, etc. not directly fasten to duct.
- L. 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.
- M. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses. Do not water down products unless directed by manufacture. Use clean potable demineralized water when required.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair all damage insulation prior to concealment as noted above.
- P. Do not insulation or conceal vibration-control devices, labels, stamps, nameplates, data plates, manholes, cleanouts, etc. require for maintenances.
- Q. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarded integrity, unless otherwise indicated.
- R. Insulate pipe elbows, tees, valves, strainers, flanges, etc., using preformed fitting insulation, mitered fittings or oversized preformed pipe insulation made from same material thickness and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, voids, and irregular surfaces with insulating mastic finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation. Provide a removable reusable insulation cover; design that maintains vapor barrier. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts.
- S. Cover segmented insulated surfaces with a layer of finishing mastic prior to jacket installation.
- T. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Secure PVC covers to adjoining insulation facing using staples and ASJ tape. Seal PVC fitting covers with mastic.
- U. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. Shape insulation at these connections by tapering it to and around the connection with insulating adhesive and finish with finishing mastic. All connections are to be accessible.
- V. Install removable insulation segment and covers at flanges, valves, controls, unions, equipment access doors, manholes, hand holes, and other elements that require frequent removal for service and inspection. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.4 PENETRATIONS

- A. Install insulation continuously through all walls, floors, and partitions penetrations and sleeves.
- B. Extend jacket of outdoor installation into wall and roof jacks by 2 inches. Seal jacket to roof flashing with approved flashing sealant.
- C. Insulation Installation at Below-Grade Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with approved flashing sealant.

3.5 GENERAL PIPE INSULATION INSTALLATION

- A. Preformed Pipe Insulation Installation on Pipe, Fittings, Valves, Flanges, Tanks, Elbows, and Appurtenances for Cellular- Glass, Mineral- Fiber, Flexible Elastomeric, and Phenolic insulations:
 - 1. Install insulation in a manner that secures material to system being insulated with staples, tape and mastic.
 - 2. When insulation with preformed pipe insulation, seal all longitudinal seams, end joints, and protrusions with manufacturers recommended tape matching jacket, vapor-barrier mastic, joint sealant, and adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
 - 3. Secure fittings, jacket, cover, etc. with tape matching jacket and secure with outward clinched staples 1 inch on center. Apply vapor-barrier mastic over staples.
 - 4. Arrange insulation to permit access to valves packing, flanges, unions, etc. and valve operation for maintenance without disturbing insulation. Install insulation so that it can be removed without damage to surrounding insulation or access enclosure.
 - 5. Pipe hangers are not to be concealed in insulation.
 - 6. Seal all exposed insulation ends with mastic.
 - 7. Seal all mitered joints prior to installing covers with vapor-barrier mastic.
 - 8. Install preformed pipe insulation to outer diameter of pipe flange.
 - 9. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 - 10. Fill voids between inner circumference of valves, flange, elbows, and bolts insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
 - 11. Install preformed sections of same material insulation when available. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Install PVC cover over fitting or mitered section.
 - 12. Arrange insulation to permit access to valves packing, flanges, unions, etc. and valve operation for maintenance without disturbing insulation. Install insulation so that it can be removed without damage to surrounding insulation or access enclosure.

3.6 GENERAL BLANKET INSULATION INSTALLATION (IN ADDITION TO COMMON REQUIREMENTS)

- A. Blanket Insulation Installation on Pipes, Drains, Tanks, Vessels, Elbows, and Appurtenances:
 - 1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for a minimum of 50 percent coverage of insulated surface and 100 percent coverage of equipment, tanks, etc.; to secure insulation to surfaces. Apply adhesive to entire circumference of all surfaces; including fittings and transitions.
 - 2. Install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from 1 edge and 1 end of insulation

segment. Secure laps to adjacent insulation section with 3/4-inch outward-clinching staples, 1 inch on center. Coat all seams/joints with mastic.

- 3. Repair punctures, tears, penetrations and protrusions with 6-inch-wide strips of same material used to insulate duct. Seal all seams with staples, cover with mastic and cover with embedded fiberglass reinforced mesh, cover mesh with finish coat of mastic.
- 4. Do not conceal hangers beneath/under insulation.
- 5. Insulation termination: Butt insulation up to termination point. Apply mastic no less than 3" overlap on insulation, and 3" on metal surface.

3.7 FIELD-APPLIED JACKET INSTALLATION

A. Install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Apply two continuous beads of sealant to seams and joints, one bead under lap and the finish bead along seam and joint edge. Secure metal jacket with stainless-steel bands 12 inches on center and at end joints.

3.8 FINISHES

- A. Equipment, and Pipe Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in painting Sections (if applicable).
 - 1. Flat Acrylic Finish: Two (2) finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
 - a. Finish Coat Material: Interior, flat, latex-emulsion size.
- B. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
- C. Do not field paint aluminum or stainless-steel jackets.

3.9 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
 - 1. Inspect insulated pipe, and equipment, randomly selected by Engineer, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to two (3) location(s) for each system.
 - 2. All insulation applications will be considered defective work if sample inspection reveals noncompliance with requirements.
 - 3. Remove all defective work and install new insulation and jackets to replace insulation and jackets removed for inspection. Repeat inspection procedures as needed.

3.10 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
 1. Fire-suppression piping.
 - 2. Drainage piping located in crawl spaces.
 - 3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.11 INDOOR PIPING INSULATION SCHEDULE

- Α. Domestic Hot and Recirculated Hot Water:
 - Concealed Locations: 1
 - All Pipe Sizes: Insulation shall be any of the following: a.
 - Mineral Fiber Preformed: Type 1: 1-inch thick. 1)
 - Phenolic (2.5 lb/ft³), 1-inch thick. 2)
 - 3) Cellular Glass: 1-1/2 inches thick.
 - 2. Exposed Locations: (including inside mechanical rooms):
 - All Pipe Sizes: Insulation shall be any of the following: а
 - Phenolic (3.5 lb/ft³), 1-inch thick. 1)
 - 2) Cellular Glass: 1-1/2 inches thick.
 - 3) Mineral Fiber Preformed: Type 1: 1-inch thick.
- Condensate, Equipment Drain, Floor Drains, Traps and Waste Water below 60 Deg F: Β.
 - All PVC Piping exposed to and in a Return Air Plenum: Insulation shall be any of the 1. following:
 - Fire rated wrap. a.

2.

1.

- All Other Pipe: Insulation shall be any of the following:
 - Cellular Glass: 1-1/2 inches thick. a.
 - Phenolic (2.5 lb/ft³): 1-1/2 inches thick. b.
- C. Sanitary Waste & Vent; Domestic Waterpiping:
 - All PVC Piping exposed to and in a Return Air Plenum: Insulation shall be any of the 1. followina:
 - Fire rated wrap. a.
- 3.12 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE (ATTIC AND CRAWL SPACE INCLUDED)
 - Domestic Cold, Hot and Recirculated Hot Water: Α.
 - All Pipe Sizes: Insulation shall be any of the following:
 - Preinsulated Pipe: 1-1/2" thick (underfloor, outdoors and buried) a.
 - Cellular Glass: 2 inches thick (outdoors, not acceptable indoors) b.
 - Phenolic (5 lb/ft³): 2 inches thick (outdoors, not acceptable indoors) c.
 - Mineral Fiber Preformed, Type 1: 1-1/2 inch thick (uninsulated Attic space) d.
 - Condensate, Equipment Drain, Floor Drains, Traps and Waste Water below 60 Deg. F: Β. 1.
 - All Pipe Sizes: Insulation shall be any of the following:
 - Cellular Glass: 1-1/2 inches thick a.
 - b. Phenolic (5 lb/ft³): 1-1/2 inches thick
 - C. Fire Protection:
 - All Pipe Sizes: Insulation shall be any of the following: 1
 - Cellular Glass: 1-1/2 inches thick а
 - b. Phenolic (5 lb/ft³): 1-1/2 inches thick

3.13 INSIDE EXTERIOR WALL PIPING INSULATION SCHEDULE

- Α. Domestic Cold, Hot and Recirculated Hot Water:
 - All Pipe Sizes: Insulation shall be any of the following: 1.
 - a. Cellular Glass: 1-1/2 inches thick
 - b. Phenolic (2.5 lb/ft³): 1 inch thick
 - Mineral Fiber Preformed, Type 1: 1 inch thick, coat entire ASJ jacket with vapor C. mastic
- Condensate, Equipment Drain, Floor Drains, Traps and Waste Water below 60 Deg. F: Β.
 - All Pipe Sizes: Insulation shall be any of the following: 1.

- a. Cellular Glass: 1-1/2 inches thick
- b. Phenolic (2.5 lb/ft³): 1-1/2 inches thick
- C. Fire Protection:
 - 1. All Pipe Sizes: Insulation shall be any of the following:
 - a. Cellular Glass: 1-1/2 inches thick
 - b. Phenolic (2.5 lb/ft³): 1-1/2 inches thick

3.14 FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. Piping exposed in finish interior areas, outdoors, in underfloor, mechanical rooms:
 1. Aluminum, Stucco Embossed: 0.016 inch thick.
- C. Indoor piping fitting or elbows:
 - 1. PVC: (0.015 inch thick).

END OF SECTION

SECTION 22 1116 DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Under-building slab and aboveground domestic water pipes, tubes, fittings, and specialties inside the building.
 - 2. Encasement for piping.

1.3 SUBMITTALS

- A. Product Data: For the following products:
 - 1. Piping and fittings.
- B. Field quality-control reports.

1.4 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency. Origin of product to be domestic. No imported product will be acceptable.
- B. Comply with NSF 14 for plastic, potable domestic water piping and components. Include marking "NSF-pw" on piping.
- C. Comply with NSF 61 for potable domestic water piping and components.

1.5 PROJECT CONDITIONS

- A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:
 - 1. Notify Owner no fewer than two days in advance of proposed interruption of water service.
 - 2. Do not proceed with interruption of water service without Owner's written permission.

PART 2 - PRODUCTS

- 2.1 PIPING MATERIALS
 - A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 COPPER TUBE AND FITTINGS

- A. Hard Copper Tube: ASTM B 88, Type L or K water tube, drawn temper.
 - 1. Copper Pressure Fittings: ASME B16.18, cast copper-alloy or ASME B16.22, wroughtcopper, solder fittings.
- B. Soft Copper Tube: ASTM B 88, Type L or K water tube, annealed temper.
 - 1. Copper Pressure Fittings: ASME B16.18, cast copper-alloy or ASME B16.22, wroughtcopper, solder fittings.

2.3 NIPPLES

- A. Brass Nipple: ASTM B687-88
 - 1. Threads: NPT (Federal Services Handbook H-28)
 - 2. Potable use.

2.4 UNIONS

- A. Factory-fabricated, brass or bronze union assembly, for 150-psig minimum working pressure at 180 deg F, ASTM B687-88
- B. End Connections: Solder-joint copper alloy and / or threaded ferrous.
- C. Potable use.

2.5 FLANGES

- A. Factory-fabricated, bronze union assembly, for 150-psig minimum working pressure at 180 deg F, ASME B16.24, Class 150.
- B. End Connections: Solder-joint copper alloy and / or threaded ferrous.
- C. Potable use.
- D. All bolts to be 316 stainless steel (Class 150).

2.6 PIPING JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free, unless otherwise indicated; full-face or ring type unless otherwise indicated.
- B. Solder Filler Metals: ASTM B 32, 95/5 lead-free alloys. Include water-flushable and soluble flux according to ASTM B 813.
- C. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for generalduty brazing unless otherwise indicated.

2.7 ENCASEMENT FOR PIPING

- A. Standard: ASTM A 674 or AWWA C105.
- B. Form: Tube.

- C. Material: LLDPE film of 0.008-inch minimum thickness or high-density, cross-laminated PE film of 0.004-inch minimum thickness.
- D. Color: Black or blue.

2.8 TRANSITION FITTINGS

- A. General Requirements:
 - 1. Same size as pipes to be joined.
 - 2. Pressure rating at least equal to pipes to be joined.
 - 3. End connections compatible with pipes to be joined.
- B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
- C. Sleeve-Type Transition Coupling: AWWA C219.
 - Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Cascade Waterworks Manufacturing.
 - b. Dresser, Inc.; Dresser Piping Specialties.
 - c. Ford Meter Box Company, Inc. (The).
 - d. JCM Industries.
 - e. Romac Industries, Inc.
 - f. Smith-Blair, Inc; a Sensus company.
 - g. Viking Johnson; c/o Mueller Co.
- D. Plastic-to-Metal Transition Fittings:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Charlotte Pipe and Foundry Company.
 - b. Harvel Plastics, Inc.
 - c. Spears Manufacturing Company.
 - 2. Description: CPVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert and one solvent-cement-socket end.
- E. Plastic-to-Metal Transition Unions:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Colonial Engineering, Inc.
 - b. NIBCO INC.
 - c. Spears Manufacturing Company.
 - 2. Description: CPVC four-part union. Include brass threaded end, solvent-cement-joint plastic end, rubber O-ring, and union nut.

PART 3 - EXECUTION

- 3.1 PIPING INSTALLATION
 - A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
 - B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."

- C. Install underground copper tube in PE encasement according to ASTM A 674 or AWWA C105.
- D. Provide and install shutoff valve, strainer, pressure reducing valve, hose-end drain valve, pressure gage, and test tee with valve, inside the building at each domestic water service entrance. Comply with requirements in Section "Meters and Gages" for pressure gages and Section "Domestic Water Piping Specialties" for drain valves and strainers.
- E. Install domestic water piping level and plumb.
- F. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
- G. 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.
- H. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
- I. Install piping adjacent to equipment and specialties to allow service and maintenance.
- J. Install piping to permit valve servicing.
- K. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than system pressure rating used in applications below unless otherwise indicated.
- L. Install piping free of sags and bends.
- M. Install fittings for changes in direction and branch connections.
- N. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty valves.
- O. All pipe nipples to be brass.

3.2 JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- C. Brazed Joints: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Brazed Joints" Chapter.
- D. Soldered Joints: Apply ASTM B 813, water-flushable flux to end of tube. Join and prepare/clean copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."
- E. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.
- F. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.
- G. All piping is to be cleaned prior to concealment.

3.3 TRANSITION FITTING INSTALLATION

- A. Install transition couplings at joints of dissimilar piping.
- B. Transition Fittings in Underground Domestic Water Piping:
 - 1. NPS 2 and Smaller: Fitting-type coupling.
 - 2. NPS 2-1/2 and Larger: mechanical joint-type coupling.
- C. Transition Fittings in Aboveground Domestic Water Piping NPS 2 and Smaller: Plastic-tometal transition unions.

3.4 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment and machines to allow service and maintenance.
- C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.
- D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to all equipment.

3.5 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 engineer and authorities having jurisdiction
 - 2. During installation, notify engineer and authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of engineer and authority 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 engineer and authority having jurisdiction to observe tests specified below and to ensure compliance with requirements.
 - 3. Reinspection: If the engineer or authority having jurisdiction finds 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 engineer and authority 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 new piping and parts of existing 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 new, altered, extended, or replaced 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.

3.6 CLEANING

- A. Clean and disinfect potable domestic water piping as follows:
 - 1. Purge new piping and parts of existing piping that have been altered, extended, or repaired 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 (50 mg/L) 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 (200 mg/L) 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.
- B. Clean non-potable domestic water piping as follows:
 - 1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
 - 2. Use purging procedures prescribed by authorities having jurisdiction or; if methods are not prescribed, follow procedures described below:
 - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
- C. Prepare and submit reports of purging and disinfecting activities.
- D. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.7 PIPING SCHEDULE

- A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
- B. Flanges and unions to be provided and installed at all equipment connections and appurtenances.
- C. Under-building-slab, domestic water, building service and distribution piping, NPS 2 and smaller, shall be the following:
 - 1. Soft copper tube, ASTM B 88, Type K; (continuous, no joints under slab.)
- D. Under-building-slab, domestic water, building-service piping, NPS 2-1/2 and larger, shall be the following (see detail for additional requirements):
 - 1. Hard copper tube, ASTM B 88, Type K; wrought- copper brazed-joint fittings and joints.
 - 2. Mechanical-joint, ductile iron pipe; standard-pattern mechanical-joint fittings; and mechanical joints.

- E. Aboveground domestic water piping, all sizes, shall be the following:
 - 1. Hard copper tube, ASTM B 88, Type L; cast- or wrought- copper solder-joint fittings; and soldered joints.
- F. Underfloor domestic water piping shall be the following:
 - 1. Hard copper tube, ASTM B 88, Type L; cast- or wrought- copper solder-joint fittings; and soldered joints.
 - 2. Pre-insulated copper pipe. (Hot and Recirculated water only)

END OF SECTION

SECTION 22 1119 DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following domestic water piping specialties:
 - 1. Vacuum breakers.
 - 2. Balancing valves.
 - 3. Temperature-actuated water mixing valves.
 - 4. Strainers.
 - 5. Water hammer arresters (shock arrestors).
 - 6. Trap-seal primer valves.
 - 7. Flexible connectors.

1.3 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig unless otherwise indicated.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Field quality-control test reports.
- D. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. NSF Compliance:
 - 1. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic domestic water piping components.
 - 2. Comply with NSF 61, "Drinking Water System Components Health Effects; Sections 1 through 9."

PART 2 - PRODUCTS

2.1 VACUUM BREAKERS

- A. Pipe-Applied, Atmospheric-Type Vacuum Breakers :
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Ames Co.
 - b. Conbraco Industries, Inc.
 - c. FEBCO; SPX Valves & Controls.
 - d. Watts Industries, Inc.; Water Products Div.
 - e. Woodford Manufacturing Company.
 - f. Zurn Plumbing Products Group; Wilkins Div.
 - 2. Standard: ASSE 1001.
 - 3. Size: NPS 1/4 to NPS 3, as required to match connected piping.
 - 4. Body: Bronze.
 - 5. Inlet and Outlet Connections: Threaded.
 - 6. Finish: Mechanical areas: Rough bronze. Finished areas: Chrome
- B. Hose-Connection Vacuum Breakers:
 - Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Conbraco Industries, Inc.
 - b. MIFAB, Inc.
 - c. Watts Industries, Inc.; Water Products Div.
 - d. Woodford Manufacturing Company.
 - e. Zurn Plumbing Products Group.
 - 2. Standard: ASSE 1011.
 - 3. Body: Bronze, non-removable, with manual drain.
 - 4. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
 - 5. Finish: Rough bronze.

2.2 BALANCING VALVES

1.

- A. Copper-Alloy Calibrated Balancing Valves:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Armstrong International, Inc.
 - b. ITT Industries; Bell & Gossett Div.
 - c. NIBCO INC.
 - d. Taco, Inc.
 - e. Watts Industries, Inc.; Water Products Div.
 - 2. Type: Y-pattern globe valve with two readout ports and memory setting indicator.
 - 3. Body: Bronze.
 - 4. Size: Same as connected piping, but not larger than NPS 2.
 - 5. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.
- B. Memory-Stop Balancing Valves:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Conbraco Industries, Inc.
 - b. Milwaukee Valve Company.
 - c. NIBCO INC.
 - 2. Standard: MSS SP-110 for two-piece, copper-alloy ball valves.

- 3. Pressure Rating: 400-psig minimum CWP.
- 4. Size: NPS 2 or smaller.
- 5. Body: Copper alloy.
- 6. Port: Standard or full port.
- 7. Ball: Chrome-plated brass.
- 8. Seats and Seals: Replaceable.
- 9. End Connections: Solder joint or threaded.
- 10. Handle: Vinyl-covered steel with memory-setting device.

2.3 TEMPERATURE-ACTUATED WATER MIXING VALVES

- A. Individual-Fixture, Water Tempering Valves:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Armstrong International, Inc.
 - b. Lawler Manufacturing Company, Inc.
 - c. Leonard Valve Company.
 - d. Powers; a Watts Industries Co.
 - e. Watts Industries, Inc.; Water Products Div.
 - f. Zurn Plumbing Products Group; Wilkins Div.
 - 2. Standard: ASSE 1016, thermostatically controlled water tempering valve.
 - 3. Pressure Rating: 125 psig minimum, unless otherwise indicated.
 - 4. Body: Bronze body with corrosion-resistant interior components.
 - 5. Temperature Control: Adjustable.
 - 6. Inlets and Outlet: Threaded.
 - 7. Finish: Rough or chrome-plated bronze.

2.4 STRAINERS FOR DOMESTIC WATER PIPING

- A. Y-Pattern Strainers:
 - 1. Pressure Rating: 125 psig minimum, unless otherwise indicated.
 - 2. Body: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or FDA-approved, epoxy coating and for NPS 2-1/2 and larger.
 - 3. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
 - 4. Screen: Stainless steel with round perforations, unless otherwise indicated.
 - 5. Perforation Size:
 - a. Strainers NPS 2 and Smaller: 0.033 inch.
 - b. Strainers NPS 2-1/2 to NPS 4: 0.062 inch.
 - 6. Drain: Factory-installed, hose-end drain valve.

2.5 WATER HAMMER ARRESTERS (SHOCK ARRESTORS)

- A. Water Hammer Arresters:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company.
 - b. MIFAB, Inc.
 - c. PPP Inc.
 - d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - e. Watts Drainage Products Inc.
 - f. Zurn Plumbing Products Group; Specification Drainage Operation.
 - 2. Standard: ASSE 1010 or PDI-WH 201.
 - 3. Type: Copper tube with piston.
 - 4. Size: ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.

2.6 TRAP-SEAL PRIMER VALVES (TRAP PRIMERS)

- A. Drainage-Type, Lavatory, Trap-Seal Primer Valves:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - 2. Standard: ASSE 1044, lavatory P-trap with NPS 3/8 minimum, trap makeup connection.
 - 3. Size: NPS 1-1/4 minimum.
 - 4. Material: Chrome-plated, cast brass.

2.7 FLEXIBLE CONNECTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Flex-Hose Co., Inc.
 - 2. Metraflex, Inc.
- B. Stainless-Steel-Hose Flexible Connectors: Corrugated-stainless-steel tubing with stainlesssteel wire-braid covering and ends welded to inner tubing.
 - 1. Working-Pressure Rating: Minimum 200 psig.
 - 2. End Connections: Flanged.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.
 - 1. Locate backflow preventers in same room as connected equipment or system.
 - 2. Install drain for backflow preventers with atmospheric-vent drain connection with airgap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe to floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are not acceptable for this application.\
 - 3. Install backflow preventers at 42-in above finished floor in an accessible location, preferably on a wall with galvanized steel channel and pipe strap support.
 - 4. Do not install bypass piping around backflow preventers.
 - 5. Provide and install threaded brass plugs for all test ports.
- B. Install balancing valves in locations where they can easily be adjusted.
- C. Install temperature-actuated water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.
 - 1. Install water mixing valves at 42-in above finished floor in an accessible location, preferably on a wall with galvanized steel channel and pipe strap support.
 - 2. Install thermometers and water regulators if specified.
 - 3. Install cabinet-type units recessed in or surface mounted on wall as specified.
- D. Install Y-pattern strainers for water on supply side of each water pressure-reducing valve, solenoid valve, and pump.
- E. Install outlet boxes recessed in wall. Install 2-by-4-inch fire-retardant-treated-wood blocking wall reinforcement between studs. Fire-retardant-treated-wood blocking is specified in Division 06 Section "Rough Carpentry."

- F. Install water hammer arresters in water piping according to PDI-WH 201 and applicable drawing details.
- G. Install trap-seal primer valves without dedicated isolation valves; supply from nearest branch serving an occupant-use plumbing fixture. System style trap primer to have isolation valve.
- H. Install supply- and drainage-type, trap-seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.
- I. Install trap-seal primer systems with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust system for proper flow. Install unit at a minimum of 36" AFF.
- J. Provide and install a calibrated balancing valve in each hot-water circulation return loop. Verify that system flowrate is set and matches drawing requirements.

3.2 FLEXIBLE CONNECTOR INSTALLATION

A. Install flexible connectors in suction and discharge manifold connections to each domestic water booster pump.

3.3 FIELD QUALITY CONTROL

- A. Perform the following tests and prepare test reports:
 - 1. Test and certify each backflow assembly according to authorities having jurisdiction and the device's reference standard.
- B. Remove and replace malfunctioning domestic water piping specialties and retest as specified above.

3.4 ADJUSTING

- A. Set field-adjustable pressure set points of water pressure-reducing valves.
- B. Set field-adjustable flow set points of balancing valves.
- C. Set field-adjustable temperature set points of temperature-actuated water mixing valves.
- D. Open throttling valves to proper setting.
- E. Verify (by instrument flow testing) that auto-flow balancing valves in hot-water-circulation return piping are flowing specified gpm.
- F. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
- G. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide flow of hot water in each branch.
- H. Check plumbing specialties and verify proper settings, adjustments, and operation.

END OF SECTION

SECTION 22 1317 SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following for soil, waste, and vent piping inside the building:
 - 1. Pipe, tube, and fittings.
 - 2. Special pipe fittings.

1.3 DEFINITION

- A. Condensate Piping: Drainage piping that indirectly conveys clear-water condensate from air conditioning and refrigeration equipment to the sanitary drainage system.
- B. Indirect Drainage Piping: Piping that conveys waste water from mechanical equipment, including cooling towers, evaporative coolers, evaporative condensers, chilled-water systems, etc., to the sanitary drainage system.
- C. EPDM: Ethylene-propylene-diene terpolymer rubber.
- D. LLDPE: Linear, low-density polyethylene plastic.
- E. NBR: Acrylonitrile-butadiene rubber.
- F. PE: Polyethylene plastic.
- G. PVC: Polyvinyl chloride plastic.
- H. TPE: Thermoplastic elastomer.

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. Product Data: For pipe, tube, fittings, and couplings.
- B. 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. Origin of product to be domestic. No imported product will be acceptable.

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; "NSF-drain" for plastic drain piping; "NSF-tubular" for plastic continuous waste piping; and "NSF-sewer" for plastic sewer piping.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

2.3 HUBLESS CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 888 and CISPI 301 and marked with the collective trademark of the CISPI and listed by NSF International.
- B. Shielded Couplings: ASTM C 1277 assembly of metal shield or housing, corrosion-resistant fasteners, and rubber sleeve with integral, center pipe stop.
 - 1. Heavy-Duty, Shielded, Stainless-Steel Couplings: ASTM C 1540, with stainless-steel shield, stainless-steel bands and tightening devices, and ASTM C 564, rubber sleeve. Coupling shall be listed by NSF International.
 - a. Manufacturers:
 - 1) ANACO.
 - 2) Clamp-All Corp.
 - 3) Ideal Div.; Stant Corp.
 - 4) Mission Rubber Co.
 - 5) Tyler Pipe; Soil Pipe Div.

2.4 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 74, Extra-Heavy or Service class and marked with the collective trademark of the CISPI and listed by NSF International.
- B. Gaskets: ASTM C 564 and ASTM C 1563, rubber.
- C. Caulking Materials: ASTM B 29, pure lead and oakum or hemp fiber.

2.5 PVC PIPE AND FITTINGS

- A. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.
 - 1. PVC Socket Fittings: ASTM D 2665, socket type, made to ASTM D 3311, drain, waste, and vent patterns.

PART 3 - EXECUTION

3.1 EXCAVATION

A. Refer to Specification Section "Earthwork" for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

- A. Flanges and unions shall be provided and installed at equipment connections and appurtenances.
- B. Above-floor, soil, waste and vent piping shall be any of the following:
 - 1. Solid-wall, Schedule 40, PVC pipe; PVC socket fittings; and solvent-cemented joints. (All locations, however, in Kitchens, PVC permitted above drain connection only)
- C. Underground, soil, waste, vent piping shall be any of the following:
 - 1. Extra-Heavy class, cast-iron soil piping, hub and spigot; and gasketed joints. (Required for use in Boiler Room, Kitchen and for Greasewaste)
- D. Above and below floor trap primer drainage piping shall be any of the following:
 - 1. Hard copper tube, ASTM B 88, Type L; cast- or wrought- copper solder-joint fittings; and soldered joints.
 - 2. All underslab piping to be wrapped in 6 mil poly-sleeve.

3.3 PIPING INSTALLATION

- A. Condensate shall be indirectly discharged into the sanitary drainage system through a 2-inch air gap (into a floor drain or hub drain) and shall not be directly connected (hard piped).
- B. Indirect drainage piping shall be discharged into the sanitary drainage system through a 2inch air gap (into a floor or hub drain) and shall not be directly connected (hard piped).
- C. Provide clean outs as indicated on drawings and per local codes.
- D. Lead fittings are not acceptable.
- E. Sanitary sewer piping outside the building is specified in Specification Section "Sanitary Sewerage."
- F. Basic piping installation requirements are specified in Plumbing Specification Section "Basic Plumbing Materials and Methods."
- G. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Sleeves and mechanical sleeve seals are specified in Plumbing Specification Section "Basic Plumbing Materials and Methods."
- H. Install sleeves for all pipes passing through walls and concrete floors. Refer to Plumbing Specification Section "Basic Plumbing Materials and Methods" for requirements.
- I. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings." Lead fittings are not acceptable.
- J. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use fixture

fittings if 2 fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 135 degrees without the installation of a cleanout. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

- K. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.
- L. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:
 - 1. Building Sanitary Drain: 2 percent downward in direction of flow for all piping.
 - 2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
 - 3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
- M. Install engineered soil and waste drainage and vent piping systems as follows:
 1. Combination Waste and Vent: Comply with standards of authorities having jurisdiction.
- N. Do not enclose, cover, or put piping into operation until it is inspected and approved by engineer and authorities having jurisdiction.

3.4 JOINT CONSTRUCTION

- A. Basic piping joint construction requirements are specified in Plumbing Specification Section "Basic Plumbing Materials and Methods."
- B. Join hubless cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.
- C. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
- D. Solder Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

3.5 VALVE INSTALLATION

- A. Provide and install backwater valves in sanitary main entering the building where the top of the manhole is at a higher elevation than the finished floor of the first floor.
- B. Backwater Valves:
 - 1. Horizontal Piping: Horizontal backwater valves. Use normally closed type, unless otherwise indicated.
 - 2. Install backwater valves in accessible locations.

3.6 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties. Contractor is responsible for coordination with all other trades.
- B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

- C. Connect drainage and vent piping to the following:
 - 1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
 - 2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
 - 3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
 - 4. Equipment: Connect drainage piping as indicated. Provide shutoff valve, if indicated, and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 and larger.
 - 5. Stainless steel flanges required at water fixture drain connection.

3.7 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 engineer and authorities having jurisdiction.
 - 1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closingin after roughing-in and before setting fixtures.
 - 2. Final Inspection: Arrange for final inspections by engineer and authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Re-inspection: If engineer or 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 engineer and authorities having jurisdiction.
- D. Test sanitary drainage and vent piping as follows:
 - 1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
 - 2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 - 3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
 - 4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg. Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
 - 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 required corrective action.

3.8 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.

END OF SECTION

SECTION 22 1319 DRAIN PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following sanitary drainage piping specialties:
 - 1. Cleanouts.
 - 2. Floor drains.
 - 3. Miscellaneous sanitary drainage piping specialties.

1.3 DEFINITIONS

A. PVC: Polyvinyl chloride plastic.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and accessories.
- B. Field quality-control test reports.
- C. Operation and Maintenance Data: For drainage piping specialties to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic sanitary piping specialty components.

1.6 COORDINATION

- A. Coordinate size and location of concrete bases for outdoor cleanouts.
- B. Coordinate size and location of roof penetrations and flashing requirements with architectural.

PART 2 - PRODUCTS

2.1 MATERIALS AND WORKMANSHIP

- A. All materials, unless otherwise specified, shall be 51% manufactured in the United States, new, free from all defects, and of the best quality. Foreign goods specifically approved for use by the Owner's Representative prior to bidding may be furnished.
- B. 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 present a neat, precise appearance.

2.2 CLEANOUTS

- A. Exposed Metal Cleanouts:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company; Josam Div.
 - b. MIFAB, Inc.
 - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - d. Tyler Pipe; Wade Div.
 - e. Watts Drainage Products Inc.
 - f. Zurn Plumbing Products Group; Specification Drainage Operation.
 - 2. Standard: ASME A112.36.2M for cast iron cleanout test tee.
 - 3. Size: Same as connected drainage piping
 - 4. Body Material: Hubless, cast-iron soil pipe test tee as required to match connected piping.
 - 5. Closure: Countersunk or raised-head, brass plug.
 - 6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
- B. Metal Floor Cleanouts:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company; Josam Div.
 - b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - c. Tyler Pipe; Wade Div.
 - d. Watts Drainage Products Inc.
 - e. Zurn Plumbing Products Group; Light Commercial Operation.
 - f. Zurn Plumbing Products Group; Specification Drainage Operation.
 - 2. Standard: ASME A112.36.2M for threaded, adjustable housing cleanout.
 - 3. Size: Same as connected branch.
 - 4. Type: Threaded, adjustable housing.
 - 5. Body or Ferrule: Cast iron.
 - 6. Clamping Device: Not required.
 - 7. Outlet Connection: Spigot.
 - 8. Closure: Brass plug with straight threads and gasket.
 - 9. Adjustable Housing Material: Cast iron with threads.
 - 10. Frame and Cover Material and Finish: Nickel-bronze, copper alloy.
 - 11. Frame and Cover Shape: Round.
 - 12. Top Loading Classification: Heavy Duty.
 - 13. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.
 - 14. Standard: ASME A112.3.1.
 - 15. Size: Same as connected branch.

2.3 FLOOR DRAINS

- A. Cast-Iron Floor Drains:
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on the drawing "Floor Drain Schedule" or a comparable product by one of the following:
 - a. Josam Company; Josam Div.
 - b. MIFAB, Inc.
 - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - d. Tyler Pipe; Wade Div.
 - e. Watts Drainage Products Inc.
 - f. Zurn Plumbing Products Group; Light Commercial Operation.
 - g. Zurn Plumbing Products Group; Specification Drainage Operation.
 - 2. Standard: ASME A112.6.3.
 - 3. Seepage Flange: Required.
 - 4. Anchor Flange: Required.
 - 5. Outlet: Bottom.
 - 6. Backwater Valve: Not required.
 - 7. Trap Pattern: Standard P-trap, unless otherwise indicated.
 - 8. Other Requirements: Refer to drawing schedule and provide full model equivalency.

2.4 ROOF FLASHING ASSEMBLIES

A. Roof Flashing Assemblies: Refer to architectural drawings and specifications for requirements.

2.5 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

- A. Floor-Drain, Trap-Seal Primer Fittings:
 - 1. Description: Cast iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
 - 2. Size: Same as floor drain outlet with NPS 1/2 side inlet.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Refer to Plumbing Specification Section "Basic Plumbing Materials and Methods" for piping joining materials, joint construction, and basic installation requirements.
- B. Provide and install cleanouts (in addition to those indicated on the drawings) in aboveground piping and building drain piping according to the following, unless otherwise indicated:
 - 1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
 - 2. Locate at each change in direction of piping greater than 135 degrees.
 - 3. Locate at maximum intervals of 50 feet for piping.
 - 4. Locate at base of each vertical soil and waste stack.
 - 5. Locate one cleanout for each restroom.
- C. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame anchored to reinforcement or studs and cover flush with finished wall.

- E. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.
 - 1. Position floor drains for easy access and maintenance.
 - 2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to architectural requirements.
 - 3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
 - 4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.
- F. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof.
- G. Assemble open drain fittings and install with top of hub 2 inches above floor.
- H. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.
 - 1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
 - 2. Size: Same as floor drain inlet.
 - 3. Connection to floor drain body is not acceptable.
- I. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.
- J. Install reinforcement for wall-mounting-type specialties.
- K. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Plumbing Specification Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.

3.3 FLASHING INSTALLATION

- A. Refer to architectural roofing drawings and specifications for requirements.
- B. Install flashing for piping passing through roofs with counter-flashing or commercially made flashing fittings, according to Specification Section "Sheet Metal Flashing and Trim."
- C. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.
- D. Fabricate and install flashing and pans, sumps, and other drainage shapes.

3.4 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
- B. Tests and Inspections:
 - 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.5 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION
SECTION 22 3300 ELECTRIC WATER HEATERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following electric water heaters:
 - 1. Commercial, storage electric water heaters.
 - 2. Compression expansion tanks.
 - 3. Water heater accessories.

1.3 SUBMITTALS

- A. Product Data: For each type and size of water heater indicated. Include rated capacities, operating characteristics, furnished specialties, and accessories. Submitted product to match specified/scheduled equipment including all options and appurtenances, in addition to specifications.
- B. Specification Compliance Review:
 - Manufacturers and bidders must provide the consulting engineer with a Compliance Review of the Specifications and Addenda's. The Compliance Review shall be a paragraph-by-paragraph review of the Specifications and schedule with the following information; "C", "D", or "E" marked in the margin of the original Specifications and any subsequent Addenda's. If the manufacturer or bidder does not provide the Compliance Review to the engineer for review, with the submittal, the submittal will be subject to rejection as non-compliant.
 - a. "C" Comply with no exceptions.
 - b. "D" Comply with deviations. For each and every deviation, provide a numbered footnote with reasons for the proposed deviation and how the intent of the Specification can be satisfied.
 - c. "E" Exception, do not comply. For each and every exception, provide a numbered footnote with reasons and possible alternatives. Non-compliance with the specifications is grounds for rejection as unacceptable. A bid from any alternative or listed equipment manufacturer with any number of exceptions will be reason for rejection for non-compliance without further review.
 - d. Unless a deviation or exception is specifically noted in the Compliance Review, the manufacturer shall provide full compliance with entire specification. Deviations or exceptions taken in letters or cover letters in a bid document, subsidiary documents, by omission or by contradiction do not release the manufacturer or bidder from being in complete compliance, unless the exception or deviation has been specifically noted in the Compliance Review and approved by the consulting engineer.
 - e. Equipment manufacturers or bidders that do not meet the specifications thru the above process will be subject to rejection without further review.
- C. Shop Drawings: Diagram power, signal, and control wiring.

- D. Product Certificates: For each type of commercial electric water heater, signed by product manufacturer.
 - 1. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - 2. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- E. Source quality-control test reports.
- F. Field quality-control test reports.
- G. Operation and Maintenance Data: For electric water heaters to include in emergency, operation, and maintenance manuals.
- H. Warranty: Special warranty specified in this Section.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain same type of electric water heaters through one source from a single manufacturer.
- B. Product Options: Drawings indicate size, profiles, and dimensional requirements of electric water heaters and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. ASME Compliance: Where indicated, fabricate and label commercial water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
- E. Comply with NSF 61, "Drinking Water System Components Health Effects; Sections 1 through 9," for all components that will be in contact with potable water.
- F. Origin of product to be domestic, no imported products will be acceptable.

1.5 COORDINATION

A. Coordinate size and location of concrete bases with Architectural and Structural Drawings.

1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of electric water heaters that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including storage tank and supports.
 - b. Faulty operation of controls.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal use.
 - 2. Warranty Period(s): From date of Substantial Completion:
 - a. Commercial Electric Water Heaters:
 - 1) Storage Tank: Six (6) years.
 - 2) Controls and Other Components: Three (3) years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

2.

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
- 2.2 COMMERCIAL ELECTRIC WATER HEATERS (50 THROUGH 120 GALLON)
 - A. Commercial, Storage Electric Water Heaters: Comply with UL 1453 requirements for storage-tank-type water heaters.
 - 1. Manufacturers:
 - a. Rheem Water Heater Div.; Rheem Manufacturing Company.
 - b. Smith, A. O. Water Products Company.
 - Storage-Tank Construction: steel vertical arrangement.
 - a. Tappings: 1-1/2" NPT factory fabricated of materials compatible with tank and piping connections. Attach tappings to tank before testing.
 - b. Pressure Rating: 150 psig.
 - c. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending lining material into tappings; high temperature porcelain enamel.
 - d. ASME rated tank per ASME Boiler and Pressure Vessel Code, Section IV Part HLW if specified on schedule.
 - 3. Factory-Installed Storage-Tank Appurtenances:
 - a. Anode Rod: Replaceable magnesium; two (2) anodes per tank.
 - b. Drain Valve: 3/4, 1/4 turn bronze ball valve, stainless steel ball and trim. 3/4 hose thread adaptor and cap.
 - c. Insulation: Comply with ASHRAE/IESNA 90.1; 3" rigid polyurethane foam insulation, non-CFC.
 - d. Jacket: Steel with enameled finish.
 - e. Heating Elements: Electric, screw-in immersion type; stainless steel. Minimum of two (2) elements.
 - 1) Staging: Input not exceeding 18 kW per step.
 - f. Temperature Control: Adjustable thermostat. (Non-ASME: Surface mounted, ASME: Immersion type)
 - g. Safety Controls: High-temperature-limit and low-water cutoff devices or systems.
 - h. Relief Valves: ASME rated and stamped and complying with ASME PTC 25.3, for combination temperature and pressure relief valves. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.
 - 4. Special Requirements: NSF 5 construction.
 - 5. Capacity and Characteristics: Refer to drawing schedule.

2.3 COMPRESSION EXPANSION TANKS

- A. Description: Steel pressure-rated tank constructed with welded joints and factory-installed butyl-rubber diaphragm. Include air pre-charge to minimum system-operating pressure at tank.
 - 1. Manufacturers:
 - a. Smith, A. O.; Aqua-Air Div.
 - b. Rheem Water Heater Div.

- 2. Construction:
 - a. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1, pipe thread.
 - b. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
 - c. Air-Charging Valve: Factory installed.
- 3. Capacity and Characteristics:
 - a. Working-Pressure Rating: 150 psig.
 - b. Capacity Acceptable: Refer to drawings.
 - c. Air Precharge Pressure: Refer to drawings.

2.4 WATER HEATER ACCESSORIES

- A. Combination Temperature and Pressure Relief Valves: ASME rated and stamped and complying with ASME PTC 25.3. Include relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select relief valves with sensing element that extends into storage tank.
- B. Pressure Relief Valves: ASME rated and stamped and complying with ASME PTC 25.3. Include pressure setting less than water heater working-pressure rating.
- C. Drain Pans: Corrosion-resistant metal with raised edge. Include dimensions not less than base of water heater and include drain outlet not less than NPS 3/4.
- D. Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE/IESNA 90.1 or ASHRAE 90.2.
- E. Water Regulators: ASSE 1003, water-pressure reducing valve. Set at 25-psig maximum outlet pressure, unless otherwise indicated.

2.5 SOURCE QUALITY CONTROL

- A. Test and inspect water heater storage tanks, specified to be ASME-code construction, according to ASME Boiler and Pressure Vessel Code.
- B. Hydrostatically test commercial water heater storage tanks before shipment to minimum of one and one-half times pressure rating.
- C. Prepare test reports.

PART 3 - EXECUTION

- 3.1 WATER HEATER INSTALLATION
 - A. Install commercial water heaters on concrete bases.
 - 1. Concrete base construction requirements are specified in Specification Section "Basic Plumbing Materials and Methods."
 - B. Install water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.

- C. Extend commercial-water-heater relief-valve outlet, with drain piping of same material as domestic water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.
- D. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains with drain piping of same material as domestic water piping.
- E. Install thermometer on outlet piping of water heaters. Refer to Specification Section "Meters and Gauges" for thermometers.
- F. Install pressure gage(s) on outlet of commercial electric water- heater piping. Refer to Specification Section "Meters and Gauges" for pressure gages.
- G. Install piping-type heat traps on inlet and outlet piping of water heater storage tanks without integral or fitting-type heat traps.
- H. Fill water heaters with water.

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other plumbing and mechanical Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install water heater and piping adjacent to heaters to allow service and maintenance. Arrange piping for easy removal of water heaters.
- C. Ground equipment according to Specification Section "Grounding and Bonding."
- D. Connect wiring according to Specification Section "Conductors and Cables."

3.3 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including connections. Report results in writing.
- B. Perform the following field tests and inspections and prepare test reports:
 - 1. Leak Test: After installation, test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Operational Test: After electrical circuitry has been energized, confirm proper operation.
 - 3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- C. Remove and replace water heaters that do not pass tests and inspections and retest as specified above.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain commercial electric water heaters. Refer to Division 1 Section "Closeout Procedures" or "Demonstration and Training."

END OF SECTION

SECTION 22 4100 PLUMBING FIXTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following conventional plumbing fixtures and related components:
 - 1. Faucets for lavatories.
 - 2. Flushometers.
 - 3. Toilet seats.
 - 4. Protective shielding guards.
 - 5. Fixture supports.
 - 6. Water closets.
 - 7. Urinals.
 - 8. Lavatories.
 - 9. Kitchen sinks.
 - 10. Service basins.
 - 11. Utility Boxes
- B. Related Sections include the following:
 - 1. Specification Section "Water Distribution" for exterior plumbing fixtures and hydrants.
 - 2. Specification Section "Toilet and Bath Accessories."
 - 3. Specification Section "Emergency Plumbing Fixtures."
 - 4. Specification Section "Security Plumbing Fixtures."
 - 5. Specification Section "Drinking Fountains and Water Coolers."
 - 6. Specification Section "Plumbing Specialties" for backflow preventers, floor drains, and specialty fixtures not included in this Section.

1.3 DEFINITIONS

- A. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities; and is compliant with the Texas Accessibility Standards (TAS), Article 9102, Texas Civil Statutes.
- B. Fitting: Device that controls the flow of water into or out of the plumbing fixture. Fittings specified in this Section include supplies and stops, faucets and spouts, shower heads and tub spouts, drains and tailpieces, and traps and waste pipes. Piping and general-duty valves are included where indicated.

1.4 SUBMITTALS

- A. Product Data: For each type of plumbing fixture indicated. Include selected fixture and trim, fittings, accessories, appliances, appurtenances, equipment, and supports. Indicate materials and finishes, dimensions, construction details, and flow-control rates.
- B. Shop Drawings: Diagram power, signal, and control wiring.

C. Operation and Maintenance Data: For plumbing fixtures to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain plumbing fixtures, faucets, and other components of each category through one source from a single manufacturer.
 - 1. Exception: If fixtures, faucets, or other components are not available from a single manufacturer, obtain similar products from other manufacturers specified for that category.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities" Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act" for plumbing fixtures for people with disabilities.
- D. Regulatory Requirements: Comply with requirements in the Texas Accessibility Standards (TAS), Architectural Barriers Act, Article 9102, Texas Civil Statutes.
- E. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.
- F. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.
- G. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.
- H. Comply with the following applicable standards and other requirements specified for plumbing fixtures:
 - 1. Enameled, Cast-Iron Fixtures: ASME A112.19.1M.
 - 2. Water-Closet, Flushometer Tank Trim: ASSE 1037.
- I. Comply with the following applicable standards and other requirements specified for lavatory and sink faucets:
 - 1. Backflow Protection Devices for Faucets with Hose-Thread Outlet: ASME A112.18.3M.
 - 2. Faucets: ASME A112.18.1.
 - 3. Hose-Connection Vacuum Breakers: ASSE 1011.
 - 4. Hose-Coupling Threads: ASME B1.20.7.
 - 5. Integral, Atmospheric Vacuum Breakers: ASSE 1001.
 - 6. NSF Potable-Water Materials: NSF 61.
 - 7. Pipe Threads: ASME B1.20.1.
 - 8. Supply Fittings: ASME A112.18.1.
 - 9. Brass Waste Fittings: ASME A112.18.2.
- J. Comply with the following applicable standards and other requirements specified for miscellaneous fittings:
 - 1. Atmospheric Vacuum Breakers: ASSE 1001.
 - 2. Brass and Copper Supplies: ASME A112.18.1.
 - 3. Dishwasher Air-Gap Fittings: ASSE 1021.
 - 4. Manual-Operation Flushometers: ASSE 1037.
 - 5. Plastic Tubular Fittings: ASTM F 409.
 - 6. Brass Waste Fittings: ASME A112.18.2.

- K. Comply with the following applicable standards and other requirements specified for miscellaneous components:
 - 1. Disposers: ASSE 1008 and UL 430.
 - 2. Dishwasher Air-Gap Fittings: ASSE 1021.
 - 3. Flexible Water Connectors: ASME A112.18.6.
 - 4. Hose-Coupling Threads: ASME B1.20.7.
 - 5. Off-Floor Fixture Supports: ASME A112.6.1M.
 - 6. Pipe Threads: ASME B1.20.1.
 - 7. Plastic Toilet Seats: ANSI Z124.5.
 - 8. Supply and Drain Protective Shielding Guards: ICC A117.1.

1.6 WARRANTY

A. Warranty Period: Two (2) years from dated of Substantial Completion.

1.7 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Faucet Cartridge, Assembly and Associated O-Rings: Equal to 2 or 5 percent of amount of each type and size installed (whichever is greater).
 - 2. Flushometer Valve, Repair Kits: Equal to 10 percent of amount of each type installed, but no fewer than 12 of each type.

PART 2 - PRODUCTS

- 2.1 GENERAL REQUIREMENTS
 - A. Product descriptions hereinafter represent minimum requirements for each fixture; refer to Basis-of-Design manufacturer and model number listed on the drawing "Plumbing Fixture Schedule" for additional features, construction details, accessories and/or options.

2.2 MATERIALS AND WORKMANSHIP

- A. All materials, unless otherwise specified, shall be 51% manufactured in the United States, new, free from all defects, and of the best quality. Foreign goods specifically approved for use by the Owner's Representative prior to bidding may be furnished.
- B. 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 present a neat, precise appearance.

2.3 STOPS

- A. Angle Stops:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following: (unless noted otherwise on drawings or on schedule).
 - a. Chicago Faucets.
 - b. McGuire Manufacturing Co., Inc.
 - c. T & S Brass and Bronze Works, Inc.

- 2. Description: Heavy duty cast brass with compression cartridge.
 - a. Finish: Chrome plated.
 - b. Stem: Brass, full turn.
 - c. Operation: Loose Key, unless otherwise indicated.
 - d. Outlet: NPS 3/8, compression
 - e. Inlet Size: NPS 1/2, female thread.

2.4 LAVATORY FAUCETS

- A. Lavatory Faucets, Manual:
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide the product listed on the drawing "Plumbing Fixture Schedule" or a comparable product by one of the following: (unless noted otherwise on drawings or within Schedule)
 - a. Chicago Faucets.
 - b. T & S Brass and Bronze Works, Inc.
 - 2. Description: Two-handle mixing valve. Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture holes; coordinate outlet with spout and fixture receptor.
 - a. Body Material: Commercial, solid brass.
 - b. Finish: Polished chrome plate.
 - c. Maximum Flow Rate: 0.5 gpm. (unless noted otherwise on drawings or within Schedule)
 - d. Valve Handle(s): Wrist blade, 4 inches.
 - e. Spout Outlet: Aerator.
 - f. Operation/Cartridge: Ceramic disk, manual.

2.5 SINK FAUCETS

- A. Sink Faucets, Manual:
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide the product listed on the drawing "Plumbing Fixture Schedule" or a comparable product by one of the following: (unless noted otherwise on drawings or within Schedule).
 - a. Chicago Faucets.
 - b. T & S Brass and Bronze Works, Inc.
 - 2. Description: Two-handle mixing. Include cold and hot-water indicators; coordinate faucet inlets with supplies and fixture holes; coordinate outlet with spout and fixture receptor.
 - a. Body Material: Commercial, solid brass.
 - b. Finish: Polished chrome plate.
 - c. Maximum Flow Rate: 2.2 gpm, (unless noted otherwise on drawings or within Schedule)
 - d. Mixing Valve: None.
 - e. Handles: Wrist blade, 4 inches.
 - f. Spout Outlet: Aerator.
 - g. Operation: Compression, manual.

2.6 FLUSHOMETERS

- A. Flushometers, Automatic:
 - Basis-of-Design Product: Subject to compliance with requirements, provide the product listed on the drawing "Plumbing Fixture Schedule" or a comparable product by one of the following: (unless noted otherwise on drawings or within Schedule)

 a. Sloan Valve Company.
 - 2. Description: Flushometer for urinal-type fixture. Include brass body with corrosionresistant internal components, non-hold-open feature, control stop with check valve,

vacuum breaker, copper or brass tubing, and polished chrome-plated finish on exposed parts.

- a. Internal Design: Diaphragm operation.
- b. Style: Exposed.
- c. Trip Mechanism: Oscillating, lever-handle actuator.

2.7 TOILET SEATS

- A. Toilet Seats:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Standard Companies, Inc.
 - b. Bemis Manufacturing Company.
 - c. Church Seats.
 - d. Kohler Co.
 - 2. Description: Toilet seat for water-closet-type fixture.
 - a. Material: Molded, solid plastic.
 - b. Configuration: Open front without cover.
 - c. Size: Elongated.
 - d. Hinge Type: SC, self-sustaining, check.
 - e. Class: Heavy-duty commercial.
 - f. Color: White.

2.8 PROTECTIVE SHIELDING GUARDS

- A. Protective Shielding Pipe Covers:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following: (unless noted otherwise on drawings or within Schedule)
 - a. McGuire Manufacturing Co., Inc.
 - b. TRUEBRO, Inc.
 - 2. Description: Manufactured plastic wraps for covering plumbing fixture hot- and coldwater supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

2.9 FIXTURE SUPPORTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Josam Company.
 - 2. MIFAB Manufacturing Inc.
 - 3. Smith, Jay R. Mfg. Co.
 - 4. Tyler Pipe; Wade Div.
 - 5. Zurn Plumbing Products Group; Specification Drainage Operation.
- B. Urinal Supports:
 - 1. Description: Type I, manufactured urinal carrier with fixture support plates and coupling with seal and fixture bolts and hardware matching fixture for wall-mounting, urinal-type fixture. Include steel uprights with feet. Factory painted.
 - 2. Accessible-Fixture Support: Include rectangular steel uprights.
- C. Lavatory Supports:
 - 1. Description: Type II, manufactured lavatory carrier with concealed arms and tie rod for wall-mounting, lavatory-type fixture. Include steel uprights with feet. Factory painted.
 - 2. Accessible-Fixture Support: Include rectangular steel uprights.

D. Securements

1. Stainless Steel drop in anchors with heavy-duty class stainless steel bolts. All-threaded is not acceptable.

2.10 WATER CLOSETS

- A. Water Closets, Floor Mounted, ADA-Compliant:
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide the product listed on the drawing "Plumbing Fixture Schedule" or a comparable product by one of the following: (unless noted otherwise on drawings or within Schedule)
 - a. American Standard Companies, Inc.
 - b. Kohler Co.
 - 2. Description: Accessible, floor-mounting, floor-outlet, vitreous-china fixture designed.
 - a. Style: Flush Tank.
 - 1) Bowl Type: Elongated with siphon-jet design; include bolt caps matching fixture.
 - 2) Height: Accessible, 16-3/4".
 - 3) Design Consumption: 1.28 gal./flush (unless noted otherwise or within Schedule).
 - 4) Color: White.
 - 5) Toilet Seat: Required; see other paragraph.
 - 6) Flushometer: Required; see other paragraph.

2.11 URINALS

- A. Urinals:
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide the product listed on the drawing "Plumbing Fixture Schedule" or a comparable product by one of the following: (unless noted otherwise on drawings or within Schedule).
 - a. American Standard Companies, Inc.
 - b. Kohler Co.
 - 2. Description: Accessible, wall-mounting, back-outlet, vitreous-china fixture designed for flushometer valve operation.
 - a. Type: Siphon jet.
 - b. Design Consumption: 0.5 gal./flush (unless noted otherwise on drawings or within Schedule).
 - c. Color: White.
 - d. Supply Spud Size: NPS 3/4.
 - e. Outlet Size: NPS 2.

2.12 LAVATORIES

- A. Lavatories:
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide the product listed on the drawing "Plumbing Fixture Schedule" or a comparable product by one of the following: (unless noted otherwise on drawings or within Schedule).
 - a. American Standard Companies, Inc.
 - b. Kohler Co.
 - 2. Description: Accessible, wall-mounting, vitreous-china fixture.
 - a. Type: With back Ledge back Shelf back Slab Pedestal.
 - b. Faucet Hole Punching: Coordinate with faucet.
 - c. Color: White.
 - d. Supplies: NPS 3/8 chrome-plated copper with stops.
 - e. Drain: Grid.

f. Drain Piping: NPS 1-1/4 chrome-plated, cast-brass 17-ga. P-trap; NPS 1-1/4 0.045-inch thick tubular brass waste to wall (trap arm); and wall escutcheon.

2.13 KITCHEN SINKS

- A. Kitchen Sinks, Barrier Free:
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide the product listed on the drawing "Plumbing Fixture Schedule" or a comparable product by one of the following: (unless noted otherwise on drawings or within Schedule).
 - a. Kohler Co.
 - b. American Standard Companies, Inc.
 - 2. Description: Two-compartment (high/low), accessible, built into counter, enameled, cast-iron kitchen sink.
 - a. Overall Dimensions:
 - b. Metal Thickness: 0.038 inch 0.050 inch.
 - c. Supplies: NPS 1/2 chrome-plated copper with stops.
 - d. Drain Piping: Drain Piping: NPS 1-1/2 chrome-plated, cast-brass P-trap; 0.045inch thick tubular brass waste to wall (trap arm); and wall escutcheon(s).
 - e. Color: White.
 - f. Barrier-free Shroud: Required.
 - g. Disposer: Required for left compartment.
 - h. Dishwasher Air-Gap Fitting: Required.

2.14 SERVICE BASINS

- A. Service Basins:
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide the product listed on the drawing "Plumbing Fixture Schedule" or a comparable product by one of the following: (unless noted otherwise on drawings or within Schedule).
 - a. Crane Plumbing, L.L.C./Fiat Products.
 - b. Stern-Williams Co., Inc.
 - 2. Description: Flush-to-wall, floor-mounting, pre-cast terrazzo fixture with rim guard.
 - a. Rim Guard: On front surfaces, stainless steel.
 - b. Faucet: As indicated on drawing "Plumbing Fixture Schedule."
 - c. Color: Not applicable.
 - d. Drain: Cast-brass with nickel-bronze grid and NPS 3 (DN 80) outlet; extra heavyduty, cast iron, deep seal trap.

2.15 UTILITY BOXES

- A. Utility Boxes, Ice Maker:
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide the product listed on the drawing "Plumbing Fixture Schedule."
 - 2. Description: Flush mounted in wall cavity with angle stop.
 - a. Material: Galvanized Steel.
 - b. Finish: Unpainted.
 - c. Supply: Annealed copper tube, minimum 48-inch length (coiled) to permit pulling out appliance for rear service.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before plumbing fixture installation.
- B. Examine cabinets, counters, floors, and walls for suitable conditions where fixtures will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Assemble plumbing fixtures, trim, fittings, and other components according to manufacturers' written instructions.
- B. Install off-floor supports, affixed to building substrate, for wall-mounting fixtures.
 - 1. Use carrier supports with waste fitting and seal for back-outlet fixtures.
 - 2. Use carrier supports without waste fitting for fixtures with tubular waste piping.
 - 3. Use chair-type carrier supports with rectangular steel uprights for accessible fixtures.
- C. All wall mounted fixtures and equipment shall be installed with floor mounted carriers (Manufacturer provided).
- D. Install wall-mounted fixtures AT ELEVATIONS INDICATED ON ARCHITECTURAL DRAWINGS.
- E. Install back-outlet, wall-mounting fixtures onto waste fitting seals and attach to supports.
- F. Install floor-mounting fixtures on closet flanges or other attachments to piping or building substrate.
- G. Install wall-mounting fixtures with tubular waste piping attached to supports.
- H. Install floor-mounting, back-outlet water closets attached to building floor substrate and wall bracket and onto waste fitting seals.
- I. Install counter-mounting fixtures in and attached to casework.
- J. Install fixtures level and plumb according to roughing-in drawings.
- K. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.
 - 1. Exception: Use ball, if supply stops are not specified with fixture. Valves are specified in Specification Section "Valves."
- L. All appurtances supporting fixtures to be chrome plated in exposed areas (including but not limited to under cabinet areas).
- M. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.
- N. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.

- O. Install flushometer valves for accessible water closets and urinals with handle mounted on wide side of compartment. Install other actuators in locations that are easy for people with disabilities to reach.
- P. Install toilet seats on water closets.
- Q. Install faucet-spout fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.
- R. Install water-supply flow-control fittings with specified flow rates in fixture supplies at stop valves.
- S. Install faucet flow-control fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.
- T. Install shower flow-control fittings with specified maximum flow rates in shower arms.
- U. Install traps on fixture outlets.
 - 1. Exception: Omit trap on fixtures with integral traps.
 - 2. Exception: Omit trap on indirect wastes, unless otherwise indicated.
- V. Install disposer in outlet of each sink indicated to have disposer. Install switch where indicated or in wall adjacent to sink if location is not indicated.
- W. Install dishwasher air-gap fitting at each sink indicated to have air-gap fitting. Install on countertop at sink. Connect inlet hose to dishwasher and outlet hose to disposer.
- X. Install escutcheons at piping wall ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings. Escutcheons are specified in Specification Section "Basic Mechanical Materials and Methods."
- Y. Seal joints between fixtures and walls, floors, and countertops using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Sealants are specified in Specification Section "Joint Sealants."

3.3 CONNECTIONS

- A. Piping installation requirements are specified in other plumbing specification sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect fixtures and appliances with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- C. Ground equipment according to Specification Section "Grounding and Bonding."
- D. Connect wiring according to Specification Section "Conductors and Cables."
- E. Arrange for electric-power connections to fixtures, transformers and devices that require power. Electric power is specified in Electrical Specification Sections.

3.4 FIELD QUALITY CONTROL

A. Verify that installed plumbing fixtures are categories and types specified for locations where installed.

- B. Check that plumbing fixtures are complete with trim, faucets, fittings, and other specified components.
- C. Inspect installed plumbing fixtures for damage. Replace damaged fixtures and components.
- D. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.

3.5 ADJUSTING

- A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.
- B. Operate and adjust disposers and controls. Replace damaged and malfunctioning units and controls.
- C. Adjust water pressure at faucets and flushometer valves to produce proper flow and stream.
- D. Replace washers and seals of leaking and dripping faucets and stops.
- E. Install fresh batteries in sensor-operated mechanisms.
- F. Run hot water (full flow) at each faucet until temperature is stable (-2 degree deviation from water heater set point); balance manual (y-type, etcetera) mixing valve at each faucet to 110 F spout-discharge temperature.
- G. After compression cartridges are well-seated (50-60 cycles), adjust faucet wrist-blade handles to position parallel to back-splash (or wall that lavatory is mounted to) when fully closed (tight).

3.6 CLEANING

- A. Clean fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials. Do the following:
 - 1. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts.
 - 2. Remove sediment and debris from drains.
- B. After completing installation of exposed, factory-finished fixtures, faucets, and fittings, inspect exposed finishes and repair damaged finishes.

3.7 PROTECTION

- A. Provide protective covering for installed fixtures and fittings.
- B. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION

SECTION 22 4500 EMERGENCY PLUMBING FIXTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following emergency plumbing fixtures:
 - 1. Eye/face wash equipment.
- B. Related Sections include the following:
 1. Specification Section "Plumbing Specialties" for backflow preventers and floor drains.

1.3 DEFINITIONS

- A. Accessible Fixture: Emergency plumbing fixture that can be approached, entered, and used by people with disabilities; and is compliant with the Texas Accessibility Standards.
- B. Plumbed Emergency Plumbing Fixture: Fixture with fixed, potable-water supply.
- C. Self-Contained Emergency Plumbing Fixture: Fixture with flushing-fluid-solution supply.
- D. Tepid: Moderately warm.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated. Include flow rates and capacities, furnished specialties, and accessories.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Product Certificates: Submit certificates of performance testing specified in "Source Quality Control" Article.
- D. Field quality-control test reports.
- E. Operation and Maintenance Data: For emergency plumbing fixtures to include in maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. ANSI Standard: Comply with ANSI Z358.1, "Emergency Eyewash and Shower Equipment."

- C. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act"; for plumbing fixtures for people with disabilities.
- D. D. Regulatory Requirements: Comply with requirements in the Texas Accessibility Standards (TAS), Architectural Barriers Act, Article 9102, Texas Civil Statutes.
- E. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.

PART 2 - PRODUCTS

- 2.1 GENERAL REQUIREMENTS
 - A. Product descriptions hereinafter represent minimum requirements for each fixture; refer to Basis-of-Design manufacturer and model number listed on the drawing "Plumbing Fixture Schedule" for additional features, construction details, accessories and/or options.

2.2 EYE/FACE WASH EQUIPMENT

- A. Eye/Face Wash Equipment:
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide the product listed on the drawing "Plumbing Fixture Schedule" or a comparable product by one of the following:
 - a. Bradley Corporation.
 - b. Encon Safety Products.
 - c. Guardian Equipment Co.
 - d. Haws Corporation.
 - e. Speakman Company.
 - 2. Description: Plumbed, freestanding or wall-mounting, eye/face wash equipment.
 - a. Capacity: Deliver potable water at rate not less than 3.0 gpm for at least 15 minutes.
 - b. Supply Piping: NPS 1/2 chrome-plated brass or stainless steel with flow regulator and stay-open control valve.
 - c. Drain Piping: NPS 1-1/4 minimum, chrome-plated brass, receptor drain, P-trap, waste to wall, and wall flange complying with ASME A112.18.2; or include galvanized-steel indirect connection to drainage system, as indicated on drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in for water and waste piping systems to verify actual locations of piping connections before plumbed emergency plumbing fixture installation.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 EMERGENCY PLUMBING FIXTURE INSTALLATION

- A. Assemble emergency plumbing fixture piping, fittings, control valves, and other components.
- B. Install fixtures level and plumb.

- C. Fasten fixtures to substrate.
- D. Install shutoff valves in water-supply piping to fixtures. Use ball, gate, or globe valve if specific type valve is not indicated. Install valves chained or locked in open position if permitted. Install valves in locations where they can easily be reached for operation. Valves are specified in Specification Section "Valves."
 - 1. Exception: Omit shutoff valve on supply to group of plumbing fixtures that includes emergency plumbing fixture.
 - 2. Exception: Omit shutoff valve on supply to emergency equipment if prohibited by authorities having jurisdiction.
- E. Install shutoff valve and strainer in steam piping and shutoff valve in condensate return piping.
- F. Install dielectric fitting in supply piping to fixture if piping and fixture connections are made of different metals. Dielectric fittings are specified in Specification Section "Basic Plumbing Materials and Methods."
- G. Install trap and waste to wall on drain outlet of fixture receptors that are indicated to be directly connected to drainage system.
- H. Install indirect waste piping to wall on drain outlet of fixture receptors that are indicated to be indirectly connected to drainage system. Drainage piping is specified in Specification Section "Sanitary Waste and Vent Piping."
- I. Install escutcheons on piping wall and ceiling penetrations in exposed, finished locations. Escutcheons are specified in Specification Section "Basic Plumbing Materials and Methods."
- J. Install equipment nameplates or equipment markers on fixtures and equipment signs on water-tempering equipment. Identification materials are specified in Specification Section "Plumbing Identification."

3.3 CONNECTIONS

- A. Piping installation requirements are specified in other plumbing specification sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect cold-water-supply piping to plumbed emergency plumbing fixtures not having watertempering equipment.
- C. Directly connect emergency plumbing fixture receptors with trapped drain outlet to sanitary drainage and vent piping.
- D. Indirectly connect emergency plumbing fixture receptors without trapped drain outlet to sanitary or storm drainage piping.
- E. Ground equipment according to Specification Section "Grounding and Bonding."

3.4 FIELD QUALITY CONTROL

- A. Mechanical-Component Testing: After plumbing connections have been made, test for compliance with requirements. Verify ability to achieve indicated capacities and temperatures.
- B. Repair or replace malfunctioning units. Retest as specified above after repairs or replacements are made.

C. Report test results in writing.

3.5 ADJUSTING

A. Adjust or replace fixture flow regulators for proper flow.

END OF SECTION

SECTION 22 4716 WATER COOLERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following water coolers and related components:
 - 1. Water coolers.
 - 2. Fixture supports.

1.3 DEFINITIONS

- A. Accessible Water Cooler: Fixture that can be approached and used by people with disabilities.
- B. Cast Polymer: Dense, cast-filled-polymer plastic.
- C. Fitting: Device that controls flow of water into or out of fixture.
- D. Water Cooler: Electrically powered fixture for generating and delivering cooled drinking water.

1.4 SUBMITTALS

- A. Product Data: For each fixture indicated. Include rated capacities, furnished specialties, and accessories.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Field quality-control test reports.
- D. Operation and Maintenance Data: For fixtures to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act"; for fixtures for people with disabilities.
- C. Regulatory Requirements: Comply with requirements in the Texas Accessibility Standards (TAS), Architectural Barriers Act, Article 9102, Texas Civil Statutes.

- D. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.
- E. ARI Standard: Comply with ARI's "Directory of Certified Drinking Water Coolers" for style classifications.
- F. ARI Standard: Comply with ARI 1010, "Self-Contained, Mechanically Refrigerated Drinking-Water Coolers," for water coolers and with ARI's "Directory of Certified Drinking Water Coolers" for type and style classifications.
- G. ASHRAE Standard: Comply with ASHRAE 34, "Designation and Safety Classification of Refrigerants," for water coolers. Provide HFC 134a (tetrafluoroethane) refrigerant, unless otherwise indicated.

PART 2 - PRODUCTS

- 2.1 Water Coolers
 - A. Basis-of-Design Product
 - 1. Subject to compliance with requirements, provide the product listed on the drawing "Plumbing Fixture Schedule" or a comparable product by one of the following:
 - a. Elkay Manufacturing Co.
 - b. Halsey Taylor.
 - 2. Description: Accessible, ARI 1010, Type PB, pressure with bubbler, Style W, wallmounting water cooler.
 - a. Cabinet: Bilevel with two attached cabinets and with bilevel skirt kit, all stainless steel.
 - b. Bubbler: One, with adjustable stream regulator, located on each cabinet deck.
 - c. Control: Push bar.
 - d. Supply: NPS 3/8 with ball, gate, or globe valve.
 - e. Drain(s): Grid with NPS 1-1/4 minimum horizontal waste and trap complying with ASME A112.18.1 (per manufacturer's requirements).
 - f. Cooling System: Electric, with hermetically sealed compressor, cooling coil, aircooled condensing unit, corrosion-resistant tubing, refrigerant, corrosionresistant-metal storage tank, and adjustable thermostat.
 - 1) Capacity: **8 gph** of 50 deg F cooled water from 80 deg F inlet water and 90 deg F ambient air temperature.
 - g. Support: Type II, water cooler carrier. Refer to "Fixture Supports" Article.Copy and edit paragraph and subparagraphs below for each semirecessed-type water cooler.

2.2 FIXTURE SUPPORTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Josam Co.
 - 2. MIFAB Manufacturing, Inc.
 - 3. Smith, Jay R. Mfg. Co.
 - 4. Tyler Pipe; Wade Div.
 - 5. Watts Drainage Products Inc.; a div. of Watts Industries, Inc.
 - 6. Zurn Plumbing Products Group; Specification Drainage Operation.
- B. Description: ASME A112.6.1M, water cooler carriers. Include vertical, steel uprights with feet and tie rods and bearing plates with mounting studs matching fixture to be supported.
 - 1. Type I: Hanger-type carrier with two vertical uprights.

 Type II: Bilevel, hanger-type carrier with three vertical uprights. Supports for Accessible Fixtures: Include rectangular, vertical, steel uprights instead of steel pipe uprights.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in for water and waste piping systems to verify actual locations of piping connections before fixture installation. Verify that sizes and locations of piping and types of supports match those indicated.
- B. Examine walls and floors for suitable conditions where fixtures are to be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

- A. Use carrier off-floor supports for wall-mounting fixtures, unless otherwise indicated.
- B. Use chrome-plated brass or copper tube, fittings, and valves in locations exposed to view. Plain copper tube, fittings, and valves may be used in concealed locations.

3.3 INSTALLATION

- A. Install off-floor supports affixed to building substrate and attach wall-mounting fixtures, unless otherwise indicated.
- B. Install mounting frames affixed to building construction and attach recessed water coolers to mounting frames, unless otherwise indicated.
- C. Install fixtures level and plumb. For fixtures indicated for children, install at height indicated in architectural drawings.
- D. Install water-supply piping with shutoff valve on supply to each fixture to be connected to water distribution piping. Use ball, gate, or globe valve. Install valves in locations where they can be easily reached for operation. Valves are specified in Specification Section "Valves."
- E. Install trap and waste piping on drain outlet of each fixture to be connected to sanitary drainage system.
- F. Install pipe escutcheons at wall penetrations in exposed, finished locations. Use deeppattern escutcheons where required to conceal protruding pipe fittings. Escutcheons are specified in Specification Section "Basic Mechanical Materials and Methods."
- G. Seal joints between fixtures and walls and floors using sanitary-type, one-part, mildewresistant, silicone sealant. Match sealant color to fixture color. Sealants are specified in Specification Section "Joint Sealants."

3.4 CONNECTIONS

A. Piping installation requirements are specified in other plumbing specification sections. Drawings indicate general arrangement of piping, fittings, and specialties.

- B. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- C. Ground equipment according to Specification Section "Grounding and Bonding."
- D. Connect wiring according to Specification Section "Conductors and Cables."

3.5 FIELD QUALITY CONTROL

- A. Water Cooler Testing: After electrical circuitry has been energized, test for compliance with requirements. Test and adjust controls and safeties.
 - 1. Remove and replace malfunctioning units and retest as specified above.
 - 2. Report test results in writing.

3.6 ADJUSTING

- A. Adjust fixture flow regulators for proper flow and stream height.
- B. Adjust water cooler temperature settings.

3.7 CLEANING

- A. After completing fixture installation, inspect unit. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.
- B. Clean fixtures, on completion of installation, according to manufacturer's written instructions.

END OF SECTION

SECTION 23 0005 MECHANICAL DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Demolition and removal of selected portions of building or structure.
 - 2. Demolition and removal of selected site elements.
 - 3. Salvage of existing items to be reused or recycled.

1.2 DEFINITIONS

- A. Remove or Demolish: Detach items from existing construction and legally dispose of them off-site, unless indicated to be removed and salvaged or removed and reinstalled.
- B. Remove and Salvage: Detach items from existing construction and deliver them to Owner cleaned, packaged, and ready for reuse.
- C. Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.
- D. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.3 MATERIALS OWNERSHIP

- A. 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 representative, who will establish special procedures for removal and salvage.

1.4 SUBMITTALS

- A. 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.
 - 2. Interruption of utility services. Indicate how long utility services will be interrupted.
 - 3. Coordination for shutoff, capping, and continuation of utility services (including but not limited to: Gas, Water, Fire Suppression, Chilled Water, Hot Water, Air Conditioning, etc).
 - 4. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.
 - 5. Means of protection for items to remain and items in path of waste removal from building.
- B. Inventory: After selective demolition is complete, submit a list of items that have been salvaged.

1.5 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Standards: Comply with ANSI A10.6 and NFPA 241.
- C. Pre-demolition Conference: Conduct conference at Project site to comply with requirements in Section "Project Management and Coordination." Review methods and procedures related to selective demolition including, but not limited to, the following:
 - 1. Inspect and discuss condition of construction to be selectively demolished.
 - 2. Review structural load limitations of existing structure.
 - 3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
 - 4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
 - 5. Review areas where existing construction is to remain and requires protection.

1.6 PROJECT CONDITIONS

- A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.
- B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
- C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- D. Hazardous Materials: It is unknown whether hazardous materials will be encountered in the Work.
 - 1. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Owner will remove hazardous materials under a separate contract.
- E. Storage or sale of removed items or materials on-site is not permitted.
- F. 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.

1.7 WARRANTY

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped.
- B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
- C. Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.
- D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Services/Systems: Maintain services/systems indicated to remain and protect them against damage during selective demolition operations.
- B. Service/ Requirements: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.
 - 1. Arrange to shut off indicated utilities with utility companies.
 - 2. If services/systems are required to be removed, relocated, or abandoned, before proceeding with selective demolition provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
 - 3. Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing.
 - a. Where entire wall is to be removed, existing services/systems may be removed with removal of the wall.

3.3 PREPARATION

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

3.4 SELECTIVE DEMOLITION, GENERAL

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
 - 1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
 - 2. 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.
 - 3. Maintain adequate ventilation when using cutting torches.
 - 4. Dispose of demolished items and materials promptly.
- B. Removed and Salvaged Items:
 - 1. Clean salvaged items.
 - 2. Pack or crate items after cleaning. Identify contents of containers.

- 3. Store items in a secure area until delivery to Owner.
- 4. Transport items to Owner's storage area designated by Owner.
- 5. Protect items from damage during transport and storage.
- C. Removed and Reinstalled Items:
 - 1. Clean and repair items to functional condition adequate for intended reuse. Paint equipment to match new equipment.
 - 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.
- D. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.
- E. Contractor shall terminate demolished pipe and/or ductwork. System shall be capped and insulated per new work specification.
- F. Contractor shall remove any abandoned piping and/or ductwork in area of construction during the demolition process.
- G. Unforeseen Conditions
 - 1. Any unforeseen utilities found during construction that directly affect any trade must be brought to the engineer's attention via RFI.
 - 2. All existing conditions must be clearly annotated on the As-Built drawings.
- H. Repair any walls, floors or roofs that piping, ducts or equipment have been removed from (or through). Patch with similar materials to match finish and color (paint to match). If paint cannot be matched, repaint entire wall or surface.

3.5 DISPOSAL OF DEMOLISHED MATERIALS

- A. General: Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.
 - 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.
- B. Burning: Do not burn demolished materials.
- C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

END OF SECTION

SECTION 23 0100 SPECIAL CONDITIONS FOR ALL MECHANICAL WORK

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. This section covers the general provisions of the mechanical specifications applicable to the following systems:
 - 1. Heating, air conditioning, and ventilation.
- B. The use of the word mechanical in the body of the various specifications sections shall be interpreted to include all the aspects of all of the systems referenced in Mechanical Specifications.

1.2 DRAWINGS

- A. These specifications are accompanied by drawings of the building and details of the installations showing the locations of equipment, piping, ductwork, etc. The drawings and these specifications are complementary to each other; requirements described in one or the other shall be considered binding as if described in both.
- B. If any departures from the drawings are deemed necessary by the Contractor, details of such departures and the reasons therefore shall be submitted to the Owner's Representative for approval. No departures shall be made without prior written approval by the Owner's Representative.
- C. There are intricacies of construction which are impractical to specify or indicate in detail; means and methods for performing such work shall adhere to commonly accepted industry standards.
- D. It is the Contractor's responsibility to properly use all information found on the Architectural, Structural, Mechanical, and Electrical drawings and applicable shop drawings where such information affects his work.
- E. For new buildings, all final dimensions shall be scaled from the Architectural drawings, unless otherwise noted. For work associated with existing buildings (renovations and additions), all final dimensions shall be field verified.

1.3 CONSTRUCTION REQUIREMENTS

- A. The architectural, civil, structural, electrical, plumbing, fire protection and mechanical drawings, and specifications are all part of the Contract Documents. In many instances there are details described on another trade's drawings that are not necessarily included or referenced in the mechanical drawings. It is the Contractor's responsibility to review in detail all parts of the Contract Documents prior to submitting a bid. Failure to comply with this requirement shall not relieve the Contractor of responsibility or be used as cause for additional compensation because architectural, structural, or electrical details were not included in the mechanical drawings.
- B. It is the intent of the Contract Documents to provide complete and fully functional installation in every respect. Material and/or construction details not specifically described in the Contract Documents, but commonly considered incidental to the industry, are required by the Contractor.
- 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 comply with Codes, to facilitate the work of other trades, to conform to the details

of the installation supplied by the manufacturer of the equipment to be installed, and thereby to provide an integrated satisfactory operating installation.

- D. The mechanical, electrical and plumbing drawings are schematic in nature and do not show every connection in detail or every pipe or conduit in its exact location. These details are subject to the requirements of ordinances and structural and architectural conditions.
- E. 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 laid out so that it will be concealed in furred chases and above suspended ceilings, etc. in finished portions of the building, unless specifically noted to be exposed. Work shall be installed to avoid compromising structural members; therefore, inserts to accommodate hangers shall be set before concrete is poured, and proper openings through floor, walls, beams, etc. shall be provided as hereinafter specified or as otherwise indicated or required. All work shall be installed parallel or perpendicular to building lines unless otherwise noted.
- F. When the mechanical drawings do not give exact details as to the elevation of pipe or ducts, physically arrange the systems to fit in the space available at the elevations intended with the proper grades for the functioning of the system involved. Piping, exposed conduit, and duct systems are generally intended to be installed true and square to the building construction, and located as high as possible against the structure in a neat and workmanlike manner. The plans do not show all required offsets, control lines, pilot lines, and other location details. Work shall be concealed in all finished areas. Piping specified to be insulated shall be supported in a manner that will allow the insulation to be installed without gaps. Insulated piping in concealed areas shall be offset with fittings as necessary to permit installation of insulation. Bending of pipes or installing pipes in a strain to insulate will not be permitted.
- G. Final placement of serviceable equipment shall be carefully coordinated with all other trades to ensure sufficient clearance for maintenance according to manufacturer's recommendations. Lubricating orifices and adjustable components shall be easily accessible. Piping, conduit, valve stems, cabling and other building systems shall not interfere with service space.
- H. Location of Exposed Devices
 - 1. All exposed devices (grills, registers, diffusers, sprinkler heads, medical gas outlets, plumbing rough-ins, lights, outlets, communication devices, etcetera) shall be referenced to fixed data points that are coordinated with all trades; shall be located to present symmetrical arrangements with respect to the fixed data point; and shall facilitate the proper arrangements of acoustical ceiling tiles. Fixed data points shall include such features as wall and ceiling lines, soffits, balanced border widths, masonry joints, etc. Devices located in acoustical ceiling tiles shall occur symmetrically in tile joints or in the centers of whole tiles. The final determination of the exact location of each outlet and the arrangements to be followed shall be acceptable to the Owner's Representative.
 - 2. The drawings schematically indicate locations of the exposed devices. Final locations shall be determined by carefully coordinating the drawings pertaining to each trade. Where conflicts are identified, Owner's Representative shall determine final location. The Owner reserves the right to make any reasonable change in location of any device before installation, without additional cost.

1.4 QUALIFICATIONS

- A. Contractor must have minimum of five years experience installing commercial heating, ventilation and air conditioning systems, plumbing and piping systems similar to those described in these Contract Documents.
- B. Contractor must be licensed and hold a current contracting license that has been valid for a minimum of five years in the State of Texas.

C. Contractor must be able to bond work for payment and performance of work being bid. Contractor's bonding agency shall have a Best's insurance rating of A or A+.

1.5 MATERIAL AND EQUIPMENT REQUIREMENTS

- A. Manufacturer's Instructions: The manufacturer's published instructions shall be followed for preparing, assembling, installing, erecting, and cleaning manufacturer materials or equipment, unless otherwise indicated. The Contractor shall promptly notify the Owner's Representative in writing of any conflict between the requirements of the Contract Documents and the manufacturer's direction and shall obtain the clarification of the Owner's Representative before proceeding with the work. Should the Contractor perform any such work that does not comply with the manufacturer's directions or such clarification by the Owner's Representative, he shall bear all costs arising in connection with the correction of the deficiencies.
- B. Storage at Site: The Contractor shall not receive material or equipment at the jobsite until there is suitable space provided to properly protect equipment from rust, drip, humidity, and dust damage and from surrounding work.
- C. Capacities shall be not less than those indicated and shall be such that no component or system becomes inoperative or is damaged because of startup or other overload conditions.
- D. Conformance to Agency Requirements: Where materials or equipment are specified to be approved, listed, tested, or labeled by the Underwriters Laboratories, Inc., ETL listed 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. or ETL 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.
- E. Nameplates: Each major component of equipment shall have the manufacturer's name, address, and model-identification number on a plate securely attached to the item of equipment. All data on nameplates shall be legible at the time of Final Inspection.
- 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. 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 inch 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 asphalttype coatings 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.
- G. Protection from Moving Parts: Belts, pulleys, chains, gears, couplings, projecting setscrews, keys, and other rotating parts located so that any person can come in close proximity thereto, shall be fully enclosed or properly guarded.
- H. Drive Guards: For machinery and equipment, provide guards as shown in AMCA 410 for belts, chains, couplings, pulleys, sheaves, shafts, gears, and other moving parts regardless of height above the floor. Drive guards may be excluded where motors and drives are inside factory-fabricated air handling units casings. Guards shall be constructed of sheet steel, cast iron, expanded metal, or wire mesh rigidly secured so as to be removable without disassembling pipe duct or electrical connection to equipment. Provide a 1-inch diameter hole in each drive guard at each shaft center to allow access for speed measurement.

- I. Verifications 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 thoroughly familiarize himself with all details of the work and working conditions, to verify all dimensions in the field, and to advise the Owner's Representative 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, Architect, or Engineer.
- J. Standard Products: Materials and equipment to be provided shall be the standard catalog products of manufacturers regularly engaged in the manufacture of products conforming to these specifications, and shall essentially duplicate materials and equipment that have been in satisfactory use at least two years.
- K. Spare Parts Data: As soon as practicable after approval of materials and equipment and, if possible, not later than four months prior to the date of beneficial occupancy, the Contractor shall furnish spare parts data for each different item of equipment listed. The data shall include a complete list of parts and supplies with current unit prices and sources of supply, a list of parts and supplies that are either normally furnished at no extra cost with the purchase of the equipment or specified hereinafter to be furnished as part of the Contract, and a list of additional items recommended by the manufacturer to assure efficient operation for a period of 120 days at the particular installation. The foregoing shall not relieve the Contractor of any responsibilities under the warranty specified.

1.6 INSPECTION OF THE SITE

A. The Contractor shall visit the site, verifying all existing items indicated on drawings and/or specified, and familiarize himself with the existing work conditions, hazards, grades, actual formations, soil conditions, structures, utilities, equipment, systems, facilities, and local requirements. The submission of bids shall be deemed evidence of such visits. All proposals shall take these existing conditions into consideration, and the lack of specific information shall not relieve the Contractor of any responsibility.

1.7 UTILITY LOCATIONS AND ELEVATIONS

A. Locations and elevations of the various utilities included within the scope of this work have been obtained from substantially reliable sources and are offered separately from the Contract Documents, as a general guide only, without guarantee as to accuracy. Examine the site, the locations, and availability of all utilities and services required for their relation to the work. Verify the location of all existing site utilities with each responsible utility company or applicable party. The Contractor shall repair all damage to existing utilities, whether indicated on the drawings or not, at his sole expense.

1.8 PERMITS, UTILITY CONNECTIONS, AND INSPECTIONS

- A. Permitting Fees: Contractor shall pay for all fees associated with permits required by municipal authorities having jurisdiction.
- B. Tapping and Impact Fees: Contractor shall pay for all fees associated with tapping into municipal utility mains, including sanitary sewer, natural gas and domestic water. Impact fees will be paid for by the Owner.
- C. Compliance: The Contractor shall comply in every respect with all requirements of local authorities having jurisdiction, including building inspections, fire marshal, local ordinances and codes, 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 a higher quality than the requirements of the above-specified authorities. Where requirements

of the specifications and drawings are below the requirements of the above offices having jurisdiction, the Contractor shall make installations in compliance with the requirements of the above authorities.

- D. Utilities: The Contractor shall coordinate with the various utility companies involved in this project and shall provide required utility relocations, extensions, modifications, and/or changes (complete in all respects) as described in the Contract Documents. Contractor shall verify the location of all existing utilities with the applicable Utility Company. The Contractor shall be responsible for all damages to existing utilities, whether indicated on drawings or not, and repair all damage to existing utilities as acceptable to the affected Utility Company.
- E. Certification: Prior to final acceptance, the Contractor shall furnish a certificate of acceptance from the inspection departments having jurisdiction over the work for any and all work installed under this Contract. Any additional labor costs incurred as a result of a substitution shall be the Contractor's responsibility.

1.9 EXISTING FACILITIES

- A. The Contractor shall be responsible for loss or damage to the existing facilities caused by him and his workmen, 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 performed 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 same 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. This is to include but is not limited to temperature controls system devices, electrical switches, relays, fixtures, piping, conduit, etc.
- 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.

1.10 DEMOLITION AND RELOCATION

A. The Contractor shall modify, remove, and/or relocate all materials and items so indicated on the drawings or required by the installation of new facilities. All removals and/or dismantling shall be conducted in a manner as to produce maximum salvage. Salvage materials shall remain the property of the Owner, and shall be delivered to such destination or otherwise disposed of as directed by the Owner. Materials and/or items scheduled for relocation and which are damaged during dismantling or reassembly operations shall be repaired and restored to good operative condition. The Contractor may, at his discretion, and upon the approval of the Owner, substitute

new materials and/or items of like design and quality in lieu of materials and/or items to be relocated.

- B. All items which are to be relocated shall be carefully removed in reverse to original assembly or placement and protected until relocated. The Contractor shall clean and repair and provide all new materials, fittings, and appurtenances required to complete the relocations and to restore to good operative order. All relocations shall be performed by workmen skilled in the work and in accordance with standard practice of the trades involved.
- C. When items scheduled for relocation and/or reuse are found to be in damaged condition before work has been started on dismantling, the Contractor shall call the attention of the Owner to such items and receive further instructions before removal. Items damaged in repositioning operations are the Contractor's responsibility and shall be repaired or replaced by the Contractor as approved by the Owner, at no additional cost to the Owner.
- D. Service lines and wiring to items to be removed, salvaged, or relocated shall be removed to points indicated on the drawings, specified, or acceptable to the Owner. Service lines and wiring not scheduled for reuse shall be removed to the points at which reuse is to be continued or service is to remain. Such services shall be sealed, capped, or otherwise tied off or disconnected in a safe manner acceptable to the Owner. All disconnections or connections into the existing facilities shall be done in such a manner as to result in minimum interruption of services to adjacent occupied areas. Services to existing areas or facilities which must remain in operation during the construction period shall not be interrupted without prior specific approval of the Owner as hereinbefore specified.

1.11 SUBSTITUTION OF MATERIALS AND EQUIPMENT

A. No substitution of materials or equipment herein specified or called for on the drawings will be permitted, except by written permission of the Owner's Representative. Where several makes of equipment or material are mentioned, any item named may be bid upon provided it meets space, capacity specifications, and other requirements.

1.12 SUBMITTALS

- A. Submittals for Review:
 - 1. As soon as practical or within 30 days after the date of contract award or notice to proceed, and before purchasing or starting installation of any materials or equipment, the Contractor shall submit for review sufficient material and equipment data to indicate that all requirements of the specifications have been met and samples shall be furnished when requested. All manufacturer's data used as part of the submittal shall have all non-applicable features crossed out or deleted in a manner that will clearly indicate exactly what is to be furnished.
 - 2. Four (4) copies of the submittal list and detailed submittals (for the Owner's and A/E's use) shall be submitted to the Owner's Representative. The Contractor is requested to include a minimum of three (3) additional copies for insertion in the project's Owner's Manuals at the completion of the project, and the number of additional copies the Contractor requires for his and his subcontractor's use during the project's construction. The detailed submittals shall be accompanied by the same number of sets of pictorial and descriptive data derived from the manufacturer's catalogs and sales literature, or incorporated in the shop drawings. The Contractor may provide a detailed submittal on any item even though not required by the Owner's Representative.

B. Format

1. Submittals shall be bound in a BLACK hardback three-ring binder with clear-view sleeves on the spine and front. Binders larger than 3-inches shall be divided into two volumes. The front sleeve shall have a cover sheet inserted with the title "MECHANICAL SUBMITTALS" centered in large print. Below the title shall be printed the name of the project, the date, the project location, the name and address of the contractor, the name and address of the subcontractor and the name and address of the engineer(s) in smaller print.

- 2. Provide a Table of Contents at the beginning of the binder that summarizes the information being submitted according to specification section.
- 3. Submittals shall be tab divided by specification section; **all sections** identified in the project specifications shall have a tab. When no information is being provided concerning a particular specification section, insert a single dated sheet that explains the circumstances.
- 4. Loose-leaf or piecemeal submittals are not acceptable and subject to rejection unless prior approval has been granted by the Engineer.
- 5. Email/Digital Submittals are not acceptable and subject to rejection unless prior approval has been granted by the Engineer.
- C. Content:
 - The Contractor shall prepare or cause to be prepared shop drawings, product data, materials and equipment lists, diagrams, data, samples, and other submittals as required by the contract documents, hereinafter referred to as "Submittal Data." The Contractor shall review and approve all submittal data for compliance with the contract documents, manufacturer's recommendations, adequacy, clearances, code compliance, safety, and coordination with associated work.
 - 2. The Contractor shall submit approved submittal data to the Owner's Representative for review and comment as to general conformance with the design concept and general compliance with information given in the contract documents. Owner's Representative's review shall not include review of quantities, dimensions, weights or gauges, fabrication processes, construction methods, coordination with other trades or work, or construction safety and precautions, all of which are the sole responsibility of the Contractor.
 - 3. The Contractor shall clearly and specifically identify and call to the attention of the Owner's Representative any deviation from the contract documents for which Owner acceptance is desired. The responsibility for such a deviation accepted by the Owner shall remain with the Contractor.
 - 4. Timeliness: The burden of timeliness in the complete cycle of submittal data is on the Contractor. The Contractor shall allow a minimum of four (4) weeks' time frame for review of each submission by the Owner's Representative. The Contractor is responsible for allowing sufficient time in the construction schedule to cover the aforementioned cycles of data processing, including time for all re-submission cycles on nonconforming 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 justify any request for scheduled construction time extensions or extra compensation.
 - 5. Work performed in accordance with approved submittal date that is not in accordance with the Contract Documents and did not have the specific acceptance of the Owner's Representative shall be replaced at Contractor's cost.
- D. Re-submittals
 - Re-submit entire submittal in accordance with afore mentioned format and content requirements. Loose-leaf or piecemeal re-submittals are not acceptable. New and/or revised data for each section shall be prefaced with a colored (yellow, pink, orange, etc) cover sheet that identifies (in a word or two) the materials and/or equipment being resubmitted. Typeset the words "REVISED SUBMITTAL NO. 1 (or 2, 3 as applicable)" centered at the bottom of the cover sheet.
 - 2. Subsequent re-submittals (second and third, if necessary) shall have different colored cover sheets to distinguish between the various re-submittals.
 - Include a cover letter at front of binder that specifically responds to each "REVISE AND RE-SUBMIT COMMENT" or "REJECTED" comment by number. Example responses would include the following:
 - a. RESPONSE: "Please see attached re-submittal."

- b. RESPONSE: "Will be re-submitted at a latter date."
- c. RESPONSE: "Requirement for (xxxxx) was deleted in Addendum No. 2."
- d. RESPONSE: "Exception requested based on Section xx, Paragraph x.x.x.
- E. These paragraphs related to Mechanical submittal data supersede any conflicting requirements contained in Division 01 sections.

1.13 CONTRACTOR CERTIFICATION OF SUBMITTAL DATA

A. The Contractor shall provide the following notarized certificate with all submittal data furnished to the Owner's Representative for review and comment.

Project Title:

Description of Submittal Data:

This is to certify that the above-described submittal data has been reviewed and is approved for compliance with the Contract Documents, manufacturer's recommendation, adequacy, clearances, code compliance, safety, and coordination with other trades and/or work except as follows: (list "none" or itemize and explain). In addition, the Contractor shall submit to the Owner's Representative 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 and are asbestos free."

Name and Company

Notary

1.14 ACCEPTANCE OF MATERIALS AND EQUIPMENT

- A. All equipment installed on this project shall have **local (within 125 miles)** representation, local factory-authorized service, and a local stock of repair parts. This requirement is essential and will be strictly reviewed by the Owner's Representative prior to concurrence with the Contractor's approval for all submittals covered by Mechanical sections of this Specification.
- B. NOTICE: The Contractor is responsible for providing materials and equipment that conform to the requirements of the project manual in every respect unless a deviation has been "accepted" in writing. Removal of any nonconforming materials and equipment and the replacement with conforming materials and equipment shall be at the Contractor's sole expense, regardless of when nonconformance was discovered.
- C. Approval of materials and equipment shall be based on manufacturer's published data and shall be tentatively subject to the submission of complete shop drawings which comply with the contract documents. Approval is also dependent upon the existence of adequate and acceptable clearances for entry, servicing, and maintenance.
- D. Approval of materials and equipment under this provision shall not be construed as authorizing any deviations from the specifications, unless the attention of the Owner's Representative has

been directed in writing to the specific deviations. Data submitted shall not contain unrelated information unless all pertinent information is properly identified.

E. Physical Size of Equipment: Space is critical; therefore, equipment of larger sizes than shown, even though of approved manufacturer, will not be acceptable unless it can be demonstrated that ample space exists for proper installation, operation, and maintenance.

1.15 SHOP DRAWINGS

- A. As soon as practicable after the award of contract and approval of materials and equipment, but prior to installation, complete and detailed shop drawings of the following shall be submitted for review and comment:
 - 1. Equipment arrangements.
 - 2. Duct layouts.
 - 3. Piping layouts.
 - 4. Layouts of equipment spaces indicating ductwork and piping larger than 2 inches.
 - 5. Typical fittings and connections.
 - 6. Equipment foundations.
 - 7. Factory-fabricated equipment and materials.
 - 8. Anchors.
 - 9. Control.
 - 10. Interlock.
 - 11. Sprinkler locations.
 - 12. Other details as directed by the Owner's Representative. Composite drawings of areas requiring coordination between trades shall be provided and expedited to eliminate conflicts and to ensure maximum cooperation and work progress.
- B. Work performed without benefit of reviewed and approved shop drawings **will not be recommended for payment by the Engineer** until such time as the shop drawings are submitted, reviewed, and approved. Any work performed without the benefit of reviewed and approved shop drawings may require removal, relocation, and/or replacement at the Contractor's sole expense in order to resolve conflicts between the various systems and provide the performance specified.
- C. All installation of equipment, fixtures, terminal devices, etc. shall be made in accordance with approved composite shop drawings. The Contractor shall modify installation and relocate installed work to provide code clearances, service access, and eliminate conflict with other systems.
- D. Submit one print of shop drawings for each area, floor, system, etc. The print will be marked with the A/E's comments and returned to the Contractor. Contractor shall revise shop drawings, incorporate revisions in field and submit revised shop drawings at project close out.

1.16 SITE OBSERVATION

A. Site observation by the Architect, Engineer, and/or Owner's Representative 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.

1.17 SUPERVISION

A. In addition to the Superintendent required under the conditions of the contract, each subcontractor shall keep a competent superintendent or foreman on the job at all times.
B. It shall be the responsibility of each superintendent to study all plans 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 jobsite by the superintendents involved. Where interferences cannot be resolved without major changes to the plans, the matter shall be referred to the Owner's Representative for comments.

1.18 OPERATION PRIOR TO COMPLETION

- A. When any piece of mechanical 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 written permission of the Owner's Representative to do so. The warranty period shall not commence, however, 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 filter media, properly adjust, and complete all deficiency list items before final acceptance by the Owner. The date of acceptance and the start of the warranty may not be the same date.

1.19 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 Owner's Representative, in writing, of any conflict between the requirements of the contract documents and the manufacturer's directions, and shall obtain the Owner's Representative's comments before proceeding with the work. Should the Contractor perform any such work that does not comply with the manufacturer's directions or applicable comments from the Owner's Representative, he shall bear all costs arising in connection with the correction of such deficiencies.

1.20 CHECKING AND TESTING MATERIALS AND/OR EQUIPMENT

A. Before final acceptance of the work, 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. 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 Owner's Representative 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 and are asbestos free."

B. Check inspections shall include plumbing, heating, air conditioning, ventilating, mechanical control and electrical equipment, and such other items hereinafter specified or specifically designated by the Owner's Representative.

1.21 OPERATING AND MAINTENANCE INSTRUCTION

A. The Contractor shall prepare for the owner's manual hereinafter specified complete sets of operating and maintenance instructions, system piping, valving, control and interlock diagrams, manuals, parts lists, etc. for each item of equipment. These are to be assembled as hereinafter specified for owner's manual.

- B. In addition, the Contractor shall provide the service of a competent engineer or a technician acceptable to the Owner's Representative to instruct a representative of the Owner in the complete and detailed operation of all equipment and systems. These instructions shall be provided for a period of sufficient duration to fully accomplish the desired results. Upon completion of these instructions, a letter of release will be required, acknowledged by the Owner, stating the dates of instruction and personnel to whom instructions were given.
- C. Additional diagrams, operating instructions, etc. shall be provided as specified hereinafter in the other sections of these specifications.

1.22 MATERIAL AND EQUIPMENT SCHEDULES

A. Contractor shall refer to both drawings and specification for schedules. Where reference is made to items "scheduled on drawings" or "scheduled in specifications," same shall include schedules contained in both the drawings and the specifications. The Contractor's attention is directed to the various specification sections and drawings for schedules.

1.23 APPLICABLE CODES AND STANDARDS

- A. 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, except as may be hereinafter specifically modified in these specifications and associated drawings.
 - 1. National Fire Protection Association Standards (NFPA):
 - NFPA 10 Portable Fire Extinguishers
 - NFPA 54 National Fuel and Gas Code
 - NFPA 70 National Electrical Code
 - NFPA 90A Air Conditioning Systems
 - NFPA 101 Life Safety Code

NFPA 255 - Method of Test of Surface Burning Characteristics of Building Materials

- American National Standards Institute (ANSI): 15-78 - Safety Code for Mechanical Refrigeration C.2 - 1984 National Electrical Safety Code A117.1 - Handicapped Code
- 3. American Society of Mechanical Engineers (ASME): Section IV, V, CSD-1
- 4. Air Conditioning and Refrigeration Institute Standards (ARI): All standards related to refrigeration and air conditioning equipment and piping furnished under these specifications.
- 5. American Water Works Association (AWWA): All applicable manuals and standards.
- 6. Sheet Metal and Air Conditioning Contractors National Associate, Inc, (SMACNA): All applicable manuals and standards.
- 7. Air Moving and Conditioning Association (AMCA): All applicable manuals and standards.
- 8. American Society of Testing Materials (ASTM): All applicable manuals and standards.
- 9. National Electrical Manufacturers' Association (NEMA): All applicable manuals and standards.
- 10. Occupational Safety and Health ACT (OSHA): National Sanitation Foundation - Standard No. 2
- 11. American Society of Heating, Refrigeration, and Air conditioning Engineers (ASHRAE): ASHRAE 90.1
- 12. Americans with Disabilities Act, 1990
- 13. American Gas Association (AGA)
- 14. Underwriters Laboratories, Inc. (ÚL)
- 15. Manufacturer's Standardization Society of the Valve and Fitting Industry (MSS)
- 16. Applicable Local and State Building Codes (International Building Codes, as amended):
- 17. Applicable Local and State Mechanical Code (International Mechanical Code, as amended).

- 18. Applicable Local and State Plumbing Code (International Plumbing Code, as amended).
- 19. Applicable Local and State Energy Code (International Energy Conservation Code, as amended).
- 20. Applicable State Gas Code (International Fuel and Gas Code, as amended).
- B. All materials and workmanship shall comply with all applicable city, state, and national codes, specifications, and industry standards. All materials shall be listed by the Underwriters Laboratories, Inc. as conforming to its standards and so labeled in every case where such a standard has been established for the particular type of material in question.
- C. 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 Owner's Representative 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 1 of these contract documents, providing no work or 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.

1.24 DEFINITIONS

- A. Refer to the condition of the contract for Division 1 for additional requirements regarding definitions.
- B. Where "as required" or "as necessary" 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 coordination requirements in performing the work described or indicated. These coordination requirements 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."
- C. Where "and/or" is used in these specifications or on the drawings, it shall mean "that situations exist where either one or both conditions occur or are required and shall not be interpreted to permit an option on the part of the Contractor.

1.25 FINAL INSPECTION

- A. Refer to Division 1 for additional requirements for final inspection.
- B. It shall be the responsibility of the Contractor to personally conduct a careful inspection, assuring himself that the work on the project is ready for final acceptance and developing his own "punchlists," before calling upon the Owner's Representative to make a final inspection. Failure of the Contractor to conduct such inspections and provide the Owner's Representative with a copy of his "punchlists" prior to the final inspection shall be adequate cause for the Owner's Representative to cancel any Contractor-requested final inspection.
- C. In order not to delay final acceptance of the work, the Contractor shall conduct his own "final inspections" prior to requesting the Owner's Representative to "final" the project; will have all necessary bonds, guarantees, receipts, affidavits, etc. called for in the various articles of this specification prepared and signed in advance; and together with a letter of transmittal listing each paper included, shall deliver the same to the Owner's Representative at or before the time of said final inspection. The Contractor is cautioned to check over each bond, receipt, etc. before

preparing same for submission to see that the terms check with the requirements of the specifications.

D. The final inspection will be made jointly by the Owner's Representative and the Owner.

1.26 REQUIREMENTS FOR FINAL ACCEPTANCE

- A. Requirements for final acceptance shall include but not be limited to the Contractor accomplishing the following:
 - 1. Construction: Complete all construction.
 - 2. Deficiency Lists: Correct all deficiencies listed at time of Substantial Completion.
 - 3. Owner's Manual: Submit at least 30 days prior to final acceptance on (1) copy of the owner's manual for the Owner's Representative's review and comments. Following acceptance, prepare three (3) copies of bound and indexed owner's manual, to be delivered at the time of final acceptance, which shall include but not be limited to the following:
 - a. System operating instructions.
 - b. System control drawings.
 - c. System interlock drawings.
 - d. System maintenance instructions.
 - e. Manufacturers', suppliers', and subcontractors' names, addresses, and telephone numbers, both local representatives and manufacturers' service headquarters.
 - f. Equipment operating and maintenance instructions and parts lists.
 - g. Manufacturer's certifications (see Checking and Testing Materials and/or Equipment, this section).
 - h. Contractor's warranty.
 - i. Acceptance certificates of authorities having jurisdiction.
 - j. Log of all tests made during course of work.
 - k. Owner's acknowledgment of receipt of instruction, enumerating items in owner's manual.
 - I. List of manufacturers' guarantees executed by the Contractor.
 - m. Certified performance curves.
 - n. Balance and performance test reports.
 - o. Owner's acknowledgment of items of equipment or accessories indicated or specified to be turned over to Owner.
 - 4. Instructions:
 - a. Verbal, as herein specified.
 - b. Posted, framed under glass or plastic laminated:
 - 1) System operating instructions.
 - 2) System control drawings.
 - 3) System interlock drawings.
 - 5. Record Drawings: Deliver the specified record drawings to the Owner's Representative.

1.27 RECORD DRAWINGS

- A. The Contractor shall maintain a set of contract drawings (black-line prints) at the jobsite on which he shall indicate the installed (as-built) locations of the following:
 - 1. Equipment
 - 2. Main lines of piping and ductwork.
 - 3. Dimensional locations (including depth) of all underground piping, valves and conduits.
- B. Drawings shall be used for construction reference and shall not leave the field office of the jobsite.
- C. Drawings shall include all addenda, ASI's, Change Orders, and existing conditions and equipment that are not reflected in the original contract drawings.

- D. Upon completion of work, the Contractor shall obtain CAD files of the contract drawings from the Owner's Representative and transfer the above as-built information into these files. The as-built files shall be permanently marked "RECORD DRAWINGS" and printed on full-size Mylar sheets. Upon completion, the CAD files shall be transferred to CD in AutoCAD 2007 format. Both the CAD files CD and Mylar drawings shall be submitted to the Owner's Representative as part of the Close-out Submittals.
- E. Refer to Division 1 paragraph entitled "Record Documents" for additional requirements.

1.28 ALLOWANCES

A. Refer to Division 1 for allowances.

1.29 ALTERNATE PROPOSALS

A. Alternate proposals are summarized in Division 1 and on the bid proposal form. Refer to all sections of the specifications and the drawings to determine the exact extent and scope of the various alternate proposals as each pertains to the work of the various trades.

1.30 WARRANTY

- A. General: All work performed (including equipment and materials furnished) under the various sections of these specifications shall be 100% warranted, for a period of one (1) year from the date of final acceptance thereof, against defective materials, design, and unauthorized substitution. Upon receipt of note of failure of any part of the guaranteed equipment and/or facilities during the guaranty period, the affected part(s) or facilities shall be replaced promptly with new parts, etc. by and at the expense of the Contractor. Further, the Contractor shall properly obtain, execute, and forward any and all manufacturer's warranties on equipment furnished under the Contract. Refer to Division 1 for additional requirements.
- B. Extended Period: The Contractor shall provide all extended time warranties available from the manufacturer of the equipment provided as standard at no additional cost. This includes all extended warranties where specified with certain equipment as directed in other sections of this Specification.

PART 2 - PRODUCTS

2.1 MATERIALS AND WORKMANSHIP

- A. All materials, unless otherwise specified, shall be current United States manufacture, new, free from all defects, and of the best quality. Foreign goods specifically approved for use by the Owner's Representative prior to bidding may be furnished.
- B. 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 present a neat, precise appearance.
- C. The responsibility for the furnishing and installation of the proper mechanical equipment and/or material as intended rests entirely upon the Contractor. The Contractor shall request advice and supervisory assistance from the representative of specific manufacturers during the installation.
- 2.2 FLAME SPREAD AND SMOKE DEVELOPED PROPERTIES OF MATERIALS

A. Duct coverings, duct linings, vapor barrier facings, tapes, adhesives, core materials, insulation, jackets, piping (of any sort), and other materials in concealed locations, including any aboveceiling area, shall have a flame spread rating not over 25 without evidence of continued progressive combustion and a smoke developed rating no higher than 50. Flame spread and smoke developed ratings shall be in accordance with NFPA Standard No. 255.

2.3 BEARINGS

A. All ball bearings shall be of radial and/or thrust type, and enclosed in a dust and moisture-proof housing.

2.4 MOTORS

A. The Contractor shall provide all motors required for equipment supplied under each portion of the work. Motors shall be premium efficiency and be built in accordance with the latest ANSI, IEE, and NEMA standards, shall be fully coordinated with the equipment served, shall be of sizes and electrical characteristics scheduled.

2.5 STARTING EQUIPMENT

A. Each motor shall be provided with proper starting equipment. This equipment, unless hereinafter specified or scheduled to the contrary, shall be provided by the trade furnishing the motor. All motor starting equipment provided by any one trade shall be of the same manufacture unless such starting equipment is an integral part of the equipment on which the motor is mounted.

2.6 LOW VOLTAGE (CONTROLS/THERMOSTAT) WIRING

A. All low voltage wiring installed by the Mechanical Contractor, Electrical Contractor or Controls Vendor shall be run in a neat and workmen like manner, parallel and perpendicular to building lines on J-Hooks (above ceiling grid only). Plenum rated cable shall be installed above ceilings. All other locations (exposed, Mechanical Rooms, outdoors or above hard lid ceiling) should be installed in conduit.

2.7 SLEEVES, INSERTS, AND FASTENINGS

- A. General: Proper openings through floors, walls, roofs, etc. for the passage of piping, ductwork, conduits, etc. shall be provided. All piping and conduit through floors and piping through walls must pass through sleeves except soil pipe installed under concrete slabs-on-fill, and pipe and conduit that is cast-in-place. Sleeves shall be set in new construction before concrete is poured, as cutting holes through any part of the concrete will not be permitted unless acceptable to the Owner's Representative.
- B. Aboveground, Exterior-Wall, Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Size sleeve for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
 - 1. Install steel pipe for sleeves smaller than 6 inches in diameter.
 - 2. Install cast-iron "wall pipes" for sleeves 6 inches in diameter and larger.
 - 3. Assemble and install mechanical sleeve seals according to manufacturer's written instructions. Tighten bolts that cause rubber sealing elements to expand and make watertight seal.
- C. Underground, Exterior-Wall, Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Size sleeve for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

- 1. Assemble and install mechanical sleeve seals according to manufacturer's written instructions. Tighten bolts that cause rubber sealing elements to expand and make watertight seal.
- D. Sleeves: The minimum clearance between horizontal pipe, including insulation where applicable, and sleeve shall be 1/4 inch, except that the minimum clearance shall be 2 inches where piping contacts the ground. Sleeves through floors shall extend 3/4 inch above the floor; sleeves through walls and partitions shall be installed flush with exposed surfaces.
- E. Materials: Install sleeves large enough to provide ¼" annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
 - 1. Steel Pipe Sleeves: For pipes smaller than 6-inch NPS.
 - 2. Steel, Sheet-Metal Sleeves: For pipes 6-inch NPS and larger, penetrating gypsum-board partitions.
 - 3. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level.
 - a) Seal space outside of sleeve fittings with non-shrink, nonmetallic grout.
- F. Inserts: Suitable concrete inserts for pipe, conduit, and equipment hangers shall be set and properly located for all piping, conduit, and equipment to be suspended from concrete construction.
- G. Fasteners: Fastening of pipes, conduits, etc. in the building shall be as follows:
 - 1. To wood members: by wood screws.
 - 2. To masonry and concrete: by threaded metal inserts, metal expansion screws, or toggle bolts, whichever is appropriate for the particular type of masonry or concrete.
 - 3. To steel: machine screws or welding (when specifically permitted or directed), or bolts. NOTE: Under no circumstances will the use of plastic anchors or plastic expansion shields be permitted for any purpose whatsoever.
- H. Ratproofing: The open space around all piping, ductwork, etc. passing through the ground floor and/or exterior walls shall be ratproofed in a manner acceptable to the Owner's Representative.
- I. Weatherproofing: The annular space between a pipe and its sleeve in exterior walls or through floor to below grade shall be filled with polyurethane foam rods 50% greater in diameter than the space as backing and fill material and made watertight with a permanent elastic polysulfide compound. Seal both surfaces of wall or floor with a fire-resistant sealant.
- J. Air Plenums: The space around piping, ductwork, etc. passing through an air plenum shall be made airtight in a manner acceptable to the Owner's Representative. The sealant used must be fire resistant.

2.8 FIRE AND SMOKE PARTITION, WALL, AND/OR FLOOR PENETRATIONS

- A. Pipe, ductwork, conduit, etc. shall pass through fire- or smoke-rated floors, partitions, walls, or other barriers within a UL-listed assembly which shall maintain the rating of the applicable wall, floor, partition, or barrier.
- B. The Contractor shall review the architectural and structural drawings and determine the location of the fire-rated building elements. Where these elements are penetrated, UL-listed fire-rated penetration assemblies approved by the local authority shall be provided in accordance with the manufacturer's instructions to obtain the required rating.
- 2.9 METAL BUILDING SYSTEMS/MECHANICAL-ELECTRICAL SUPPORTS

- A. Metal building systems are required to be designed by the manufacturer to accommodate and support the mechanical systems indicated on the mechanical drawings and specified in Mechanical specifications.
- B. The metal building systems manufacturer is required to provide the following:
 - 1. Framed openings through the roofs with supports, roof curbs, and flashings for roofmounted equipment, fans, vents, and air intakes.
 - 2. Structural support for piping, conduits, and suspended equipment consisting of beam, joists, purlins, and/or blocking above and perpendicular to pipe routes and equipment hangers at intervals not to exceed 8 feet.
 - 3. Structural support for suspended ceilings, diffusers, grilles, light fixtures including associated raceways and ductwork.
- C. The mechanical trade shall:
 - 1. Provide all routes, weights, installation heights, opening locations, etc. for all equipment, piping, vents, etc. to the metal building system manufacturer and coordinate requirements for structural supports, hangers, attachments, etc. with the metal building systems manufacturer.
 - 2. Provide all supporting devices (hangers, attachments, brackets, cross beams, etc.) to attach to the metal building structural system.

2.10 FOUNDATIONS / HOUSEKEEPING PADS

- A. General: All special foundations and supports required for the proper installation of equipment and pipe shall be provided as hereinafter specified and under the section of the specifications covering the equipment, unless otherwise indicated on the drawings.
- B. All mechanical equipment shall receive concrete housekeeping pads unless otherwise noted. Equipment to receive pads are to include (but not limited to): air handlers, fan-coils, condensing units, boilers, water heaters, water softeners, expansion / compression tanks, filter feeders, water treatment equipment, air compressors, fans, pumps (in addition to inertia bases where required), chillers, surge tanks, deareators, etc.
- C. Concrete foundations for the support of equipment such as floor-mounted pumps, fans, etc. shall be not less than 5½ inches high and not less than 4 inches larger (in both directions) than supported unit, unless otherwise noted and shall be poured in forms built of new dressed lumber. All corners of the foundations shall be neatly chamferred by means of sheet metal or triangular wood strips nailed to the form. Pads shall not be laid out directly against walls or structures. 2 inches shall be left available for pad form work. Foundation bolts shall be placed in the forms when the concrete is poured, the bolts being correctly located by means of templates. Allow 1 inch below the equipment bases for alignment and grouting (where applicable). Foundations for equipment located on the exterior of the building shall be provided as indicated. Foundations shall be constructed in accordance with approved shop drawings and shall be reinforced with #4 bars at 12 inches on center both ways (minimum).
- D. Pipe and Conduit Support: All pipes and conduits throughout the building, both horizontal and vertical, shall be adequately supported from the construction to line of grade, with proper provision for expansion, contraction, vibration elimination, and anchorage. Vertical pipes and conduits shall be supported from floor lines with riser clamps sized to fit the lines and to adequately support their weight. At the bases of lines, where required for proper support, provide anchor base fittings or other approved supports.

2.11 ACCESS DOORS

- A. General: Provide access doors for all serviceable mechanical appurtenances (valves, trap primers, shock arresters, volume dampers, fire/smoke dampers, actuators, sensors, etcetera) in inaccessible locations. Such locations include gypsum, brick and CMU ceilings and walls.
- B. Location of panels shall be carefully coordinated with other Exposed Devices as described in earlier paragraphs.
- C. Manufacturers shall be Inland-Milcor, Bilco, Miami Carey, or approved equal. Unless indicated otherwise, use panels equal to Milcor Style M for masonry and drywall construction, equal to Milcor Style K for plastered masonry walls and ceilings. Stainless steel panels shall be used in ceramic tile or glazed structural tile.
- D. Minimum construction features include 14-gage frame and door, continuous hinges, cam-style latch and 10x10" unobstructed opening size.
- E. UL labeled when in fire-rated construction, one and one-half hour rating.
- F. Access doors located outside, in restrooms or in a moisture-laden environment (dressing area, shower area, lockers, etc.) shall be stainless steel construction.
- G. Equipment access doors shall be of sufficient size to remove/replace equipment and provide routine maintenance as necessary, unless otherwise noted. Doors shall be set flush with adjacent finish surfaces. Exterior doors shall be provided with cylinder locks.
- H. Access doors into ductwork shall be 14-gauge insulated galvanized steel with 16-gauge galvanized gasketed steel frame and cam-type locks. Ductwork access door shall be a minimum of 12" H 12" in size.

2.12 FLOOR AND CEILING PLATES

A. Except as otherwise noted, provide one-piece chrome-plated brass floor and ceiling plates (or escutcheons) around all pipes, conduits, etc. passing through walls, floors, or ceilings in any spaces, except underfloor and attic spaces. Plates shall be sized to fit snugly against the outside of the pipe or against the outside of insulation on lines which are insulated, and positively secured to such pipe or insulation. Plates will not be required for piping where pipe sleeves extend ³/₄ of an inch above finish floor and are concealed. Plates shall be one piece.

PART 3 - EXECUTION

3.1 SPACE AND EQUIPMENT ARRANGEMENT

- A. The size of mechanical equipment indicated on the drawings is based on the dimensions of a particular manufacturer. While other manufacturers will be acceptable, it is the responsibility of the Contractor to determine whether the equipment he proposes to furnish will fit in the space. Shop drawings shall be prepared when required by the Owner's Representative 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.

3.2 LARGE APPARATUS

A. Any large piece of apparatus which is to be installed in any space in the building, and which is too large to permit access through 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.

3.3 PROTECTION

- A. The Contractor shall 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 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 uncompleted building with tarpaulins or other protective covering. 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. The Contractor shall protect existing facilities, the work of others, and the premises from any and all damages that may be made possible by the execution of work.
- 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.

3.4 COOPERATION BETWEEN TRADES AND WITH OTHER CONTRACTORS

- A. Each trade, subcontractor, and/or Contractor must work in harmony with the various 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.
- B. It shall be the responsibility of each trade to cooperate fully with the other trades on the job to help keep the jobsite in a clean and safe condition. At the end of each day's work, each trade shall properly store all of its tools, equipment, and materials and shall clean its debris from the job. Upon the completion of the job, each trade shall immediately remove all of its tools, equipment, any surplus materials, and all debris caused by its portion of the work.

3.5 PRECEDENCE OF MATERIALS AND COORINATION OF WORK

- A. These specifications and the accompanying drawings are intended to cover systems which will not interfere with the structural design of the building, which will fit into the several available spaces, and which will ensure complete and satisfactory systems. Each subcontractor and/or trade shall be responsible for the proper fitting of his material and apparatus into the building.
- B. The work of the various trades shall be performed in the most direct and workmanlike manner without hindering or handicapping the work of other trades. Piping interferences shall be handled by giving precedence to pipe lines which require a stated grade for proper operation. Where space requirements conflict, the following order or precedence shall, in general, be observed:
 - 1. Building lines.
 - 2. Structural members.
 - 3. Light fixtures.
 - 4. Soil and drain piping.
 - 5. Condensate drains.
 - 6. Vent piping.
 - 7. Supply, return, and outside air ductwork.
 - 8. Exhaust ductwork.

- 9. HVAC water and steam piping.
- 10. Steam condensate piping.
- 11. Fire protection piping.
- 12. Natural gas piping.
- 13. Domestic water (cold and hot).
- 14. Refrigerant piping.
- 15. Electrical conduit.
- C. The light fixture grid layout as indicated on the drawings must be maintained. This Contractor shall refer to all light fixture plans and details indicated on the drawings and shall coordinate the location of dampers, supply grilles, return air grilles, sprinkler heads, etc. with the location of the light fixtures to assure proper access to all items in a manner acceptable to the Owner's Representative.
- D. The electrical trades shall locate all junction boxes, pull boxes, conduits, etc. to avoid interference with the diffusers, dampers, grilles, etc. hereinbefore mentioned. The mechanical trades shall furnish to all other trades copies of approved ductwork shop drawings to assist in the coordination of the rough-in and installation of all items of work.

3.6 CONNECTIONS FOR OTHERS

- A. This Contractor shall rough-in for and make all water, sewer, electrical, etc. connections to all fixtures, equipment, machinery, etc. provided by others in accordance with detailed roughing-in drawings provided by the equipment suppliers, by actual measurements of the equipment connections, or as detailed.
- B. After the equipment is set in place, this Contractor shall make all final connections and shall provide all required pipe, fittings, valves, traps, connectors, etc.
- C. Provide all air gap fittings required, using materials hereinbefore specified. In each water line serving an item of equipment or piece of machinery, provide a shutoff valve. On each drain without integral trap provide a suitable trap.
- D. All pipe fittings, valves, traps, etc. exposed in finished areas and connected to chrome-plated lines provided by others shall be chrome-plated to match.
- E. Provide all sheet metal ducts, transition pieces, etc. required for a complete installation of equipment provided by others.

3.7 INSTALLATION METHODS

- A. Where to Conceal: All pipes and conduits shall be concealed in pipe chases, walls, furred spaces, below suspended floors, 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 and conduit may be run exposed. All exposed piping and conduit shall be run in the neatest, most inconspicuous manner, and parallel or perpendicular to the building lines.
- C. Support: All piping and conduit 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 and below concrete beams or other deep projections, pipe and conduit 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 Owner's Representative for each penetration.

- E. All pipe, conduits, etc. shall be cut accurately to measurements established at the building and shall be worked into place without springing or forcing. All ducts, pipes, and conduits run exposed in machinery and equipment rooms shall be installed parallel to the building lines, except that they shall be sloped to obtain the proper pitch. Piping and ducts run in furred ceilings, etc. shall be similarly installed, except as otherwise shown. Conduits in furred ceilings and in other concealed spaces may be run at angles to the construction but shall be neatly grouped and racked indicating good workmanship. All conduit and pipe openings shall be kept closed until the systems are closed with final connections.
- F. Special Requirements:
 - 1. There shall be no pipe joints nearer than 12 inches to a wall, ceiling, or floor penetration unless pipe joint is a welded or mechanically-coupled-type joint.
 - 2. The Contractor shall study all construction documents and carefully lay out all work in advance of fabrication and erection in order to meet the requirements of the extremely limited spaces. Where conflicts occur the Contractor shall meet with all involved trades and the Owner's Representative and resolve the conflict prior to erection of any work in the area involved.
 - 3. All piping not directly buried in the ground shall be considered as "interior piping."
 - 4. Prior to the installation of any ceiling material, gypsum, plaster, or acoustical board, the Contractor shall notify the Owner's Representative so that arrangements 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 up to ten (10) working days, but in no case less than five (5) working days.
 - 5. The purpose of this inspection is to verify the completeness and quality of the installation of the air conditioning systems, the plumbing systems, and any other special above-ceiling systems such as pneumatic tube. The ceiling supports (tee bar or lath) should be in place so that access panel and light fixture locations are identifiable and so that clearances and access provisions may be evaluated.
 - 6. No ceiling material shall be installed until the deficiencies listed from this inspection have been corrected to the satisfaction of the Owner's Representative.

3.8 CUTTING AND PATCHING

- A. General: Cut and patch walls, floors, etc. resulting from work in existing construction or where made necessary 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 Owner's Representative. Impact-type equipment will not be used except where specifically acceptable to the Owner's Representative. Openings in concrete for pipes, conduits, outlet boxes, etc. shall be core drilled to exact size. **Determine location of embedded conduit and reinforcing bars prior to cutting.**
- 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 Owner's Representative.
- E. Plaster: All mechanical work in area containing plaster shall be completed prior to the application of the finish plaster coat. Cutting of finish plaster coat will not be permitted.

F. Weakening: No cutting, boring, or excavating which will weaken the structure shall be undertaken.

3.9 ROOF PENETRATIONS AND FLASHING

- A. Pipe and conduit ducts, pitch pockets, curb bases, and flashing compatible with the roofing installation shall be provided for roof penetrations. Provide framing or other support around all openings through roof as required to preserve the structural integrity of the roof system and make the penetration weathertight.
- B. Provide 30-inch round or square flashing acceptable to the roofing trades at all roof and deck drain and sleeve flashing locations.
- C. Roof curbs for all roofs except standing seam metal roofs shall be provided by the equipment supplier supplying the roof-mounted equipment, etc., and such curbs shall be installed by the roofing trades. Contractor shall coordinate all roof curb requirements with all trades and the roofing trades at the earliest possible stage of the project.
- D. Roof curbs for standing seam metal roofs shall be provided by the roofing trades. Curb base size, height, and type shall be coordinated with the roofing trades at the earliest possible stage of the project.
- E. Flashing for pipe and conduit penetrations of standing seam metal roofs shall be provided and installed by the roofing trades.

3.10 EXCAVATING AND BACKFILLING

- A. Perform trenching, excavating, backfilling for mechanical work as set forth below.
- B. Depth of excavation to provide a minimum of 3 feet above top of pipe. Excavation to be carried to a depth of at least 6 inches below bottom of pipe elevation. Fill below pipe (6 inches), around pipe, and a minimum of 12 inches above pipe with sand of Class "B" crushed stone tamped firm and even. Separate topsoil during excavation. Final layer of dirt (12 inches minimum) to be topsoil. Trenches to be at least 18 inches wider than pipe with batter boards placed every 25 feet. Backfilling shall be done to exclude use of rock or stone above sand or Class "B" crushed stone.

3.11 TESTS AND INSPECTIONS

- A. General: The Contractor shall make all tests deemed necessary by the inspection departments of the authority having jurisdiction, Board of Underwriters, etc. He shall provide all equipment, materials, and labor for making such tests. Fuel and electrical energy for system operational tests following beneficial occupancy by the Owner will be paid for by the Owner.
- B. Other: Additional tests specified hereinafter under the various specifications sections shall be made.
- C. Notification: The Owner's Representative shall be notified at his office 36 hours prior to each test and other specifications requirements requiring action on the part of the Owner, Architect, Engineer, and/or Owner's Representative.
- D. Test Logs: All tests which the Contractor conducts 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 any other pertinent data. Data shall be delivered to the Owner's Representative as specified under "Requirements for Final Acceptance.

E. Inspections: In general, an inspection by the Owner's Representative shall be required prior to closing up any work and prior to beneficial occupancy or final project completion. The closing up of work includes, but is not limited to, pipe and conduit installations prior to backfilling; mechanical, electrical, and fire protection work prior to placement of concrete; or closing up walls and overhead mechanical, electrical, and fire protection work prior to installation of the ceiling.

3.12 CLEANING AND PAINTING

- A. Thoroughly clean and touch up the finish on all parts of the materials and equipment. Exposed parts in equipment rooms, and all other spaces except sealed chases and attics shall be thoroughly cleaned of cement, plaster, and other materials, and all oil and grease spots shall be removed. Such surfaces shall be carefully wiped and all cracks and corners scraped out.
- B. Exposed metal work which is not galvanized shall be carefully brushed down with steel brushes to remove rust and other spots and left smooth and clean and then painted with a suitable rust resistant primer. Exposed metal work includes work exterior to the building; exposed in mechanical or electrical equipment rooms and storage rooms; and other areas where occupants could see the work, whether normally occupied or not.
- C. All other painting shall be accomplished under the Painting Section of Division 9 of the specifications.

3.13 DISCHARGE OF WASTES FROM CONSTRUCTION SITE

A. The Contractor shall comply with all applicable provisions of local, state, and federal laws regarding the discharge of wastes into sewer and waterways. Special caution shall be exercised to prevent the discharge of wastes which contain oil, tar, asphalt, roofing compound, kerosene, gasoline, paint, mud, cement, lime, or other materials which would degrade the water quality of the receiving water course. The Contractor shall construct and maintain oil interceptors, settling basins, acid neutralization tanks, and/or other effective pollution countermeasures, as required by the Texas Water Quality Board.

END OF SECTION

SECTION 23 0513 BASIC MECHANICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following basic mechanical materials and methods to complement other Mechanical Sections.
 - 1. Piping materials and installation instructions common to most piping systems.
 - 2. Concrete base construction requirements.
 - 3. Escutcheons.
 - 4. Dielectric fittings.
 - 5. Dielectric isolation tape
 - 6. Flexible connectors.
 - 7. Mechanical sleeve seals.
 - 8. Nonshrink grout for equipment installations.
 - 9. Field-fabricated metal and wood equipment supports.
 - 10. Installation requirements common to equipment specification sections.
 - 11. Mechanical demolition.
 - 12. Cutting and patching.
 - 13. Touchup painting and finishing.
 - 14. Access Doors
- B. Pipe and pipe fitting materials are specified in mechanical piping system Sections, if applicable.

1.2 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawl spaces, 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 in duct shafts.
- 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 unheated shelters.
- F. The following are industry abbreviations for plastic materials:
 - 1. ABS: Acrylonitrile-butadiene-styrene plastic.
 - 2. CPVC: Chlorinated polyvinyl chloride plastic.
 - 3. NP: Nylon plastic.
 - 4. PE: Polyethylene plastic.
 - 5. PVC: Polyvinyl chloride plastic.
- G. The following are industry abbreviations for rubber materials:
 - 1. CR: Chlorosulfonated polyethylene synthetic rubber.

2. EPDM: Ethylene propylene diene terpolymer rubber.

1.3 SUBMITTALS

- A. Product Data: For dielectric fittings, flexible connectors, access doors, solder/brazing material and mechanical sleeve seals.
- B. Shop Drawings: Detail fabrication and installation for metal and wood supports and anchorage for mechanical materials and equipment.
- C. Coordination Drawings: Detail major elements, components, and systems of mechanical equipment and materials in relationship with other systems, installations, and building components. Show space requirements for installation and access. Indicate if sequence and coordination of installations are important to efficient flow of the Work. Include the following:
 - 1. Clearances for servicing and maintaining equipment, accessories, and specialties, including space for disassembly required for periodic maintenance.
 - 2. Equipment and accessory service connections and support details.
 - 3. Fire-rated wall and floor penetrations.
 - 4. Scheduling, sequencing, movement, and positioning of large equipment into building during construction.
 - 5. Access panel and door locations

1.4 QUALITY ASSURANCE

- A. Comply with ASME A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.
- B. Equipment Selection: Equipment of higher electrical characteristics, physical dimensions, capacities, and ratings may be furnished provided such proposed equipment is approved in writing and connecting mechanical and electrical services, circuit breakers, conduit, motors, bases, and equipment spaces are increased. Additional costs shall be approved in advance by appropriate Contract Modification for these increases. If minimum energy ratings or efficiencies of equipment are specified, equipment must meet design and commissioning requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and prevent entrance of dirt, debris, and moisture.
- B. Protect stored pipes and tubes from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor, if stored inside.
- C. Protect flanges, fittings, and piping specialties from moisture and dirt.
- D. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.6 SEQUENCING AND SCHEDULING

- A. Coordinate Mechanical equipment installation with other building components.
- B. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction to allow for mechanical installations.

- C. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components, as they are constructed.
- D. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Coordinate installation of large equipment requiring positioning before closing in building.
- E. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies.
- F. Coordinate requirements for access panels and doors if mechanical items requiring access are concealed behind finished surfaces.
- G. Coordinate installation of identifying devices after completing covering and painting, if devices are applied to surfaces. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Dielectric Tape:
 - a. Holdrite (#272-4).
 - 2. Metal, Flexible Connectors:
 - a. Flexicraft Industries.
 - b. Flex-Hose, Co., Inc.
 - c. Grinnell Corp.; Grinnell Supply Sales Co.
 - d. Mercer Rubber Co.
 - e. Metraflex Co.
 - f. Uniflex, Inc.
 - 3. Rubber, Flexible Connectors:
 - a. General Rubber Corp.
 - b. Mercer Rubber Co.
 - c. Metraflex Co.
 - d. Red Valve Co., Inc.
 - e. Uniflex, Inc.
 - 4. Mechanical Sleeve Seals:
 - a. Calpico, Inc.
 - b. Metraflex Co.
 - c. Thunderline/Link-Seal.

2.2 PIPE AND PIPE FITTINGS

- A. Refer to individual Specification piping Sections for pipe and fitting materials and joining methods, if applicable.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.
- 2.3 JOINING MATERIALS

- A. Refer to individual Specification piping Sections for special joining materials not listed below, if applicable.
- B. 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.
 - 2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
- C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- D. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
- E. Solder Filler Metals: ASTM B 32.
 - 1. ASTM B 32, 95/5 lead-free alloys. Include water –flushable and soluble flux according to ASTM B 813.
- F. Brazing Filler Metals: AWS A5.8.
 - 1. BCuP Series: Copper-phosphorus alloys.
 - 2. BAg1: Silver alloy.
- G. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- H. Solvent Cements: Manufacturer's standard solvent cements for the following:
 - 1. CPVC Piping: ASTM F 493.
 - 2. PVC Piping: ASTM D 2564, medium bodied (bond). Include purple primer according to ASTM F 656.
- I. Plastic Pipe Seals: ASTM F 477, elastomeric gasket.
- J. Flanged, Ductile-Iron Pipe Gasket, Bolts, and Nuts: AWWA C110, rubber gasket, carbonsteel bolts and nuts.
- K. Couplings: Iron-body sleeve assembly, fabricated to match OD of plain-end, pressure pipes.
 - 1. Sleeve: ASTM A 126, Class B, gray iron.
 - 2. Followers: ASTM A 47 malleable iron or ASTM A 536 ductile iron.
 - 3. Gaskets: Rubber.
 - 4. Bolts and Nuts: AWWA C111.
 - 5. Finish: Enamel paint.

2.4 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials or ferrous material body with separating nonconductive insulating material suitable for system fluid, pressure, and temperature, to prevent galvanic action and stop corrosion. Unions in first paragraph below are available in at least NPS 1/2 to NPS 2.
- B. 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. EPCO Sales, Inc.
- d. Hart Industries International, Inc.
- e. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
- f. Zurn Mechanical Products Group; Wilkins Water Control Products.
- 2. Description:
 - a. Pressure Rating: 250 psig at 180 deg F.
 - b. End Connections: Solder-joint copper alloy and threaded ferrous.
 - c. Flanges in first paragraph below are available in at least NPS 1-1/2 to NPS 4.
- C. Dielectric Flanges:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Capitol Manufacturing Company.
 - b. Central Plastics Company.
 - c. EPCO Sales, Inc.
 - d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - 2. Description:
 - a. Factory-fabricated, bolted, companion-flange assembly.
 - b. Pressure Rating: 175 psig minimum.
 - c. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.
- D. Dielectric-Flange Kits:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Advance Products & Systems, Inc.
 - b. Calico, Inc.
 - c. Central Plastics Company.
 - d. Pipeline Seal and Insulator, Inc.
 - 2. Description:
 - a. Nonconducting materials for field assembly of companion flanges.
 - b. Pressure Rating: 150 psig.
 - c. Gasket: Neoprene or phenolic.
 - d. Bolt Sleeves: Phenolic or polyethylene.
 - e. Washers: Phenolic with steel backing washers.
- E. Dielectric Couplings:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Calpico, Inc.
 - b. Lochinvar Corporation.
 - 2. Description:
 - a. Galvanized-steel coupling.
 - b. Pressure Rating: 300 psig at 225 deg F.
 - c. End Connections: Female threaded.
 - d. Lining: Inert and noncorrosive, thermoplastic.
- F. Dielectric Nipples:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Perfection Corporation; a subsidiary of American Meter Company.
 - b. Precision Mechanical Products, Inc.
 - c. Victaulic Company.
 - 2. Description:
 - a. Electroplated steel nipple complying with ASTM F 1545.
 - b. Pressure Rating: 300 psig at 225 deg F.

- c. End Connections: Male threaded or grooved.
- d. Lining: Inert and noncorrosive, propylene.

2.5 DIELECTRIC ISOLATION TAPE

- A. Tape to eliminate dissimilar metal contact: (equal to Holdrite #272-4)
 - 1. White Polyester Felt. Pressure sensitive adhesive rubber base (one side only).
 - 2. 4" width.

2.6 FLEXIBLE CONNECTORS

- A. General: Fabricated from materials suitable for system fluid and that will provide flexible pipe connections. Include 125-psig minimum working-pressure rating, unless higher working pressure is indicated, and ends according to the following:
 - 1. 2-Inch NPS and Smaller: Threaded.
 - 2. 2-1/2-Inch NPS and Larger: Flanged.
 - 3. Option for 2-1/2-Inch NPS and Larger: Grooved for use with keyed couplings.
- B. Bronze-Hose, Flexible Connectors: Corrugated, bronze, inner tubing covered with bronze wire braid. Include copper-tube ends or bronze flanged ends, braze welded to hose.
- C. Rubber, Flexible Connectors: CR or EPDM elastomer rubber construction, with multiple plies of NP fabric, molded and cured in hydraulic presses. Include 125-psig minimum working-pressure rating at 220 deg F. Units may be straight or elbow type, unless otherwise indicated.

2.7 MECHANICAL SLEEVE SEALS

- A. Description: Modular sealing element unit, designed for field assembly, used to fill annular space between pipe and sleeve.
 - 1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe materials and size of pipe.
 - 2. Pressure Plates: Stainless steel.
 - 3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

2.8 PIPING SPECIALTIES

- A. Sleeves: The following materials are for wall, floor, slab, and roof penetrations:
 - 1. Steel Sheet Metal: 0.0239-inch minimum thickness, galvanized, round tube closed with welded longitudinal joint.
 - 2. Steel Pipe: ASTM Á 53, Type E, Grade A, Schedule 40, galvanized, plain ends.
 - 3. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
 - 4. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
 a. Underdeck Clamp: Clamping ring with set screws.
 - Sleeve Fasteners: Manufactured, steel clips for securement during pour. Equal to Bline, BD40, BE-5-8 or BE-9-12.
- B. Escutcheons: Manufactured wall, ceiling, and floor plates; deep-pattern type if required to conceal protruding fittings and sleeves.
 - 1. ID: Closely fit around pipe, tube, and insulation of insulated piping.
 - 2. OD: Completely cover opening.
 - 3. Cast Brass: One piece, with set screw. (split face acceptable for existing piping)

a. Finish: Polished chrome-plate.

2.9 GROUT

- A. Nonshrink, Nonmetallic Grout: ASTM C 1107, Grade B.
 - 1. Characteristics: Post-hardening, volume-adjusting, dry, hydraulic-cement grout, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 - 2. Design Mix: 5000-psig, 28-day compressive strength.
 - 3. Packaging: Premixed and factory packaged.

2.10 ACCESS DOORS

- A. General: Provide access doors for all serviceable mechanical appurtenances (valves, trap primers, shock arresters, actuators, sensors, etcetera) in inaccessible locations. Such locations include gypsum, brick and CMU ceilings and walls.
- B. Location of panels shall be carefully coordinated with other Exposed Devices as described in earlier paragraphs.
- C. Manufacturers shall be Milcor, Mifab, or approved equal. Unless indicated otherwise, use panels equal to Milcor Style M for masonry and drywall construction, equal to Milcor Style K for plastered masonry walls and ceilings. Stainless steel panels shall be used in ceramic tile or glazed structural tile.
- D. Minimum construction features include 16-gage frame and door, continuous hinges, camstyle latch and 10x10" unobstructed opening size.
- E. UL labeled when in fire-rated construction, one and one-half hour rating.
- F. Access doors located outside, in restrooms or in a moisture-laden environment (dressing area, shower area, lockers, etcetera) shall be stainless steel construction.
- G. Equipment access doors shall be of sufficient size to remove/replace equipment and provide routine maintenance as necessary, unless otherwise noted. Doors shall be set flush with adjacent finish surfaces. All access doors shall be provided with cylinder locks. All access doors (MEP) shall have one (1) common key.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS AND APPLICATIONS

- A. General: Install piping as described below, unless piping Sections specify otherwise. Individual piping Sections specify unique piping installation requirements.
- B. General Locations and Arrangements: 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 Coordination Drawings.
- C. All piping to be installed in compliance with current NEC required clearances.
- D. Install manufactured isolation clamps at all dissimilar metal pipe supports. Install dielectric isolation tape (engineer approved) only when a manufactured isolation clamp is not available.

- E. Install piping at indicated slope.
- F. Install components with pressure rating equal to or greater than system operating pressure.
- G. Install piping in concealed interior and exterior locations, except in equipment rooms and service areas.
- H. Install piping free of sags and bends.
- I. Install exposed interior and exterior piping at right angles or parallel to building walls. Diagonal runs are prohibited, unless otherwise indicated.
- J. Install piping tight to slabs, beams, joists, columns, walls, and other building elements. Allow sufficient space above removable ceiling panels to allow for ceiling panel removal.
- K. Install piping to allow application of insulation plus 1-inch clearance around insulation.
- L. Locate groups of pipes parallel to each other, spaced to permit valve servicing.
- M. Install fittings for changes in direction and branch connections.
- N. Install couplings according to manufacturer's written instructions.
- O. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements in Section "Penetration Firestopping" for firestop materials and installations.
 - 1. Fire-stop all sleeves at floor penetrations of multistory buildings including underfloor penetrations.
- P. Verify final equipment locations for roughing-in.
- Q. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.
- R. Piping Joint Construction: Join pipe and fittings as follows and as specifically required in individual piping specification Sections:
 - 1. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
 - 2. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
 - 3. Soldered Joints: Construct joints according to AWS's "Soldering Manual," Chapter "The Soldering of Pipe and Tube"; or CDA's "Copper Tube Handbook."
 - 4. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."
 - 5. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - a. Note internal length of threads in fittings or valve ends, and proximity of internal seat or wall, to determine how far pipe should be threaded into joint.
 - b. Apply appropriate tape or thread compound to external pipe threads, unless dry seal threading is specified.
 - c. Align threads at point of assembly.
 - d. Tighten joint with wrench. Apply wrench to valve end into which pipe is being threaded.
 - e. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

- 6. Welded Joints: Construct joints according to AWS D10.12, "Recommended Practices and Procedures for Welding Low Carbon Steel Pipe," using qualified processes and welding operators according to "Quality Assurance" Article.
- 7. Flanged Joints: Align flange surfaces parallel. Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly using torque wrench.
- 8. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join pipe and fittings according to the following:
 - a. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
 - b. CPVC Piping: ASTM D 2846 and ASTM F 493.
 - c. PVC Pressure Piping: ASTM D 2672.
 - d. PVC Nonpressure Piping: ASTM D 2855.
- 9. Plastic Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657 procedures and manufacturer's written instructions.
 - a. Plain-End Pipe and Fittings: Use butt fusion.
 - b. Plain-End Pipe and Socket Fittings: Use socket fusion.

3.2 ESCUTCHEON REQUIREMENTS

- A. Install escutcheons at pipe penetrations of walls, ceilings, and floors in finished areas.
 - 1. Escutcheons for New Piping:
 - a. Piping exposed through floors and walls in finished areas: One piece, cast brass with polished chrome-plated finish with set screw. Deep escutcheons to be provided where standard depth will not fit.
 - b. Escutcheons shall cover entire hole penetration.
 - c. Escutcheon to be appropriately sized for pipe.
 - 2. Escutcheons for Existing piping:
 - a. Piping exposed through floors and walls in finished areas: Split plate, cast brass with polished chrome-plated finish with set screw. Deep escutcheons to be provided where standard depth will not fit.
 - b. Escutcheons shall cover entire hole penetration.
 - c. Escutcheon to be appropriately sized for pipe.
 - 3. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

3.3 PIPE SLEEVE INSTALLATION REQUIREMENTS

- A. Pipe sleeves are required at all through wall and floor penetrations.
 - 1. Sleeves are to be of the following material:
 - a. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc-coated, with plain ends.
 - 2. Sleeves are required for all through floor and wall penetrations. Sleeves to be set and poured in place (in slab applications), secure all sleeves with fasteners.
 - 3. Sleeves to extend 2 inches past face of floor or wall. Pipe sleeve in finished areas to be flush with wall or floor for installation of escutcheon.
 - 4. Install sleeves in new partitions, slabs, and walls as they are built.
 - 5. For interior wall penetrations, seal annular space between sleeve and pipe or pipe insulation using joint sealants appropriate for size, depth, and location of joint. Comply with requirements in Section "Joint Sealants" for joint sealants.

- 6. For exterior wall penetrations above grade, seal annular space between sleeve and pipe using joint sealants appropriate for size, depth, and location of joint. Comply with requirements in Section "Joint Sealants" for joint sealants.
- 7. For exterior wall penetrations below grade, seal annular space between sleeve and pipe using sleeve seals specified in this Section.
- 8. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation unless otherwise indicated. Seal annular space with water tight sealant. (equal to NP-1). All sleeves and penetrations to maintain rating of wall / floor. Seal pipe penetrations with fire-stopping materials.
- 9. Install sleeve materials according to the following applications:
 - a. Sleeves for Piping Passing through Concrete Floor Slabs: galvanized steel pipe.
 - b. Sleeves for Piping Passing through Concrete Floor Slabs of Mechanical Equipment Areas or Other Wet Areas: Galvanized-steel pipe sleeves.
 - 1) Extend sleeves 2 inches above finished floor level.
 - 2) For pipes penetrating floors with membrane waterproofing, extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches (50 mm) above finished floor level. Comply with requirements in Section "Sheet Metal Flashing and Trim" for flashing.
- 10. Sleeves for Piping Passing through Gypsum-Board Partitions:
 - a. Galvanized-steel pipe sleeves.
 - b. Exception: Sleeves are not required for water supply tubes and waste pipes for individual mechanical fixtures if escutcheons will cover openings.
- 11. Sleeves for Piping Passing through Concrete Roof Slabs: Reference details.
- 12. Sleeves for Piping Passing through Exterior Concrete Walls:
 - a. Galvanized-steel pipe sleeves.
 - b. Install sleeves that are large enough to provide 1-inch annular clear space between sleeve and pipe or pipe insulation when sleeve seals are used.
- 13. Sleeves for Piping Passing through Interior Concrete Walls:
 - a. Galvanized-steel pipe sleeves.
- 14. Mechanical sleeve seals
 - a. Install sleeve seals in sleeves in exterior concrete walls at water-service piping entries into building. Sleeves must be poured in place. Installation of sleeves after wall is constructed is not acceptable.
 - b. Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble sleeve seal components and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- B. Piping Connections: Make connections according to the following, unless otherwise indicated:
 - 1. Install unions, in piping 2-inch NPS and smaller, adjacent to each valve and at final connection to each piece of equipment with 2-inch NPS or smaller threaded pipe connection.
 - 2. Install flanges, in piping 2-1/2-inch NPS and larger, adjacent to flanged valves and at final connection to each piece of equipment with flanged pipe connection.
 - 3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
 - 4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.
- 3.4 DIELECTRIC FITTING INSTALLATION

- A. Install unions, in piping 2-inch NPS and smaller, adjacent to each valve and at final connection to each piece of equipment with 2-inch NPS or smaller threaded pipe connection.
- B. Install flanges, in piping 2-1/2-inch NPS and larger, adjacent to flanged valves and at final connection to each piece of equipment with flanged pipe connection.

3.5 EQUIPMENT INSTALLATION – COMMON REQUIREMENTS

- A. Install equipment to provide maximum possible headroom, if mounting heights are not indicated.
- B. Install equipment according to approved submittal data. Portions of the Work are shown only in diagrammatic form. Refer conflicts to Architect.
- C. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- D. Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- E. Install equipment giving right of way to piping installed at required slope.

3.6 PAINTING AND FINISHING

- A. Apply paint to exposed piping according to the following, unless otherwise indicated:
 - 1. Interior, Ferrous Piping: Use semigloss, acrylic-enamel finish. Include finish coat over enamel undercoat and primer.
 - 2. Interior, Galvanized-Steel Piping: Use semigloss, acrylic-enamel finish. Include two finish coats over galvanized metal primer.
 - 3. Interior, Ferrous Supports: Use semigloss, acrylic-enamel finish. Include finish coat over enamel undercoat and primer.
 - 4. Exterior, Ferrous Piping: Use semigloss, acrylic-enamel finish. Include two finish coats over rust-inhibitive metal primer.
 - 5. Exterior, Galvanized-Steel Piping: Use semigloss, acrylic-enamel finish. Include two finish coats over galvanized metal primer.
 - 6. Exterior, Ferrous Supports: Use semigloss, acrylic-enamel finish. Include two finish coats over rust-inhibitive metal primer.
- B. Do not paint piping specialties with factory-applied finish.
- C. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.7 ERECTION OF METAL SUPPORTS AND ANCHORAGE

- A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.
- B. Field Welding: Comply with AWS D1.1, "Structural Welding Code--Steel."

3.8 ERECTION OF WOOD SUPPORTS AND ANCHORAGE

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorage to support and anchor mechanical materials and equipment (not to be used at pipe supports).

- B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.
- C. Attach to substrates as required to support applied loads.

3.9 DEMOLITION

- A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces necessary for mechanical installations. Perform cutting by skilled mechanics of trades involved.
- B. Repair cut surfaces to match adjacent surfaces.

3.10 CUTTING AND PATCHING

- A. Disconnect, demolish, and remove Work specified in Mechanical Sections.
- B. If pipe, ductwork, insulation, or equipment to remain is damaged or disturbed, remove damaged portions and install new products of equal capacity and quality.
- C. Accessible Work: Remove indicated exposed pipe and ductwork in its entirety.
- D. Work Abandoned in Place: Cut and remove underground pipe a minimum of 2 inches beyond face of adjacent construction. Cap and patch surface to match existing finish.
- E. Removal: Remove indicated equipment from Project site.
- F. Temporary Disconnection: Remove, store, clean, reinstall, reconnect, and make operational equipment indicated for relocation.

3.11 GROUTING

- A. Install nonmetallic, nonshrink, grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors. Mix grout according to manufacturer's written instructions.
- B. Clean surfaces that will come into contact with grout.
- C. Provide forms as required for placement of grout.
- D. Avoid air entrapment during placing of grout.
- E. Place grout, completely filling equipment bases.
- F. Place grout on concrete bases to provide smooth bearing surface for equipment.
- G. Place grout around anchors.
- H. Cure placed grout according to manufacturer's written instructions.

END OF SECTION

SECTION 23 0529 HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following hangers and supports for plumbing system piping and equipment:
 - 1. Steel pipe hangers and supports.
 - 2. Trapeze pipe hangers.
 - 3. Metal framing systems.
 - 4. Thermal-hanger shield inserts.
 - 5. Fastener systems.
 - 6. Pipe positioning systems.
 - 7. Equipment supports.
- B. Related Sections include the following:
 - 1. Specification Section "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
 - 2. Specification Section "Metal Ducts" for duct hangers and supports.

1.3 DEFINITIONS

- A. MSS: Manufacturers Standardization Society for The Valve and Fittings Industry Inc.
- B. 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: For the following:
 - 1. Steel pipe hangers and supports.
 - 2. Thermal-hanger shield inserts.
 - 3. Powder-actuated fastener systems.
 - 4. Pipe positioning systems.
- 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 AWS D1.1, "Structural Welding Code--Steel."
- B. Welding: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1, "Structural Welding Code--Steel."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 METAL COATING REQUIREMENTS:

- A. All metal products shall have the following coatings:
 - 1. Wet/damp areas: hot dipped galvanized.
 - 2. Dry or conditioned areas: pre-galvanized.

2.3 STEEL PIPE HANGERS AND SUPPORTS

- A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.
- B. Manufacturers:
 - 1. AAA Technology & Specialties Co., Inc.
 - 2. Bergen-Power Pipe Supports.
 - 3. B-Line Systems, Inc.; a division of Cooper Industries.
 - 4. Carpenter & Paterson, Inc.
 - 5. Empire Industries, Inc.
 - 6. ERICO/Michigan Hanger Co.
 - 7. Globe Pipe Hanger Products, Inc.
 - 8. Grinnell Corp.
 - 9. GS Metals Corp.
 - 10. National Pipe Hanger Corporation.
 - 11. PHD Manufacturing, Inc.
 - 12. PHS Industries, Inc.
 - 13. Piping Technology & Products, Inc.
 - 14. Tolco Inc.
- C. Galvanized, Metallic Coatings: Pre-galvanized (minimum thickness of 0.5 mils) or hot dipped (1.4 to 3.9 mil thickness).
- D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

E. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

2.4 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.

2.5 METAL FRAMING SYSTEMS

- A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.
- B. Manufacturers:
 - 1. B-Line Systems, Inc.; a division of Cooper Industries.
 - 2. ERICO/Michigan Hanger Co.; ERISTRUT Div.
 - 3. GS Metals Corp.
 - 4. Power-Strut Div.; Tyco International, Ltd.
 - 5. Thomas & Betts Corporation.
 - 6. Tolco Inc.
 - 7. Unistrut Corp.; Tyco International, Ltd.
- C. Coatings: Manufacturer's standard finish unless bare metal surfaces are indicated.
- D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

2.6 THERMAL-HANGER SHIELD INSERTS

- A. Description: 100-psig minimum, compressive-strength insulation insert with a sheet metal shield.
- B. Manufacturers:
 - 1. Carpenter & Paterson, Inc.
 - 2. ERICO/Michigan Hanger Co.
 - 3. PHS Industries, Inc.
 - 4. Pipe Shields, Inc.
 - 5. Rilco Manufacturing Company, Inc.
 - 6. Buckaroos
- C. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with vapor barrier. **Wood inserts are not acceptable.**
- D. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass.
- E. Insulation-Insert Material for Hot Piping only, up to 3" diameter: Molded fiberglass block, 20 lbs/ft³ density, thermal conductivity of 0.30.
- F. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- G. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- H. Insert Length: Extend 4 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.7 FASTENER SYSTEMS

- A. Mechanical-Expansion Anchors: Insert-wedge-type stainless steel, for use in hardened Portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
 - 1. Manufacturers:
 - a. B-Line Systems, Inc.; a division of Cooper Industries.
 - b. Empire Industries, Inc.
 - c. Hilti, Inc.
 - d. ITW Ramset/Red Head.
 - e. MKT Fastening, LLC.
 - f. Powers Fasteners.

2.8 PIPE POSITIONING SYSTEMS

- A. Description: IAPMO PS 42, system of metal brackets, clips, and straps for positioning piping in pipe spaces for plumbing fixtures for commercial applications.
- B. Manufacturers:
 - 1. C & S Mfg. Corp.
 - 2. HOLDRITE Corp.; Hubbard Enterprises.
 - 3. Samco Stamping, Inc.

2.9 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

2.10 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars.
 - 1. Exterior: Galvanized steel.
 - 2. Interior: Black steel.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, non-shrink 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 specifying 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, metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

- E. Use padded hangers for piping that is subject to scratching.
- F. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of non-insulated or insulated stationary pipes, NPS 1/2 to NPS 30.
 - 2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of 120 to 450 deg F pipes, NPS 4 to NPS 16, requiring up to 4 inches of insulation.
 - 3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS 3/4 to NPS 24, requiring clamp flexibility and up to 4 inches of insulation.
 - 4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes, NPS 1/2 to NPS 24, if little or no insulation is required.
 - 5. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS 1/2 to NPS 4, to allow offcenter closure for hanger installation before pipe erection.
 - 6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated stationary pipes, NPS 3/4 to NPS 8.
 - 7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of non-insulated stationary pipes, NPS 1/2 to NPS 8.
 - 8. Adjustable Band Hangers (MSS Type 9): For suspension of non-insulated stationary pipes, NPS 1/2 to NPS 8.
 - 9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 2.
 - 10. Split Pipe-Ring with or without Turnbuckle-Adjustment Hangers (MSS Type 11): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 8.
 - 11. Extension Hinged or 2-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 3.
 - 12. U-Bolts (MSS Type 24): For support of heavy pipes, NPS 1/2 to NPS 30.
 - 13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
 - 14. Pipe Saddle Supports (MSS Type 36): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange.
 - 15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange and with U-bolt to retain pipe.
 - 16. Adjustable, Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes, NPS 2-1/2 to NPS 36, if vertical adjustment is required, with steel pipe base stanchion support and cast-iron floor flange.
 - 17. Single Pipe Rolls (MSS Type 41): For suspension of pipes, NPS 1 to NPS 30, from 2 rods if longitudinal movement caused by expansion and contraction might occur.
 - Adjustable Roller Hangers (MSS Type 43): For suspension of pipes, NPS 2-1/2 to NPS 20, from single rod if horizontal movement caused by expansion and contraction might occur.
 - 19. Complete Pipe Rolls (MSS Type 44): For support of pipes, NPS 2 to NPS 42, if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
 - 20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes, NPS 2 to NPS 24, if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
 - 21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes, NPS 2 to NPS 30, if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.
- G. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20.

- 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20, if longer ends are required for riser clamps.
- H. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
 - 2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
 - 3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
 - 4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
 - 5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.
- I. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
 - 2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction to attach to top flange of structural shape.
 - 3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
 - 4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
 - 5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
 - 6. C-Clamps (MSS Type 23): For structural shapes.
 - 7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
 - 8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
 - 9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel Ibeams for heavy loads.
 - 10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel Ibeams for heavy loads, with link extensions.
 - 11. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
 - 12. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:
 - a. Light (MSS Type 31): 750 lb.
 - b. Medium (MSS Type 32): 1500 lb.
 - c. Heavy (MSS Type 33): 3000 lb.
 - 13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
 - 14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
 - 15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.
- J. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
 - 2. Thermal-Hanger Shield Inserts: For supporting insulated cold pipe. Wood inserts are not acceptable.
- K. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.

- 2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
- 3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
- 4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
- 5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from hanger.
- 6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from base support.
- 7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from trapeze support.
- 8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
 - a. Horizontal (MSS Type 54): Mounted horizontally.
 - b. Vertical (MSS Type 55): Mounted vertically.
 - c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.
- L. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.
- M. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.
- N. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

3.2 HANGER AND SUPPORT INSTALLATION

- A. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure; **attaching to metal roof decks is not permissible.**
- B. Trapeze Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated trapeze pipe hangers.
 - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
 - 2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.
- C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.
- D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- E. Fastener System Installation:
 - 1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.

- 2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- F. Pipe Positioning System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture. Refer to Specification Section "Plumbing Fixtures" for plumbing fixtures.
- G. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.
- H. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- I. Install hangers and supports to allow controlled thermal movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- J. Install lateral bracing with pipe hangers and supports to prevent swaying.
- K. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- L. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- M. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9 (for building services piping) are not exceeded.
- N. Insulated Piping: Comply with the following:
 - 1. Attach clamps and spacers to piping.
 - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits according to ASME B31.9 for building services piping.
 - 2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weightdistribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
 - 3. Install thermal-hanger shield inserts on insulated piping with vapor barrier. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
 - 4. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
 - b. NPS 4: 12 inches long and 0.06 inch thick.
 - c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
 - 5. Insert Material: Length at least as long as protective shield.
 - 6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.
- O. Insulated Ducts (Mineral Fiber Blanket). Comply with the following:
 - 1. At all unistrut supports provide mineral fiber board insert in between ductwork and unistrut. Insert to extend 12" on both sides of unistrut, full length of strut. Extend blanket between structural insert.

3.3 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make smooth bearing surface.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.4 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and 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. 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.

3.5 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.6 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. Touch Up: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 09 painting Sections.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION

SECTION 23 0553 MECHANICAL IDENTIFICATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following mechanical identification materials and their installation:
 - 1. Equipment nameplates.
 - 2. Equipment markers.
 - 3. Equipment signs.
 - 4. Access panel and door markers.
 - 5. Pipe markers.
 - 6. Duct markers.
 - 7. Stencils.
 - 8. Valve tags.
 - 9. Valve schedules.
 - 10. Warning tags.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Valve Schedules: For each piping system. Furnish extra copies (in addition to mounted copies) to include in maintenance manuals. Reproduce on 8½ H 11 bond. Tabulate valve number, piping system, system abbreviation as shown on tag, room or space location of valve, and variations for identification. Mark valves intended for emergency shutoff and similar special uses. Indicate normal operating positions (open, closed, modulating, or balance).

1.4 QUALITY ASSURANCE

A. ASME Compliance: Comply with ASME A13.1, "Scheme for the Identification of Piping Systems," for letter size, length of color field, colors, and viewing angles of identification devices for piping.

1.5 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 location of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS
2.1 GENERAL

A. Products specified are for applications referenced in other Mechanical sections. In addition to a factory installed equivalent nameplate, all equipment shall have an engraved equipment sign that matches the schedule tag name.

2.2 EQUIPMENT IDENTIFICATION DEVICES

- A. Equipment Nameplates: Metal, with data engraved or stamped, for permanent attachment on equipment.
 - 1. Data:
 - a. Manufacturer, product name, model number, and serial number.
 - b. Capacity, operating and power characteristics, and essential data.
 - c. Labels of tested compliances.
 - 2. Location: Accessible and visible.
 - 3. Fasteners: As required to mount on equipment.
 - 4. Material: Brass.
- B. Equipment Signs: ASTM D 709, Type I, cellulose, paper-base, phenolic-resin-laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white melamine subcore, unless otherwise indicated. Fabricate in sizes required for message. Provide holes for mechanical fastening.
 - 1. Data: Instructions for operation of equipment and for safety procedures.
 - 2. Engraving: Manufacturer's standard letter style, of sizes and with terms to match equipment identification.
 - 3. Thickness: 1/8 inch, unless otherwise indicated.
 - 4. Fasteners: Self-tapping, stainless-steel screws or contact-type, permanent adhesive.

2.3 PIPING IDENTIFICATION DEVICES

- A. Manufactured Pipe Markers, General: Manufacturers standard preprinted, semi-rigid, snapon type.
 - 1. Colors: Comply with ASME A13.1, unless otherwise indicated.
 - 2. Pipes with OD, Including Insulation, Less Than 6 Inches: Full-band pipe markers extending 360 degrees around pipe at each location.
 - 3. Pipes with OD, Including Insulation, 6 Inches and Larger: Either full-band or strip-type pipe markers at least three times letter height and of length required for label.
 - 4. Arrows: Integral with piping system service lettering to accommodate both directions; or as separate unit on each pipe marker to indicate direction of flow.
 - 5. Lettering: Manufacturers standard preprinted.

2.4 DUCT IDENTIFICATION DEVICES

A. Duct Markers: Engraved, color-coded laminated plastic. Include direction and quantity of airflow and duct service (such as supply, return, and exhaust). Include contact-type, permanent adhesive. See Execution section for color scheme.

2.5 VALVE TAGS

- A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch sequenced numbers. Provide 5/32-inch hole for fastener.
 - 1. Material: 0.032-inch thick aluminum.
 - 2. Valve-Tag Fasteners: Brass S-hook.
 - 3. Size: 1¹/₂ inches in diameter, unless otherwise indicated.

2.6 VALVE SCHEDULES

- A. Valve-Schedule Frames: Glazed display frame for removable mounting on masonry walls for each page of valve schedule. Include mounting screws.
- B. Frame: Extruded aluminum.
- C. Glazing: ASTM C 1036, Type I, Class 1, Glazing Quality B, 2.5-mm, single-thickness glass.

2.7 WARNING TAGS

- A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags; of plasticized card stock with matte finish suitable for writing.
 - 1. Size: 3 by 5-1/4 inches **minimum**.
 - 2. Fasteners: Brass grommet and wire.
 - 3. Nomenclature: Large-size primary caption such as DANGER, CAUTION, or DO NOT OPERATE.
 - 4. Color: Yellow background with black lettering.

PART 3 - EXECUTION

- 3.1 APPLICATIONS, GENERAL
 - A. Products specified are for applications referenced in other Mechanical Sections. If more than single-type material, device, or label is specified for listed applications, selection is Installer's option.

3.2 EQUIPMENT IDENTIFICATION

- A. Install and permanently fasten equipment nameplates on each major item of mechanical equipment that does not have nameplate or has nameplate that is damaged or located where not easily visible. Locate nameplates where accessible and visible. Include nameplates for the following general categories of equipment:
 - 1. Fuel-burning units, including boilers, furnaces, heaters, stills, and absorption units.
 - 2. Pumps, compressors, chillers, condensers, and similar motor-driven units.
 - 3. Heat exchangers, coils, evaporators, cooling towers, heat recovery units, and similar equipment.
 - 4. Fans, blowers, primary balancing dampers, and mixing boxes.
 - 5. Packaged HVAC central-station and zone-type units.
- B. Install equipment markers with permanent adhesive on or near each major item of mechanical equipment. Data required for markers may be included on signs, and markers may be omitted if both are indicated.
 - 1. Letter Size: Minimum 1/4 inch for name of units if viewing distance is less than 24 inches, ½ 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.
 - 2. Data: Distinguish among multiple units, indicate operational requirements, indicate safety and emergency precautions, warn of hazards and improper operations, and identify units.
 - 3. Locate markers where accessible and visible. Include markers for the following general categories of equipment:
 - a. Main control and operating valves, including safety devices and hazardous units such as gas outlets.

- b. Fire department hose valves and hose stations.
- c. Meters, gages, thermometers, and similar units.
- d. Fuel-burning units, including boilers, furnaces, heaters, stills, and absorption units.
- e. Pumps, compressors, chillers, condensers, and similar motor-driven units.
- f. Heat exchangers, coils, evaporators, cooling towers, heat recovery units, and similar equipment.
- g. Fans, blowers, primary balancing dampers, and mixing boxes.
- h. Packaged HVAC central-station and zone-type units.
- i. Tanks and pressure vessels.
- j. Strainers, filters, humidifiers, water-treatment systems, and similar equipment.
- C. Install equipment signs with screws or permanent adhesive on or near each major item of mechanical equipment. Locate signs where accessible and visible.
 - 1. Identify mechanical equipment with equipment markers in the following color codes:
 - a. Green: For cooling equipment and components.
 - b. Yellow: For heating equipment and components.
 - c. Green and Yellow, Orange: For combination cooling and heating equipment and components.
 - d. Brown: For energy-reclamation equipment and components.
 - 2. Letter Size: Minimum 1/2 inch for name of units if viewing distance is less than 24 inches, 3/4 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.
 - 3. Data: Distinguish among multiple units, indicate operational requirements, indicate safety and emergency precautions, warn of hazards and improper operations, and identify units.
 - 4. Include signs for the following general categories of equipment:
 - a. Main control and operating valves, including safety devices and hazardous units such as gas outlets.
 - b. Fuel-burning units, including boilers, furnaces, heaters, stills, and absorption units.
 - c. Pumps, compressors, chillers, condensers, and similar motor-driven units.
 - d. Heat exchangers, coils, evaporators, cooling towers, heat recovery units, and similar equipment.
 - e. Fans, blowers, primary balancing dampers, and mixing boxes.
 - f. Packaged HVAC central-station and zone-type units.
 - g. Tanks and pressure vessels.
 - h. Strainers, filters, humidifiers, water-treatment systems, and similar equipment.
- D. Install access panel markers with screws on equipment access panels.

3.3 PIPING IDENTIFICATION

- A. Install manufactured pipe markers indicating service on each piping system. Install with flow indication arrows showing direction of flow.
 - 1. Pipes with OD, Including Insulation, Less Than 6 Inches: Snap-on application of pretensioned, semi-rigid plastic pipe marker.
 - 2. Pipes with OD, Including Insulation, 6 Inches and Larger: Shaped pipe markers. Use size to match pipe and secure with manufacturer's stainless steel bands.
 - 3. Fasten Option: Laminated or bonded application of pipe marker to pipe or insulation.
- B. Locate pipe markers and color bands where piping is exposed in finished spaces; in machine rooms; in accessible maintenance spaces such as shafts, tunnels and plenums; and in exterior nonconcealed locations such as rooftops and chiller yards, 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 nonaccessible 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. On piping above removable acoustical ceilings.

3.4 DUCT IDENTIFICATION

- A. Install duct markers with permanent adhesive on air ducts in the following color codes:
 - 1. Green: For cold-air supply ducts.
 - 2. Yellow: For hot-air supply ducts.
 - 3. Blue: For exhaust-, outside-, relief-, return-, and mixed-air ducts.
 - 4. ASME A13.1 Colors and Designs: For hazardous material exhaust.
 - 5. Letter Size: Minimum 1/2 inch for name of units if viewing distance is less than 24 inches, 3/4 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.
- B. Locate markers near points where ducts enter into concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system. Reduce intervals to 25 feet in areas of high duct congestion.

3.5 VALVE-SCHEDULE INSTALLATION

A. Mount valve schedule on wall in accessible location in each major equipment room.

3.6 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

3.7 VALVE TAGS

- A. Install on valves and control devices in piping systems, except check valves, valves within factory-fabricated equipment units, plumbing fixture supply stops, shutoff valves, and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in valve schedule.
- B. Valve Tag Application Schedule: Tag valves according to size, shape, color scheme, and with captions similar to those indicated in the following:
- C. Tag Material: Aluminum.
- D. Tag Size and Shape: 1-1/2 inches, round.
- E. Tag Color: According to the following:
 - 1. Chilled Water: Blue.
 - 2. Cold Water: Black.
 - 3. Hot Water: Red.
 - 4. Fire Protection: Red.
 - 5. Sprinkler: White.

- 6. Gas: Yellow.
- 7. Steam: Red.
- F. Letter Color: White.
- G. Install mounted valve schedule in each major equipment room.

3.8 EQUIPMENT SIGNS AND MARKERS

- A. Install engraved plastic-laminate signs or equipment markers on or near each major item of mechanical equipment. Include signs for the following general categories of equipment:
 - 1. Main control and operating valves, including safety devices and hazardous units such as gas outlets.
 - 2. Meters, gages, thermometers, and similar units.
 - 3. Fuel-burning units, including boilers, furnaces, heaters, stills, and absorption units.
 - 4. Pumps, compressors, chillers, condensers, and similar motor-driven units.
 - 5. Heat exchangers, coils, evaporators, cooling towers, heat recovery units, and similar equipment.
 - 6. Fans, blowers, primary balancing dampers, and mixing boxes.
 - 7. Packaged HVAC central-station and zone-type units.
 - 8. Tanks and pressure vessels.
 - 9. Strainers, filters, humidifiers, water-treatment systems, and similar equipment.
 - 10. Any concealed appurtenances requiring access for maintenance shall be clearly identified by sign (to include but not be limited to unions, strainers, valves, etc.).
- B. Duct Systems: Identify air supply, return, exhaust, intake, and relief ducts with duct markers; or provide stenciled signs and arrows showing service and direction of flow.
 - 1. Location: Locate signs near points where ducts enter into concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.

3.9 ADJUSTING AND CLEANING

- A. Relocate mechanical identification materials and devices that have become visually blocked by work of this or other Divisions.
- B. Clean faces of identification devices and glass frames of valve charts.

END OF SECTION

SECTION 23 0719 MECHANICAL INSULATION

PART 1- GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes mechanical insulation for duct, equipment, and pipe, including the following:
 - 1. Insulation Materials:
 - a. Cellular glass.
 - b. Flexible elastomeric.
 - c. Mineral fiber.
 - d. Phenolic
 - 2. Adhesives.
 - 3. Mastics.
 - 4. Sealants.
 - 5. Factory-applied jackets.
 - 6. Field-applied fabric-reinforcing mesh.
 - 7. Field-applied tape.
 - 8. Field-applied jackets.
 - 9. Securements.
 - 10. Corner angles.
- B. Related Sections include the following:
 - 1. Specification Section "Metal Ducts" for duct liners.
 - 2. Specification Section "Hangers and Supports" for high-density inserts at hangers; wood inserts at hangers are not acceptable.
 - 3. Specification Section "Special Conditions for All Mechanical Work".
 - 4. Specification Section "Basic Mechanical Materials and Methods".
- C. Not all items listed within this specification are used. Use only items applicable per application schedule.

1.3 DEFINITIONS

- A. ASJ: All-service jacket.
- B. CONCEALED: Covered or concealed by a ceiling (gypsum or lay-in acoustical tile) or wall.
- C. EXPOSED: Open to view; not concealed by a ceiling or wall of any sort.
- D. FSK: Foil, scrim, kraft paper.
- E. UNDERFLOOR: Accessible crawl space beneath lowest floor level. (considered "outdoors")
- 1.4 SUBMITTALS

A. Product Data: For each type of product indicated, identify thermal conductivity, thickness, and jackets (both factory and field applied, if any). Provide submittal data on all products to be used.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, and cement material containers, with appropriate markings of applicable testing and inspecting agency.
 - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.
- B. All products to be stored in a dry location, protected from the elements. All damaged insulation to be replaced.

1.7 COORDINATION

- A. Coordinate size and location of supports, hangers, and high-density insulation inserts and shields specified in Specification Section "Hangers and Supports." Coordinate with drawing details where applicable; wood inserts at hangers are not acceptable.
- B. Coordinate clearance requirements with piping Installer for piping insulation application, duct Installer for duct insulation application, and equipment Installer for equipment insulation application. Before preparing piping and ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.8 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.
- C. Insulation not to be installed until building is dried in.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 INSULATION MATERIALS

- A. Refer to Part 3 schedule articles for requirements about where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Phenolic: 1. Man
 - Manufacturers:
 - a. Resolco
 - b. Dyplast Products
 - c. Polyguard
 - d. Approved equal.
 - 2. 100% CFC-free, HCFC-free, and halogen-free, closed cell rigid phenolic foam insulation.
 - 3. Minimal thermal conductivity @ 75° F
 - a. Green, 2.5 lb/ft³: 0.15 (Btu.in/hr.ft². F)
 - b. Pink, 5.0 lb/ft³: 0.21 (Btu.in/hr.ft². F)
- G. Cellular Glass:
 - 1. Manufacturers:
 - a. Pittsburgh Corning Corporation; Foamglas Super K.
 - 2. Block Insulation: ASTM C 552, Type I.
 - 3. Special-Shaped Insulation: ASTM C 552, Type III.
 - 4. Board Insulation: ASTM C 552, Type IV.
 - 5. Preformed Pipe Insulation with Factory-Applied ASJ: Comply with ASTM C 552, Type II, Class 2.
 - 6. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.
 - 7. Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Minimal thermal conductivity at 75° F of 0.27 (Btu.in/hr.ft². F) (R-value of 10.34@ 3 inches thickness). Factory-applied jacket requirements are specified in Part 2 "Factory-Applied Jackets" Article.
- H. Flexible Elastomeric:
 - 1. Manufacturers:
 - a. Aeroflex USA Inc.; Aerocel.
 - b. Armacel LLC; AP Armaflex.
 - 2. Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.
 - 3. Minimal thermal conductivity at 75° F of 0.25 (Btu.in/hr.ft². F).
- I. Mineral-Fiber Blanket Insulation:
 - 1. Manufacturers:

- Johns Manville; Microlite. a.
- Knauf Insulation; Duct Wrap b.
- Owens-Corning; All-Service Duct Wrap. c.
- Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, 2. Type II and ASTM C 1290, Type III with factory-applied FSP jacket. Factory-applied jacket requirements are specified in Part 2 "Factory-Applied jackets" Article.
- 3. Minimal density of 1.0 lb/ft³, installed R-value of 6.0 (at 2" thick).
- J. Mineral-Fiber Board Insulation:
 - Manufacturers: 1
 - Johns Manville; 800 Series Spin-Glas. a.
 - Knauf Insulation; Insulation Board. b.
 - Owens Corning; Fiberglas 700 Series. c.
 - Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, 2. Type IA or Type IB. For duct and plenum applications, provide insulation with factoryapplied FSK jacket. For equipment applications, provide insulation with factory-applied FSK jacket. Factory-applied jacket requirements are specified in Part 2 "Factory-Applied Jackets" Article.
 - 3. Minimal density of 2.25 lb/ft³, with a R-value of 8.7 (at 2" thickness).
- Mineral-Fiber, Preformed Pipe Insulation: K.
 - Manufacturers: 1.
 - a. Johns Manville: Micro-Lok.
 - Knauf Insulation; 1000° Pipe Insulation. b.
 - Owens Corning; Fiberglas Pipe Insulation. C.
 - Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. 2. Minimum thermal conductivity at 75° F of 0.23 (Btu.in/hr.ft². F). Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in Part 2 "Factory-Applied Jackets" Article.

2.3 **ADHESIVES**

- Α. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated. All products are to contain low V.O.C. as defined/governed by LEED IEQ 4.1 and 4.2 (Regardless of project type).
- Β. Cellular-Glass, Solvent-based resin adhesive, with a service temperature range of minus 75 to plus 300 deg F. 1.
 - Products:
 - Foamglas: Pittseal 444N or equal a.
- C. Flexible Elastomeric: Comply with MIL-A-24179A, Type II, Class I.
 - 1. Products:
 - K-Flex: 720 LVOC or equal a.
- D. Phenolic: Water based adhesive with a service temp of minus 20°F to 700°F.
 - 1. Products:
 - Foster 97-15 а
- Ε. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
 - 1 Products:
 - a. Design Polymerics, DP2502 (or approved equal).
- MASTICS 2.4

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II. All products are to contain low V.O.C. as defined/governed by LEED IEQ 4.1 and 4.2 (Regardless of project type).
- B. Vapor-Barrier Mastic: Water based; suitable for outdoor use on below ambient services, or indoor vapor barrier use.
 - 1. Products:
 - a. Childers Products, Division of ITW; CP-35.
 - 2. Water-Vapor Permeance: ASTM F 1249, 0.09 perm at 55-mils film thickness.
 - 3. Service Temperature Range: Minus 20 to plus 190 deg F.
 - 4. Solids Content: ASTM D 1644, 60 percent by volume and 73 percent by weight.
 - 5. Color: White.
 - 6. VOC: 36 g/l

2.5 SEALANTS

- A. Joint Sealants:
 - 1. Joint Sealants for Cellular-Glass Products:
 - a. Pittsburgh Corning Corporation; Pittseal 444N.
 - 2. Joint Sealant for Phenolic Products
 - a. Foster 95-50
- B. Metal Jacket:
 - 1. Products:
 - a. Foster 95-44 or equal.
 - b. Childers Products, Division of ITW; CP-76.
- C. Mineral Fiber:
 - 1. Design Polymerics DP 2502.
 - 2. Childers Products, Division of ITW; CP-35.
- D. PVC Jacket:
 - 1. Childers Products, Division of ITW; CP-35.

2.6 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
 - 1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
 - 2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
 - 3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.7 FIELD-APPLIED FABRIC-REINFORCING MESH

- A. Woven Glass-Fiber Fabric: Comply with MIL-C-20079H, Type I, plain weave, and presized a minimum of 2.2 oz./sq. yd. 10 x 10 strand count per square inch, minimum 4" wide band.
 - 1. Available Products:
 - a. Chil-glas #10.
 - b. Charles Harmon and Co. white weaveset.

2.8 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, 25/50 ASTM-F 84, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
 - 1. Products:
 - a. Johns Manville; Zeston.
 - b. Proto PVC Corporation; LoSmoke.
 - 2. Color: White:
 - 3. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
 - a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.
 - 4. Factory-fabricated tank heads and tank side panels.
- C. Metal Jacket:
 - 1. Products:
 - a. Childers Products, Division of ITW; Metal Jacketing Systems.
 - 2. Aluminum Jacket: Comply with ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105 or 5005, Temper H-14.
 - a. Factory cut and rolled to size.
 - b. Finish and thickness are indicated in field-applied jacket schedules.

2.9 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136 and UL listed.
 - 1. Width: 4 inches.
 - 2. Thickness: 14.0 mils.
 - 3. Adhesion: 73 ounces force/inch in width.
 - 4. Elongation: 2 percent.
 - 5. Tensile Strength: 55 lbf/inch in width.
 - 6. Color: White
- B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136 and UL listed.
 - 1. Width: 4 inches.
 - 2. Thickness: 13 mils.
 - 3. Adhesion: 73 ounces force/inch in width.
 - 4. Elongation: 2 percent.
 - 5. Tensile Strength: 40 lbf/inch in width.
 - 6. Color: Silver

2.10 SECUREMENTS

A. Bands:

- 1. Products:
 - a. Childers Products; Bands.
- 2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 316; 0.015 inch thick, 3/4 inch wide with wing or closed seal.
- 3. Aluminum: ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch with wing or closed seal.
- 4. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.
- B. Insulation Pins and Hangers:

- 1. Cupped-Head, Capacitor-Discharge-Insulated Weld Pins: Zinc-coated steel pin, fully annealed for capacitor-discharge welding, 12 Gauge shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer. Contractor to field verify, integrity of pin weld on ductwork with sheet metal thickness less than 22-gauge. Integrity to be verified prior to concealment with insulation.
 - a. Products:
 - 1) GEMCO; Cupped Head Weld Pin or equal.
- 2. Metal, "Peel and Press" Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
 - a. Products:
 - 1) GEMCO; Peel and Press or equal.
 - b. Baseplate: Galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
 - c. Spindle: Copper- or zinc-coated, low carbon steel, fully annealed, 12 Gauge diameter shank, length to suit depth of insulation indicated.
 - d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
- 3. Insulation-Retaining Washers and Cap: Self-locking cap washers formed from 12 Gauge, galvanized-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
 - a. Products:
 - 1) AGM Industries, Inc.; RC-150.
 - 2) GEMCO; R-150.
 - b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.
- C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.
- 2.11 CORNER ANGLES
 - A. PVC Corner Angles: 30 mils thick, minimum 1 by 1 inch, PVC according to ASTM D 1784, Class 16354-C. White or color-coded to match adjacent surface.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.
 - 1. Verify that systems and equipment to be insulated have been tested and are free of defects.
 - 2. Verify that surfaces to be insulated are clean and dry.
 - 3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application. For Stainless Steel; apply a corrosion coating to insulated surfaces with an epoxy primer and an epoxy finish 5 mils thick.

B. Verify and coordinate insulation installation with the systems and trades installing heat tracing. Comply with requirements for heat tracing that applies to insulation.

3.3 COMMON INSTALLATION REQUIREMENTS

- A. Requirements in this Article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. 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.
- C. 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.
- D. 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.
- E. Install high-density inserts at hanger locations prior to insulating (duct and pipe); wood or block inserts are not acceptable.
- F. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- G. Where multiple layers of insulation are required, longitudinal and end seams are to be staggered.
- H. Do not weld brackets, clips, pins or other attachment devices to piping, fittings, tanks, coils, equipment, vessel, and specialties.
- I. Keep insulation materials clean and dry before, during application, and finishing.
- J. Install insulation with tight longitudinal seams and end joints.
- K. Install insulation with least number of joints practical.
- L. Install insulation so that material is not over compressed. Install corner angles prior to insulating; to protect all insulation from damage.
- M. Seal all joints, and seams, including penetrations in insulation, at supports, and other projections with insulation of same material overlapped by 2". Secure strips with outward clinching staples along edge of overlap, (spaced 1 inch on center) and seal entire joint or seam with mastic and embedded fiberglass reinforcing mesh, minimum 4", cover mesh with finish coat of mastic.
- N. Do not insulate, conceal, or enclose pipe hangers, channel and steel supports, etc. not directly fasten to duct.
- O. 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.
- P. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses. Do not water down products unless directed by manufacture. Use clean potable demineralized water when required.
- Q. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

- R. Repair all damage insulation prior to concealment as noted above.
- S. Do not insulate or conceal vibration-control devices, labels, stamps, nameplates, data plates, manholes, cleanouts, etc. require for maintenances.
- T. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarded integrity, unless otherwise indicated.
- U. Insulate pipe elbows, tees, valves, strainers, flanges, etc., using preformed fitting insulation, mitered fittings or oversized preformed pipe insulation made from same material thickness and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, voids, and irregular surfaces with insulating mastic finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation. Provide a removable reusable insulation cover; design that maintains vapor barrier. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts.
- V. Cover segmented insulated surfaces with a layer of finishing adhesive and coat with a vaporbarrier mastic. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
- W. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Secure PVC covers to adjoining insulation facing using staples and ASJ tape. Seal PVC fitting covers with mastic.
- X. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. Shape insulation at these connections by tapering it to and around the connection with insulating adhesive and finish with mastic. All connections are to be accessible.
- Y. Install removable insulation segment and covers at flanges, valves, controls, unions, equipment access doors, manholes, hand holes, and other elements that require frequent removal for service and inspection. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.4 PENETRATIONS

- A. Install insulation continuously through all walls, floors, and partitions penetrations and sleeves.
- B. Extend jacket of outdoor installation into wall and roof jacks by 2 inches. Seal jacket to roof flashing with approved flashing sealant.
- C. Insulation Installation at Fire-Rated Walls, floors and Partitions Penetrations for duct work were fire/smoke dampers are required: Terminate insulation at fire damper sleeves as require by damper manufacturer. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.
- 3.5 GENERAL PIPE INSULATION INSTALLATION (IN ADDITION TO COMMON REQUIREMENTS)
 - A. Preformed Pipe Insulation Installation on Pipe, Fittings, Valves, Flanges, Tanks, Elbows, and Appurtenances for Cellular- Glass, Mineral- Fiber, Flexible Elastomeric, and Phenolic insulations:

- 1. Install insulation in a manner that secures material to system being insulated with staples, tape and mastic.
- 2. When insulation with preformed pipe insulation, seal all longitudinal seams, end joints, and protrusions with manufacturers recommended tape matching jacket, vapor-barrier mastic, joint sealant, and adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- 3. Secure fittings, jacket, cover, etc. with tape matching jacket and secure with outward clinched staples 1 inch on center. Apply vapor-barrier mastic over staples.
- 4. Arrange insulation to permit access to valves packing, flanges, unions, etc. and valve operation for maintenance without disturbing insulation. Install insulation so that it can be removed without damage to surrounding insulation or access enclosure.
- 5. Pipe hangers are not to be concealed in insulation.
- 6. Seal all exposed insulation ends with mastic.
- 7. Seal all mitered joints prior to installing covers with vapor-barrier sealant and mastic.
- 8. Install preformed pipe insulation to outer diameter of pipe flange.
- 9. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
- 10. Fill voids between inner circumference of valves, flange, elbows, and bolts insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
- 11. Install preformed sections of same material insulation when available. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Install PVC cover over fitting or mitered section.
- 12. Arrange insulation to permit access to valves packing, flanges, unions, etc. and valve operation for maintenance without disturbing insulation. Install insulation so that it can be removed without damage to surrounding insulation or access enclosure.

3.6 GENERAL BLANKET AND BOARD INSULATION INSTALLATION (IN ADDITION TO COMMON REQUIREMENTS)

- A. Blanket and Board Insulation Installation on Duct, Tanks, Vessels, Elbows, and Appurtenances:
 - 1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for a minimum of 50 percent coverage of duct and plenum and 100 percent coverage of equipment, tanks, etc.; to secure insulation to surfaces. Apply adhesive to entire circumference of all surfaces; including fittings and transitions.
 - 2. Install cupped-head, capacitor-discharge-weld pins surfaces to secure insulation to ductwork. Install on sides and bottom of horizontal and vertical ducts having a width or height greater than 23 inches. Locate 16 inches center and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface as required by manufacturer recommendation. Use approved adhesive stick anchor pins with washers for all equipment, tanks, etc. Cut excess portion of stick anchor pins and install washer's caps. Cover exposed pins and washers caps with tape and mastic matching insulation facing.
 - 3. Install PVC corner angles prior to installing blanket insulation.
 - 4. Do not over compress insulation during installation. Cover exposed pins and washers with tape matching insulation facing and mastic.
 - 5. Install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from 1 edge and 1 end of insulation segment. Secure laps to adjacent insulation section with 3/4-inch outward-clinching staples, 1 inch on center. Coat all seams/joints with mastic and embed with fiberglass reinforced mesh, minimum 4", cover mesh with finish coat of mastic.

- 6. Repair punctures, tears, penetrations and protrusions with 6-inch-wide strips of same material used to insulate duct. Seal all seams with staples, cover with mastic and cover with embedded fiberglass reinforced mesh, cover mesh with finish coat of mastic.
- 7. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to 2 times the insulation thickness but not less than 3 inches.
- 8. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
- 9. Insulate hangers attached to duct work. Do not insulate or enclose channel, supports, etc. not directly fasten to duct.
- Insulation termination: Butt insulation up to termination point. Apply mastic no less than 3" overlap on insulation, and 3" on metal surface. Embed fiberglass reinforced mesh overlapping full 3" of termination point, 6" strip. Cover mesh with finish coat of mastic.

3.7 FIELD-APPLIED JACKET INSTALLATION

A. Install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge. Secure metal jacket with stainless-steel bands 12 inches on center and at end joints.

3.8 FINISHES

- A. Duct, Equipment, and Pipe Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Division 9 painting Sections.
 - 1. Flat Acrylic Finish: Two (2) finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
 - a. Finish Coat Material: Interior, flat, latex-emulsion size.
- B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
- C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
- D. Do not field paint aluminum or stainless-steel jackets.

3.9 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
 - 1. Inspect insulated duct, pipe, and equipment, randomly selected by Engineer, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to two (3) location(s) for each system.
 - 2. All insulation applications will be considered defective work if sample inspection reveals noncompliance with requirements.
 - 3. Remove all defective work and install new insulation and jackets to replace insulation and jackets removed for inspection. Repeat inspection procedures as needed.

3.10 INSULATION SCHEDULE, GENERAL

- A. Plenums and Ducts Requiring Insulation:
 - 1. Indoor, concealed/exposed supply, return, relief and outdoor air.
 - 2. Outdoor, concealed/exposed supply, return and relief air.
- B. Piping Requiring Insulation:
 - 1. Indoor and outdoor hydronics.
 - 2. All pipe and appurtenances that are susceptible to sweating.
 - 3. All pipe and appurtenances carrying water or refrigerant, for space conditioning.
 - 4. Any piping not specifically scheduled for insulation below to be insulated with the code minimum required insulation.
- C. Items Not Insulated:
 - 1. Fibrous-glass ducts.
 - 2. Double-wall metal ducts or lined metal ducts, both with sufficient insulation thickness to comply with adopted edition of IECC and ASHRAE/ IESNA 90.1.
 - 3. Factory-insulated flexible ducts.
 - 4. Factory-insulated plenums and casings.
 - 5. Flexible connectors.
 - 6. Vibration-control devices.
 - 7. Factory-insulated access panels and doors.
 - 8. General building exhaust duct.

3.11 DUCT AND PLENUM INSULATION SCHEDULE

- A. Indoor, concealed, all duct insulation shall be of the following (Including dishwasher exhaust):
 1. Mineral-Fiber Blanket: 2 inches thick and 0.75-lb/cu. ft. nominal density.
- B. Indoor, exposed (including mechanical rooms and utility rooms), rectangular, all duct insulation shall be of the following:
 - 1. Mineral-Fiber Board: 2 inches thick and 2.25-lb/cu. ft. nominal density.
- C. Indoor, exposed round or flat oval ductwork shall be double-wall construction.
- D. Outdoor (including underfloor), all duct insulation shall be any of the following:
 - 1. Rectangular Duct: Cellular Glass, 3 inches thick and 7.5-lb/cu. ft. nominal density. (minimum R-value of 8)
 - 2. Round/Flat Oval: Double wall construction (reference Metal Ducts Specification).

3.12 AIR DEVICE INSULATION SCHEDULE

- A. Supply-air devices (all styles/sizes): Field insulate backside of all devices that are not factory lined:
 - 1. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density. Secured to air device with FSK tape, all sides.

3.13 EQUIPMENT INSULATION SCHEDULE

- A. Insulate indoor and outdoor equipment in paragraphs below that is not factory insulated.
- B. Expansion/compression/buffer tanks, Air-separators, filter feeders, etc. insulation shall be any of the following:
 - 1. Cellular Glass: 3 inches. (chilled water service)
 - 2. Phenolic: 2 inches. (chilled water service)
 - 3. Mineral Fiber Board: 3 inches. (hot water service)

- C. Steam-to-hot water heat exchanger insulation:
 - 1. Mineral-Fiber board: 3" thick, 3lb/cu. ft. density.
 - 2. Cellular Glass: 3" thick, 7.5 lb/cu. ft density.

3.14 PIPING INSULATION SCHEDULE

1.

1

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range.
- B. Condensate and Equipment Drains:
 - All Pipe Sizes: Insulation shall be any of the following:
 - a. Flexible Elastomeric: 1 inch thick.
- C. Chilled Water Supply and Return:
 - All Pipe Sizes: Insulation shall be any of the following:
 - a. Pre-insulated Pipe: Reference Hydronic Piping Specification (for use underfloor, buried, and outdoors).
 - b. Cellular Glass: (for use indoors and outdoors, not accepted in underfloor or buried). Reference schedule below for thickness.
 - c. Phenolic: (for use indoors and outdoors, not accepted in underfloor or buried). Reference schedule below for thickness.
- D. Hot Water Supply and Return:
 - 1. All pipe sizes:
 - a. Mineral-Fiber (for use indoors) Reference table below for thickness.
 - b. Pre-insulated Pipe: Reference Hydronic Piping Specification (for use underfloor and outdoors). Reference table below for thickness.
 - c. Phenolic: (for use indoors and outdoors, not accepted in underfloor or buried) Reference Schedule below for thickness.
 - d. Cellular Glass: (for use indoors and outdoors, not accepted in underfloor or buried) Reference Schedule below for thickness.
- E. Phenolic Density Schedule:
 - 1. Indoors Concealed: 2.5 lb/ft.³ (Green)
 - 2. Indoors Exposed: 5 lb/ft.³ (Pink)
 - 3. Outdoors: 5 lb/ft.³ (Pink)
- F. Steam and Steam Condensate, 350° F and below:
 - 1. All pipe sizes:
 - a. Mineral-Fiber, Preformed pipe, Type I: 3" thick.

Insulation Thickness Schedule										
Fluid	≤1.5" Pipe Size					>1.5" Pipe Size				
	Cellular Glass	Phenolic	Pre- Insulated	Mineral Fiber	Flex Elastomeric	Cellular Glass	Phenolic	Pre- Insulated	Mineral Fiber	Flex Elastomeric
Chilled Water	2"	1.5"	1.5"	N/A	N/A	2"	1.5"	1.5"	N/A	N/A
Hot Water	2"	1.5"	1.5"	1.5"	N/A	2.5"	2"	2"	2"	N/A
Steam/	N/A	N/A	N/A	3"	N/A	N/A	N/A	N/A	3"	N/A
Condensate										
Condensate	N/A	N/A	N/A	N/A	1"	N/A	N/A	N/A	N/A	1"
Refrigerant Suction/Hot Gas Piping	N/A	N/A	N/A	N/A	1.5"	N/A	N/A	N/A	N/A	1"

- G. Refrigerant Suction and Hot Gas Piping:
 - All pipe sizes: Insulation shall be the following:
 - a. Flexible elastomeric: 1-1/2 inch thick.

3.15 FIELD-APPLIED JACKET SCHEDULE

1.

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. Ducts/Piping exposed in finished indoor areas, outdoors, underfloor and mechanical rooms.
 1. Aluminum, Stucco Embossed: 0.016 inch thick.
- C. Indoor hydronic piping fitting or elbows.
 - 1. PVC: 0.015 inch thick.

END OF SECTION

SECTION 23 0900 INSTRUMENTATION AND CONTROLS FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes control equipment for HVAC systems and components, including control components for terminal heating and cooling units not supplied with factory-wired controls.
- B. This Section includes digital control, BAS, and energy management equipment for HVAC systems, including, but not limited to, multiple central station constant air volume air handling units. All microprocessor-based controller shall be of the same manufacturer. Refer to the drawings for additional requirements.

1.3 DEFINITIONS

- A. DDC: Direct digital control.
- B. I/O: Input/output.
- C. MS/TP: Master slave/token passing.
- D. PC: Personal computer.
- E. PID: Proportional plus integral plus derivative.
- F. RTD: Resistance temperature detector.

1.4 SYSTEM PERFORMANCE

- A. Comply with the following performance requirements:
 - 1. Graphic Display: Display graphic with minimum 20 dynamic points with current data within 10 seconds.
 - 2. Graphic Refresh: Update graphic with minimum 20 dynamic points with current data within 8 seconds.
 - 3. Object Command: Reaction time of less than two seconds between operator command of a binary object and device reaction.
 - 4. Object Scan: Transmit change of state and change of analog values to control units or workstation within six seconds.
 - 5. Alarm Response Time: Annunciate alarm at workstation within 45 seconds. Multiple workstations must receive alarms within five seconds of each other.
 - 6. Program Execution Frequency: Run capability of applications as often as five seconds, but selected consistent with mechanical process under control.
 - 7. Performance: Programmable controllers shall execute DDC PID control loops, and scan and update process values and outputs at least once per second.

- 8. Reporting Accuracy and Stability of Control: Report values and maintain measured variables within tolerances as follows:
 - a. Water Temperature: Plus or minus 1 deg F (0.5 deg C).
 - b. Water Flow: Plus or minus 5 percent of full scale.
 - c. Water Pressure: Plus or minus 2 percent of full scale.
 - d. Space Temperature: Plus or minus 1 deg F (0.5 deg C).
 - e. Ducted Air Temperature: Plus or minus 1 deg F (0.5 deg C).
 - f. Outside Air Temperature: Plus or minus 2 deg F (1.0 deg C).
 - g. Dew Point Temperature: Plus or minus 3 deg F (1.5 deg C).
 - h. Temperature Differential: Plus or minus 0.25 deg F (0.15 deg C).
 - i. Relative Humidity: Plus or minus 5 percent.
 - j. Airflow (Pressurized Spaces): Plus or minus 3 percent of full scale.
 - k. Airflow (Measuring Stations): Plus or minus 5 percent of full scale.
 - I. Airflow (Terminal): Plus or minus 10 percent of full scale.
 - m. Air Pressure (Space): Plus or minus 0.01-inch wg (2.5 Pa).
 - n. Air Pressure (Ducts): Plus or minus 0.1-inch wg (25 Pa).
 - o. Carbon Dioxide: Plus or minus 50 ppm.
 - p. Electrical: Plus or minus 5 percent of reading.

1.5 SUBMITTALS

- A. Product Data: Include manufacturer's technical literature for each control device. Indicate dimensions, capacities, performance characteristics, electrical characteristics, finishes for materials, and installation and startup instructions for each type of product indicated.
 - 1. DDC System Hardware: Bill of materials of equipment indicating quantity, manufacturer, and model number. Include technical data for operator workstation equipment, interface equipment, control units, transducers/transmitters, sensors, actuators, valves, relays/switches, control panels, and operator interface equipment.
 - 2. Control System Software: Include technical data for operating system software, operator interface, color graphics, and other third-party applications.
 - 3. Controlled Systems: Instrumentation list with element name, type of device, manufacturer, model number, and product data. Include written description of sequence of operation including schematic diagram.
- B. Specification Compliance Review:
 - Manufacturers and bidders must provide the consulting engineer with a Compliance Review of the Specifications and Addenda's. The Compliance Review shall be a paragraph-by-paragraph review of the Specifications and schedule with the following information; "C", "D", or "E" marked in the margin of the original Specifications and any subsequent Addenda's. If the manufacturer or bidder does not provide the Compliance Review to the engineer for review, with the submittal, the submittal will be subject to rejection as non-compliant.
 - a. "C" Comply with no exceptions.
 - b. "D" Comply with deviations. For each and every deviation, provide a numbered footnote with reasons for the proposed deviation and how the intent of the Specification can be satisfied.
 - c. "E" Exception, do not comply. For each and every exception, provide a numbered footnote with reasons and possible alternatives. Non-compliance with the specifications is grounds for rejection as unacceptable. A bid from any alternative or listed equipment manufacturer with any number of exceptions will be reason for rejection for non-compliance without further review.
 - d. Unless a deviation or exception is specifically noted in the Compliance Review, the manufacturer shall provide full compliance with entire specification. Deviations or exceptions taken in letters or cover letters in a bid document, subsidiary documents, by omission or by contradiction do not release the manufacturer or

bidder from being in complete compliance, unless the exception or deviation has been specifically noted in the Compliance Review and approved by the consulting engineer.

- e. Equipment manufacturers or bidders that do not meet the specifications thru the above process will be subject to rejection without further review.
- C. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 1. Bill of materials of equipment indicating quantity, manufacturer, and model number.
 - 2. Schematic flow diagrams showing fans, pumps, coils, dampers, valves, and control devices.
 - 3. Wiring Diagrams: Power, signal, and control wiring.
 - 4. Details of control panel faces, including controls, instruments, and labeling.
 - 5. Written description of sequence of operation.
 - 6. Schedule of dampers including size, leakage, and flow characteristics.
 - 7. Schedule of valves including flow characteristics.
 - 8. DDC System Hardware:
 - a. Wiring diagrams for control units with termination numbers.
 - b. Schematic diagrams and floor plans for field sensors and control hardware.
 - c. Schematic diagrams for control, communication, and power wiring, showing trunk data conductors and wiring between operator workstation and control unit locations.
 - 9. Control System Software: List of color graphics indicating monitored systems, data (connected and calculated) point addresses, output schedule, and operator notations.
 - 10. Controlled Systems:
 - a. Schematic diagrams of each controlled system with control points labeled and control elements graphically shown, with wiring.
 - b. Scaled drawings showing mounting, routing, and wiring of elements including bases and special construction.
 - c. Written description of sequence of operation including schematic diagram.
 - d. Points list.
- D. Data Communications Protocol Certificates: Certify that each proposed DDC system component complies with ASHRAE 135.
- E. Software and Firmware Operational Documentation: Include the following:
 - 1. Software operating and upgrade manuals.
 - 2. Program Software Backup: On a magnetic media or compact disc, complete with data files.
 - 3. Device address list.
 - 4. Printout of software application and graphic screens.
 - 5. Software license required by and installed for DDC workstations and control systems.
- F. Software Upgrade Kit: For Owner to use in modifying software to suit future systems revisions or monitoring and control revisions.
- G. Qualification Data: For Installer.
- H. Field quality-control test reports.
- I. Operation and Maintenance Data: For HVAC instrumentation and control system to include in emergency, operation, and maintenance manuals. In addition to items specified in Section "Operation and Maintenance Data," include the following:
 - 1. Maintenance instructions and lists of spare parts for each type of control device and compressed-air station.

- 2. Interconnection wiring diagrams with identified and numbered system components and devices.
- 3. Keyboard illustrations and step-by-step procedures indexed for each operator function.
- 4. Inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.
- 5. Calibration records and list of set points.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Automatic control system manufacturer's authorized representative who is trained and approved for installation of system components required for this Project. The installer must have a minimum of five (5) continuous years experience with the manufacturer and have an established service office within 100 miles of the project site.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with ASHRAE 135 for DDC system components.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Factory-Mounted Components: Where control devices specified in this Section are indicated to be factory mounted on equipment, arrange for shipping of control devices to equipment manufacturer.
- B. System Software: Update to latest version of software at Project completion.

1.8 COORDINATION

- A. Coordinate location of thermostats, humidistats, and other exposed control sensors with plans and room details before installation.
- B. Coordinate equipment with Section "Fire Alarm" to achieve compatibility with equipment that interfaces with that system.
- C. Coordinate supply of electrical branch circuits for control units and operator workstation.
- D. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Section "Cast-in-Place Concrete."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 CONTROL SYSTEM

- A. Manufacturers:
 - 1. Schneider Controls
 - 2. Automated Logic
- B. Control system shall consist of sensors, indicators, actuators, final control elements, interface equipment, other apparatus, accessories, and software connected to distributed controllers operating in multiuser, multitasking environment on token-passing network and programmed to control mechanical systems. An operator workstation permits interface with the network via dynamic color graphics with each mechanical system, building floor plan, and control device depicted by point-and-click graphics.

2.3 SPECIAL PROVISION

A. Contractor shall include components to as required to provide either SNMP or MODBUS TCP Ethernet communications protocols. SNMP MIB or MODBUS register lists shall be included in the submittal. External control power and or control wiring from device to protocol converter shall be furnished. Furnish, install, calibrate, program, and test the operational system in cooperation with the DCIM supplier/installer.

2.4 DDC EQUIPMENT

- A. Control Units: Modular, comprising processor board with programmable, nonvolatile, random-access memory; local operator access and display panel; integral interface equipment; and backup power source.
 - 1. Units monitor or control each I/O point; process information; execute commands from other control units, devices, and operator stations; and download from or upload to operator workstation or diagnostic terminal unit.
 - 2. Stand-alone mode control functions operate regardless of network status. Functions include the following:
 - a. Global communications.
 - b. Discrete/digital, analog, and pulse I/O.
 - c. Monitoring, controlling, or addressing data points.
 - d. Software applications, scheduling, and alarm processing.
 - e. Testing and developing control algorithms without disrupting field hardware and controlled environment.
 - 3. Standard Application Programs:
 - a. Electric Control Programs: Demand limiting, duty cycling, automatic time scheduling, start/stop time optimization, night setback/setup, on-off control with differential sequencing, staggered start, antishort cycling, PID control, DDC with fine tuning, and trend logging.
 - b. HVAC Control Programs: Optimal run time, supply-air reset, and enthalpy switchover.
 - c. Chiller Control Programs: Control function of condenser-water reset, chilledwater reset, and equipment sequencing.
 - d. Programming Application Features: Include trend point; alarm processing and messaging; weekly, monthly, and annual scheduling; energy calculations; runtime totalization; and security access.
 - e. Remote communications.
 - f. Maintenance management.
 - g. Units of Measure: Inch-pound and SI (metric).
 - 4. Local operator interface provides for download from or upload to operator workstation or diagnostic terminal unit.

- 5. ASHRAE 135 Compliance: Control units shall use ASHRAE 135 protocol and communicate using ISO 8802-3 (Ethernet) datalink/physical layer protocol.
- B. Local Control Units: Modular, comprising processor board with electronically programmable, nonvolatile, read-only memory; and backup power source.
 - 1. Units monitor or control each I/O point, process information, and download from or upload to operator workstation or diagnostic terminal unit.
 - 2. Stand-alone mode control functions operate regardless of network status. Functions include the following:
 - a. Global communications.
 - b. Discrete/digital, analog, and pulse I/O.
 - c. Monitoring, controlling, or addressing data points.
 - 3. Local operator interface provides for download from or upload to operator workstation or diagnostic terminal unit.
 - 4. ASHRAE 135 Compliance: Control units shall use ASHRAE 135 protocol and communicate using ISO 8802-3 (Ethernet) datalink/physical layer protocol.
- C. I/O Interface: Hardwired inputs and outputs may tie into system through controllers. Protect points so that shorting will cause no damage to controllers.
 - 1. Binary Inputs: Allow monitoring of on-off signals without external power.
 - 2. Pulse Accumulation Inputs: Accept up to 10 pulses per second.
 - 3. Analog Inputs: Allow monitoring of low-voltage (0- to 10-V dc), current (4 to 20 mA), or resistance signals.
 - 4. Binary Outputs: Provide on-off or pulsed low-voltage signal, selectable for normally open or normally closed operation with three-position (on-off-auto) override switches and status lights.
 - 5. Analog Outputs: Provide modulating signal, either low voltage (0- to 10-V dc) or current (4 to 20 mA) with status lights, two-position (auto-manual) switch, and manually adjustable potentiometer.
 - 6. Tri-State Outputs: Provide two coordinated binary outputs for control of three-point, floating-type electronic actuators.
 - 7. Universal I/Os: Provide software selectable binary or analog outputs.
- D. Power Supplies: Transformers with Class 2 current-limiting type or overcurrent protection; limit connected loads to 80 percent of rated capacity. DC power supply shall match output current and voltage requirements and be full-wave rectifier type with the following:
 - 1. Output ripple of 5.0 mV maximum peak to peak.
 - 2. Combined 1 percent line and load regulation with 100-mic.sec. response time for 50 percent load changes.
 - 3. Built-in overvoltage and overcurrent protection and be able to withstand 150 percent overload for at least 3 seconds without failure.
- E. Power Line Filtering: Internal or external transient voltage and surge suppression for workstations or controllers with the following:
 - 1. Minimum dielectric strength of 1000 \breve{V} .
 - 2. Maximum response time of 10 nanoseconds.
 - 3. Minimum transverse-mode noise attenuation of 65 dB.
 - 4. Minimum common-mode noise attenuation of 150 dB at 40 to 100 Hz.

2.5 UNITARY CONTROLLERS

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.
- 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.
- 4. Enclosure (interior): Dustproof rated for operation at 32 to 120 deg F (0 to 50 deg C).
- 5. Enclosure (exterior): NEMA 3R.

2.6 OCCUPANT INTERFACE PANELS

A. Provide manufacturer standard 7-day programmable thermostat for each air handling unit.

2.7 ANALOG CONTROLLERS

- A. Step Controllers: 6- or 10-stage type, with heavy-duty switching rated to handle loads and operated by electric motor.
- B. Electric, Outdoor-Reset Controllers: Remote-bulb or bimetal rod-and-tube type, proportioning action with adjustable throttling range, adjustable set point, scale range minus 10 to plus 70 deg F (minus 23 to plus 21 deg C), and single- or double-pole contacts.
- C. Electronic Controllers: Wheatstone-bridge-amplifier type, in steel enclosure with provision for remote-resistance readjustment. Identify adjustments on controllers, including proportional band and authority.
 - 1. Single controllers can be integral with control motor if provided with accessible control readjustment potentiometer.

2.8 ELECTRONIC SENSORS

- A. Description: Vibration and corrosion resistant; for wall, immersion, or duct mounting as required.
- B. Thermistor Temperature Sensors and Transmitters:
 - 1. Available Manufacturers:
 - a. BEC Controls Corporation.
 - b. Ebtron, Inc.
 - c. Heat-Timer Corporation.
 - d. I.T.M. Instruments Inc.
 - e. MAMAC Systems, Inc.
 - f. RDF Corporation.
 - 2. Accuracy: Plus or minus 0.5 deg F (0.3 deg C) at calibration point.
 - 3. Wire: Twisted, shielded-pair cable.
 - 4. Insertion Elements in Ducts: Single point, 8 inches (200 mm) long; use where not affected by temperature stratification or where ducts are smaller than 9 sq. ft. (0.84 sq. m).
 - 5. Averaging Elements in Ducts: 36 inches (915 mm) long, flexible; use where prone to temperature stratification or where ducts are larger than 10 sq. ft. (1 sq. m).

- 6. Insertion Elements for Liquids: Brass or stainless-steel socket with minimum insertion length of 2-1/2 inches (64 mm).
- 7. Room Sensor Cover Construction: Manufacturer's standard locking covers.
 - a. Set-Point Adjustment (where indicated): Exposed.
 - b. Set-Point Indication (where indicated): Exposed.
 - c. Thermometer: Concealed.
 - d. Color: Manufacturer's standard.
- 8. Outside-Air Sensors: Watertight inlet fitting, shielded from direct sunlight.
- 9. Room Security Sensors: Stainless-steel cover plate with insulated back and security screws.
- C. RTDs and Transmitters:
 - 1. Available Manufacturers:
 - a. Automation Components, Inc. (ACI)
 - b. Building Automation Products, Inc. (BAPI)
 - 2. Accuracy: Plus or minus 0.2 percent at calibration point.
 - 3. Wire: Twisted, shielded-pair cable.
 - 4. Insertion Elements in Ducts: Single point, with length equal to 1/3-distance of duct width, minimum; use where not affected by temperature stratification or where ducts are smaller than 9 sq. ft. (0.84 sq. m).
 - 5. Averaging Elements in Ducts: 24 inches (610 mm) long, rigid; use where prone to temperature stratification or where ducts are larger than 9 sq. ft. (0.84 sq. m); length as required.
 - 6. Insertion Elements for Liquids: Brass socket with minimum insertion length of 2-1/2 inches (64 mm).
 - 7. Room Sensor Cover Construction: Manufacturer's standard locking covers.
 - a. Set-Point Adjustment (where indicated): Exposed.
 - b. Set-Point Indication (where indicated): Exposed.
 - c. Thermometer: Concealed.
 - d. Color: Manufacturer's standard.
 - 8. Outside-Air Sensors: Watertight inlet fitting, shielded from direct sunlight.
 - 9. Room Security Sensors: Stainless-steel cover plate with insulated back and security screws.
- D. Humidity Sensors: Bulk polymer sensor element.
 - 1. Available Manufacturers:
 - a. BEC Controls Corporation.
 - b. General Eastern Instruments.
 - c. MAMAC Systems, Inc.
 - d. ROTRONIC Instrument Corp.
 - e. TCS/Basys Controls.
 - f. Vaisala.
 - 2. Accuracy: 2 percent full range with linear output.
 - 3. Room Sensor Range: 20 to 80 percent relative humidity.
 - 4. Room Sensor Cover Construction: Manufacturer's standard locking covers.
 - 5. Duct Sensor: 20 to 80 percent relative humidity range with element guard and mounting plate.
 - 6. Outside-Air Sensor: 20 to 80 percent relative humidity range with mounting enclosure, suitable for operation at outdoor temperatures of 32 to 120 deg F (0 to 50 deg C).
 - 7. Duct and Sensors: With element guard and mounting plate, range of 0 to 100 percent relative humidity.

2.9 STATUS SENSORS

- A. Status Inputs for Pumps: Differential-pressure switch with pilot-duty rating and with adjustable pressure-differential range of 8 to 60 psig (55 to 414 kPa), piped across pump.
- B. Status Inputs for Electric Motors: Comply with ISA 50.00.01, current-sensing fixed- or splitcore transformers with self-powered transmitter, adjustable and suitable for 175 percent of rated motor current.
- C. Voltage Transmitter (100- to 600-V ac): Comply with ISA 50.00.01, single-loop, self-powered transmitter, adjustable, with suitable range and 1 percent full-scale accuracy.
- D. Power Monitor: 3-phase type with disconnect/shorting switch assembly, listed voltage and current transformers, with pulse kilowatt hour output and 4- to 20-mA kW output, with maximum 2 percent error at 1.0 power factor and 2.5 percent error at 0.5 power factor.
- E. Current Switches: Self-powered, solid-state with adjustable trip current, selected to match current and system output requirements.

2.10 GAS DETECTION EQUIPMENT

- A. Manufacturers:
 - 1. General Monitors.
- B. Carbon Dioxide Sensor and Transmitter: Single detectors using solid-state, non-dispersive, infrared sensors; suitable over a temperature range of 23 to 130 deg F (minus 5 to plus 55 deg C) and calibrated for 0 to 2 percent, with continuous or averaged reading, 4- to 20-mA output.
 - 1. Operating Range: 0 to 2,000 ppm.
 - 2. Exposure Range: 0 to 140 deg F (without damage).
 - 3. Operating Humidity: 5 to 95% relative humidity.
 - 4. Repeatability: plus or minus 20 ppm.
 - 5. Maximum Drift: plus or minus 25 ppm per year.

2.11 THERMOSTATS

- A. Available Manufacturers:
 - 1. Erie Controls.
 - 2. Danfoss Inc.; Air-Conditioning and Refrigeration Div.
 - 3. Heat-Timer Corporation.
 - 4. Sauter Controls Corporation.
 - 5. tekmar Control Systems, Inc.
 - 6. Theben AG Lumilite Control Technology, Inc.
- B. Electric, solid-state, room thermostat for DDC monitoring only.

2.12 HUMIDISTATS

- A. Available Manufacturers:
 - 1. MAMAC Systems, Inc.
 - 2. ROTRONIC Instrument Corp.
- B. Duct-Mounting Humidistats: Electric insertion, 2-position type with adjustable, 2 percent throttling range, 20 to 80 percent operating range, and single- or double-pole contacts.

2.13 CONTROL CABLE

- A. Electronic and fiber-optic cables for control wiring are specified in Section "Control/Signal Transmission Media."
 - 1. All cable shall be return-air plenum rated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that power supply is available to control units and operator workstation.
- B. Verify that duct-, pipe-, and equipment-mounted devices are installed before proceeding with installation.

3.2 INSTALLATION

- A. Install software in control units and operator workstation(s). Implement all features of programs to specified requirements and as appropriate to sequence of operation.
- B. Connect and configure equipment and software to achieve sequence of operation specified.
- C. Verify location of thermostats, humidistats, and other exposed control sensors with Drawings and room details before installation. Install devices at elevations indicated on architectural drawings or 48 inches (1220 mm) above the finished floor where requirements are not indicated.
 - 1. Install averaging elements in ducts and plenums in crossing or zigzag pattern.
- D. Install guards on thermostats in the following locations:1. Where indicated.

3.3 ELECTRICAL WIRING AND CONNECTION INSTALLATION

- A. Install raceways, boxes, and cabinets according to Section "Raceway and Boxes."
 - 1. Interior raceway shall be EMT with steel set-screw fittings. Final 18 inches (441 mm) of raceway to equipment and sensors (not junction boxes or control enclosures/panels) is permitted to be 1/2-inch flexible metallic conduit.
 - 2. Exterior raceway shall be intermediate metallic conduit with compression fittings, unless indicated otherwise. Where roofing supports are required, refer to Division 07 Sections and other roofing drawings specific requirements. Final 24 inches (610 mm) of raceway to equipment and sensors (not junction boxes or control enclosures/panels) is permitted to be liquid-tight flexible non-metallic conduit with compression fittings; associated elbows shall be LFNC compression water-tight fittings. LB's are not acceptable.
- B. Install building wire and cable according to Section "Conductors and Cables."
- C. Install signal and communication cable according to Section "Control/Signal Transmission Media."
 - 1. Conceal cable, except in mechanical rooms and areas where other conduit and piping are exposed. Route concealed cable parallel to building lines on j-hooks, bundled.
 - 2. Install exposed (open ceilings, occupied areas) cable in raceway.

- 3. Install permanently concealed wall and partition cable in raceway with a radius bend and nylon bushing termination at an accessible location above ceiling.
- 4. Bundle and harness multiconductor instrument cable in place of single cables where several cables follow a common path.
- 5. Fasten flexible conductors, bridging cabinets and doors, along hinge side; protect against abrasion. Tie and support conductors.
- 6. Number-code or color-code conductors for future identification and service of control system, except local individual room control cables.
- 7. Install wire and cable with sufficient slack and flexible connections to allow for vibration of piping and equipment.
- D. Connect manual-reset limit controls independent of manual-control switch positions. Automatic duct heater resets may be connected in interlock circuit of power controllers.
- E. Connect hand-off-auto selector switches to override automatic interlock controls when switch is in hand position.

3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, **test**, **and adjust** field-assembled components and equipment installation, including connections, **and to assist in field testing**. Report results in writing.
- B. 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 calibration of electronic controllers by disconnecting input sensors and stimulating operation with compatible signal generator.
 - 4. Test each point through its full operating range to verify that safety and operating control set points are as required.
 - 5. Test each control loop to verify stable mode of operation and compliance with sequence of operation. Adjust PID actions.
 - 6. Test each system for compliance with sequence of operation.
 - 7. Test software and hardware interlocks.
- C. 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 temperature instruments and material and length of sensing elements.
 - 4. 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.
- D. Replace damaged or malfunctioning controls and equipment and repeat testing procedures.

3.5 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. 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.
- 6. 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.
- C. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to three visits to Project during other than normal occupancy hours for this purpose.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain HVAC instrumentation and controls. Refer to Section "Demonstration and Training."

END OF SECTION

SECTION 23 2300 REFRIGERANT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes refrigerant piping used for air-conditioning applications.
- B. Related Sections include the following:
 - 1. Specification Section "Hangers and Supports" for pipe supports and installation requirements.
 - 2. Specification Section "Mechanical Identification" for labeling and identifying refrigerant piping.

1.3 SUBMITTALS

- A. Product Data: For each type of valve and refrigerant piping specialty indicated. Include pressure drop, based on manufacturer's test data, for thermostatic expansion valves, solenoid valves, and pressure-regulating valves.
- 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 relationship between piping and equipment.
 - 1. Refrigerant piping indicated is schematic only. Size piping and design the actual piping layout, including oil traps, double risers, specialties, and pipe and tube sizes, to ensure proper operation and compliance with warranties of connected equipment.

1.4 QUALITY ASSURANCE

- A. ASHRAE Standard: Comply with ASHRAE 15, "Safety Code for Mechanical Refrigeration."
- B. ASME Standard: Comply with ASME B31.5, "Refrigeration Piping."
- C. UL Standard: Provide products complying with UL 207, "Refrigerant-Containing Components and Accessories, Nonelectrical"; or UL 429, "Electrically Operated Valves."

1.5 COORDINATION

- A. Coordinate layout and installation of refrigerant piping and suspension system components with other construction, including light fixtures, HVAC equipment, fire-suppression-system components, and partition assemblies.
- B. Coordinate pipe sleeve installations for foundation wall penetrations.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Refrigerants:
 - a. Allied Signal, Inc./Fluorine Products; Genetron Refrigerants.
 - b. DuPont Company; Fluorochemicals Div.
 - c. Elf Atochem North America, Inc.; Fluorocarbon Div.
 - d. ICI Americas Inc./ICI KLEA; Fluorochemicals Bus.
 - 2. Refrigerant Valves and Specialties:
 - a. Climate & Industrial Controls Group; Parker-Hannifin Corp.; Refrigeration & Air Conditioning Division.
 - b. Danfoss Electronics, Inc.
 - c. Emerson Electric Company; Alco Controls Div.
 - d. Henry Valve Company.
 - e. Sporlan Valve Company.

2.2 COPPER TUBE AND FITTINGS

- A. Drawn-Temper Copper Tube: ASTM B 280, Type ACR
- B. Annealed-Temper Copper Tube: ASTM B 280, Type ACR
- C. Wrought-Copper Fittings: ASME B16.22.
- D. Wrought-Copper Unions: ASME B16.22.
- E. Bronze Filler Metals: AWS A5.8, Classification BAg-1 (silver)

2.3 REFRIGERANT PIPING SPECIALITIES

- A. Straight- or Angle-Type Strainers: 500-psig working pressure; forged-brass or steel body with stainless-steel wire or brass-reinforced Monel screen of 80 to 100 mesh in liquid lines up to 1-1/8 inches, 60 mesh in larger liquid lines, and 40 mesh in suction lines; with screwed cleanout plug and solder-end connections.
- B. Moisture/Liquid Indicators: 500-psig maximum working pressure and 200 deg F operating temperature; all-brass body with replaceable, polished, optical viewing window with color-coded moisture indicator; with solder-end connections.

2.4 REFRIGERANTS

- A. ASHRAE 34, R-134a: Tetrafluoroethane.
- B. ASHRAE 34, R-410a: Difluoromethane/Pentafluoroethane blend.

PART 3 – EXECUTION

- 3.1 PIPING APPLICATIONS
 - A. Aboveground, within Building: Type ACR drawn-copper tubing

3.2 SPECIALTY APPLICATIONS

- A. Install liquid indicator upstream of filter-dryer in liquid line leaving condenser.
- B. Install permanent filter-dryers in systems using hermetic compressors.
- C. Install moister-liquid indicators in liquid lines between filter-dryers and fan/coil units.
- D. Install strainers immediately upstream from each automatic valve, including expansion valves, solenoid valves, hot-gas bypass valves.

3.3 PIPING INSTALLATION

- A. Install refrigerant piping according to ASHRAE 15.
- B. Basic piping installation requirements are specified in Specification Section "Basic Mechanical Materials and Methods."
- C. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.
- D. Arrange piping to allow inspection and service of compressor and other equipment. Install valves and specialties in accessible locations to allow for service and inspection.
- E. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation. Use sleeves through floors, walls, or ceilings, sized to permit installation of full-thickness insulation.
- F. 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.
 - 5. Install bypass around moisture-liquid indicators in lines larger than NPS 2.
 - 6. Install unions to allow removal of solenoid valves, press-regulating valves, and expansion valves and at connections to compressors and evaporators.
- H. When brazing, 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.
- I. Hanger, support, and anchor products are specified in Specification Section "Hangers and Supports."
- J. Install the following pipe attachments:
 - 1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet long.
 - 2. Roller hangers and spring hangers for individual horizontal runs, 20 feet or longer.
 - 3. Pipe rollers for multiple horizontal runs 20 feet or longer, supported by a trapeze.
 - 4. Spring hangers to support vertical runs.
- K. Install hangers for copper tubing with the following maximum spacing and minimum rod sizes:
 - 1. NPS 1/2: Maximum span, 60 inches; minimum rod size, 1/4 inch.
 - 2. NPS 5/8: Maximum span, 60 inches; minimum rod size, 1/4 inch.
 - 3. NPS 1: Maximum span, 72 inches; minimum rod size, 1/4 inch.
 - 4. NPS 1-1/4: Maximum span, 96 inches; minimum rod size, 3/8 inch.
 - 5. NPS 1-1/2: Maximum span, 96 inches; minimum rod size, 3/8 inch.

- 6. NPS 2: Maximum span, 96 inches; minimum rod size, 3/8 inch.
- 7. NPS 2-1/2: Maximum span, 108 inches; minimum rod size, 3/8 inch.
- 8. NPS 3: Maximum span, 10 feet; minimum rod size, 3/8 inch.
- 9. NPS 4: Maximum span, 12 feet; minimum rod size, 1/2 inch.
- L. Support vertical runs at each floor.

3.4 PIPE JOINT CONSTRUCTION

- A. Braze joints according to Specification Section "Basic Mechanical Materials and Methods."
- B. Fill pipe and fittings with an inert gas (nitrogen or carbon dioxide) during brazing to prevent scale formation.

3.5 FIELD QUALITY CONTROL

- A. Test and inspect refrigerant piping according to ASME B31.5, Chapter VI.
 - 1. Test refrigerant piping, specialties, and receivers. Isolate compressor, condenser, evaporator, and safety devices from test pressure.
 - Test high- and low-pressure side piping of each system at not less than the lower of the design pressure or the setting of pressure relief device protecting high and low side of system.
 - 3. System shall maintain test pressure at the manifold gage throughout duration of test.
 - 4. Test joints and fittings by brushing a small amount of soap and glycerin solution over joint.
 - 5. Fill system with nitrogen to raise a test pressure of 150 psig or higher as required by authorities having jurisdiction.
 - 6. Remake leaking joints using new materials and retest until satisfactory results are achieved.

3.6 ADJUSTING

- A. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:
 - 1. Check compressor oil level above center of sight glass.
 - 2. Open compressor suction and discharge valves.
 - 3. Open refrigerant valves, except bypass valves that are used for other purposes.
 - 4. Check compressor-motor alignment, and lubricate motors and bearings.

3.7 SYSTEM CHARGING

- A. Charge system using the following procedures:
 - 1. Install permanent-type filter-dryer after leak test but before evacuation.
 - 2. Evacuate entire refrigerant system with a vacuum pump to a vacuum of 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 permanent-type filter-dryer in charging line. Provide fulloperating charge.

END OF SECTION

SECTION 23 3113 METAL DUCTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Single-wall rectangular ducts and fittings.
 - 2. Double-wall rectangular ducts and fittings.
 - 3. Single-wall round and flat-oval ducts and fittings.
 - 4. Double-wall round and flat-oval ducts and fittings.
 - 5. Sheet metal materials.
 - 6. Duct liner.
 - 7. Sealants and gaskets.
 - 8. Hangers and supports.
 - 9. Ductwork Handling and Plenum Protection.
 - 10. Ductwork Cleaning
- B. Related Sections:
 - 1. Mechanical Specification Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
 - 2. Mechanical Specification Section "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.
 - 3. Mechanical Specification Section "Hangers & Supports".
 - 4. Mechanical Specification Section "Mechanical Means and Methods".
 - 5. Mechanical Specification Section "Special Conditions for Mechanical Work".

1.3 PERFORMANCE REQUIREMENTS

- A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible" and performance requirements and design criteria indicated.
 - 1. Static-Pressure Classes: Variable Volume Systems
 - a. Supply Ducts: (Upstream from Air Terminal Units): 3-inch wg.
 - b. Supply Ducts (Downstream from Air Terminal Units): 1-inch wg.
 - c. Return Ducts (Negative Pressure): 1-inch wg.
 - d. Outside Air Ducts (Negative Pressure): 1-inch wg.
 - 2. Static-Pressure Classes: Constant Volume Systems
 - a. Supply Ducts: 2-inch wg.
 - b. Return Ducts (Negative Pressure): 1-inch wg.
 - c. Outside Air Ducts (Negative Pressure): 1-inch wg.
 - 3. Static-Pressure Classes: Other Systems
 - a. Fume Hood Exhaust (negative Pressure): 3-inch wg.
 - b. General Exhaust (Negative Pressure): 1-inch wg.
 - c. Relief Air: 1-inch wg.
 - 4. Leakage Class:
 - a. Round Supply-Air Duct: 3 cfm/100 sq. ft. at static pressure class.
- b. Flat-Oval Supply-Air Duct: 3 cfm/100 sq. ft. at static pressure class.
- c. Rectangular Supply-Air Duct: 6 cfm/100 sq. ft. at static pressure class.
- d. Flexible Supply-Air Duct: 6 cfm/100 sq. ft. at static pressure class.
- B. Structural Performance: Duct hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1.4 DEFINITIONS

- A. Exposed: Open to view; not concealed by a ceiling.1. Includes mechanical rooms.
- B. Concealed: Covered or Concealed by a ceiling, solid inaccessible or lay-in acoustical tile.

1.5 SUBMITTALS

- A. Product Data: For each type of the following products:
 - 1. Liners and adhesives.
 - 2. Sealants and gaskets.
 - 3. Insulation.
 - 4. Metal.
 - 5. Fasteners.
 - 6. Hangers.
 - 7. Double Wall Ductwork (Round or Flat Oval).
 - 8. Single Wall (Round or Flat Oval).
- B. Shop Drawings/Coordination Drawings: CADD generated, ¼" scale. Show fabrication and installation details for metal ducts.
 - 1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
 - 2. Factory- and shop-fabricated ducts and fittings.
 - 3. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.
 - 4. Elevation of top of ducts.
 - 5. Dimensions of main duct runs from building grid lines.
 - 6. Fittings.
 - 7. Reinforcement and spacing.
 - 8. Seam and joint construction.
 - 9. Penetrations through fire-rated and other partitions.
 - 10. Equipment installation based on equipment being used on Project.
 - 11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
 - 12. Hangers and supports, including methods for duct and building attachment, and vibration isolation (where applicable).
 - 13. Ceiling suspension assembly members.
 - 14. Other systems installed in same space as ducts, including fire sprinkler piping; electrical conduits; cable trays; hydronic, domestic, and sanitary piping; and structural members.
 - 15. Ceiling-and-wall-mounting access doors and panels required to provide access to dampers and other operating devices.
 - 16. Ceiling-mounting items, including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
- C. Welding certificates.
- D. Field quality-control reports.

E. Field Pressure test Reports.

1.6 QUALITY ASSURANCE

- Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code Steel," for hangers and supports.
 - 2. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.

PART 2 - PRODUCTS

Α.

2.1 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.
- B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-4, "Transverse (Girth) Joints," for static-pressure class, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Figure 1-5, "Longitudinal Seams Rectangular Ducts," for static-pressure class, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards Metal and Flexible."
- D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Chapter 2, "Fittings and Other Construction," for static-pressure class, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards Metal and Flexible."
- E. Seal all duct transverse joints, longitudinal seams, flanges, and duct wall penetrations (SMACNA Seal Class-A regardless of static pressure construction class).

2.2 DOUBLE-WALL RECTANGULAR DUCTS AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. McGill Airflow LLC.
- B. Rectangular Ducts: Fabricate ducts with indicated dimensions for the inner duct.
- C. Outer Duct: Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.
- D. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-4, "Transverse (Girth) Joints," for static-pressure class, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- E. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-5, "Longitudinal Seams - Rectangular Ducts," for static-pressure class, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

METAL DUCTS

- F. Interstitial Insulation: Fibrous-glass liner complying with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."
 - 1. Maximum Thermal Conductivity: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
 - 2. Thickness:
 - a. 1 inch, minimum for INDOOR, exposed ducts in conditioned spaces.
 - b. 1-1/2 inches, minimum for INDOOR ducts in unconditioned spaces, including, but not limited to return-air plenums and mechanical rooms.
 - c. 2-1/2 inches, minimum for OUTDOOR ducts.
 - 3. Install spacers that position the inner duct at uniform distance from outer duct without compressing insulation.
 - 4. Coat insulation with antimicrobial coating.
- G. Formed-on Transverse Joints (Flanges): Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-4, "Traverse (Girth) Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- H. Seal all duct transverse joints, longitudinal seams, flanges and duct wall penetrations (SMACNA Seal Class-A regardless of static pressure construction class).

2.3 SINGLE-WALL ROUND AND FLAT-OVAL DUCTS AND FITTINGS

- A. General Fabrication Requirements: **Spiral seams** complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class. **Longitudinal-seams (snap-lock) are not acceptable for any application.**
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Lindab Inc.
 - b. McGill AirFlow LLC.
 - c. SEMCO Incorporated.
 - d. Spiral Pipe of Texas
- B. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter (diameter of the round sides connecting the flat portions of the duct).
- C. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Figure 3-2, "Transverse Joints Round Duct," for static-pressure class, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards Metal and Flexible."
 - 1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.
- D. Seams: Fabricate according to the **spiral seam requirements** of SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Seams - Round Duct and Fittings," for static-pressure class, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible." **Longitudinal-seams** (snap-lock) are not acceptable for any application, except where indicated below.
 - 1. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.
 - 2. Fabricate flat-oval ducts larger than 72 inches in width (major dimension) with buttwelded longitudinal seams.

- E. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards Metal and Flexible," 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's "HVAC Duct Construction Standards Metal and Flexible."
- F. Seal all duct transverse joints, longitudinal seams, flanges and duct wall penetrations (SMACNA Seal Class-A regardless of static pressure construction class).

2.4 DOUBLE-WALL ROUND AND FLAT-OVAL DUCTS AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Lindab Inc.
 - 2. McGill AirFlow LLC.
 - 3. SEMCO Incorporated.
 - 4. Spiral Pipe of Texas
- B. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter (diameter of the round sides connecting the flat portions of the duct) of the inner duct.
- C. Outer Duct Fabrication Requirements: **Spiral seams** complying with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class. **Longitudinal-seams (snap-lock) are not acceptable for any application.**
 - Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Transverse Joints -Round Duct," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
 - a. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.
 - 2. Seams: Fabricate according to the **spiral seam requirements** of SMACNA's "HVAC Duct Construction Standards Metal and Flexible," 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's "HVAC Duct Construction Standards Metal and Flexible." Longitudinal-seams (snap-lock) are not acceptable for any application, except where indicated below.
 - a. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.
 - b. Fabricate flat-oval ducts larger than 72 inches in width (major dimension) with butt-welded longitudinal seams.
 - 3. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," 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's "HVAC Duct Construction Standards - Metal and Flexible."
- D. Inner Duct: Minimum 0.028-inch perforated galvanized sheet steel having 3/32-inchdiameter perforations, with overall open area of 23 percent.
- E. Interstitial Insulation: Fibrous-glass liner complying with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."
 - 1. Maximum Thermal Conductivity: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
 - 2. Thickness:
 - a. 1 inch, minimum for INDOOR, exposed ducts in conditioned spaces.

- b. 1-1/2 inches, minimum for INDOOR ducts in unconditioned spaces, including, but not limited to return-air plenums and mechanical rooms.
 2.1/2 inches, minimum for OUTDOOR ducts
- c. 2-1/2 inches, minimum for OUTDOOR ducts.
- 3. Install spacers that position the inner duct at uniform distance from outer duct without compressing insulation.
- 4. Coat insulation with antimicrobial coating.
- 5. Cover insulation with polyester film complying with UL 181, Class 1.

2.5 SHEET METAL MATERIALS

- A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, rust, stains, discolorations, and other imperfections. All ductwork shall be a minimum of 24 gage, with a minimum thickness of 0.023 inches. Where in the SMACNA "HVAC Duct Construction Standards-Metal Flexible" it is indicated that a lighter gage to a minimum of 24 gage.
- B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
 - 1. Galvanized Coating Designation: G60 (Z180).
 - 2. Finishes for Surfaces Exposed to View: Mill phosphatized.
- C. PVC-Coated, Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
 - 1. Galvanized Coating Designation: G60 (Z180).
 - 2. Minimum Thickness for Factory-Applied PVC Coating: 4 mils thick on sheet metal surface of ducts and fittings exposed to corrosive conditions, and minimum 4 mils thick on opposite surface.
 - 3. Coating Materials: Acceptable to authorities having jurisdiction for use on ducts listed and labeled by an NRTL for compliance with UL 181, Class 1.
- D. Carbon-Steel Sheets: Comply with ASTM A 1008/A 1008M, with oiled, matte finish for exposed ducts.
- E. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304 or 316, as indicated in the "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B, No. 2D, No. 3, or No. 4 as indicated in the "Duct Schedule" Article.
- F. Aluminum Sheets: Comply with ASTM B 209 (ASTM B 209M) Alloy 3003, H14 temper; with mill finish for concealed ducts, and standard, one-side bright finish for duct surfaces exposed to view.
- G. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
 - 1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.
- H. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.
- I. Plastic Connectors are not acceptable.

2.6 DUCT LINER

A. Fibrous-Glass Duct Liner: Comply with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. CertainTeed Corporation; Insulation Group.
 - b. Johns Manville.
 - c. Knauf Insulation.
 - d. Owens Corning.
 - e. Maximum Thermal Conductivity:
 - 1) Type I, Flexible: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
 - 2) Type II, Rigid: 0.23 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
- 2. Antimicrobial Erosion-Resistant Coating: Apply to the surface of the liner that will form the interior surface of the duct to act as a moisture repellent and erosion-resistant coating. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
- 3. Water-Based Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916. Equal to DP 2502.
- B. Insulation Pins and Washers:
 - 1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer. Equal to CS-10.
- C. Shop Application of Duct Liner: Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Figure 2-19, "Flexible Duct Liner Installation."
 - 1. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.
 - 2. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.
 - 3. Butt transverse joints without gaps, and coat joint with adhesive.
 - 4. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure buttededge overlapping.
 - 5. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and dimensions of standard liner make longitudinal joints necessary.
 - 6. Secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12 inches transversely; at 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally.
 - 7. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:
 - a. Fan discharges.
 - b. Intervals of lined duct preceding unlined duct.
 - c. Upstream edges of transverse joints in ducts where air velocities are higher than 2500 fpm or where indicated.
 - 8. Terminate inner ducts with buildouts attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct walls with bolts, screws, rivets, or welds.

2.7 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed in-

dex of 50 when tested according to UL 723; certified by an NRTL. All products are to contain low V.O.C. as defined/governed by LEED IEQ 4.1 and 4.2 (Regardless of project type).

- B. Water-Based Joint and Seam Sealant (for indoor installation):
 - 1. Application Method: Brush on.
 - 2. Solids Content: Minimum 68 percent.
 - 3. Water resistant.
 - 4. Mold and mildew resistant.
 - 5. VOC: less than 30 g/l (less water).
 - 6. Maximum Static-Pressure Class: 15-inch wg, positive and negative.
 - 7. Service: Indoor.
 - 8. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.
 - 9. DP 1020 or approved equal.
- C. Water-Based Joint and Seam Sealant (for outdoor installation):
 - 1. Application Method: Tube application or dry tooling.
 - 2. Service Temp Range (degrees F): -40 to 180.
 - 3. Water resistant.
 - 4. Mold and mildew resistant.
 - 5. Service: Indoor.
 - 6. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.
 - 7. Sonolastic NP-1 or approved equal.
- D. Flanged Joint Sealant: Comply with ASTM E-84.
 - 1. General: Butyl gasket tape.
 - 2. Type: Butyl Rubber.
 - 3. Service Temperature: Minus 40°F to 245°F
 - 4. Pressure Class: All
 - 5. DP 1040

2.8 HANGERS AND SUPPORTS

- A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.
- B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
- C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Table 4-1 (Table 4-1M), "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct."
- D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.
- E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.
- F. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.
- G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- H. Trapeze and Riser Supports:
 - 1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
 - 2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.

3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

- A. 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.
- B. Install ducts according to SMACNA's "HVAC Duct Construction Standards Metal and Flexible".
- C. Install round and flat-oval ducts in maximum practical lengths.
- D. Install ducts with fewest possible joints.
- E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.
- F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
- G. Conceal ducts from view in finished spaces. Do not encase horizontal runs in solid partitions unless specifically indicated.
- H. Coordinate layout with suspended ceiling, fire-and smoke-control dampers, lighting layouts, and similar finished work.
- I. Seal all joints and seams. Apply sealant to male end connectors before insertion, and afterward to cover entire joint and sheet metal screws. Sealant of seems/joints to include (but not limited to): all joints (including gasketed joints) metal seams, taps, any connections, etc.
- J. Paint interiors of metal ducts that do not have duct liner, for 24 inches (600 mm) upstream of return air registers and grilles. Apply one coat of flat, black, latex finish coat over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Division 9 painting Sections.
- K. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- L. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness. Compression of insulation by other trades (pipe, conduit, etc) is not acceptable.
- M. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.
- N. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

- O. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Mechanical Specification Section "Air Duct Accessories" for fire and smoke dampers.
- P. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "Duct Cleanliness for New Construction Guidelines."

3.2 DUCTWORK HANDLING AND PLENUM PROTECTION

- A. All ductwork shall be delivered to site and stored with all openings protected from the elements. Protection to include 2.5 mil thick polyethylene plastic film secured with tape or integral elastic band.
- B. Each segment/section of ductwork installed is to be appropriately protected from elements.
- C. Any ductwork damaged during delivery, installation, or at any time during construction will be removed from job and replaced.
- D. Ductwork found onsite (installed or stored) without approved protection will be removed from job and replaced.
- E. Ductwork installed exposed to the elements to be sealed (joints and seems) immediately after installation. Any ductwork not sealed is susceptible to rejection and removed from job.
- F. Under no circumstances shall insulation be applied to ductwork prior to the building being fully dried in (i.e.: building sealed, windows and roof installed, etc). Any ductwork being insulated prior to building dry-in is susceptible to rejections and removed from job.
- G. If ductwork is found onsite not protected or the newly installed ductwork is deemed as dirty, engineer can elect for the contractor to clean all duct at no cost to the owner per NADCA 1992.

3.3 SEAM AND JOINT SEALINGS

A. Seal all duct transverse joints, longitudinal seams, flanges and duct wall penetrations (SMACNA Seal Class-A regardless of static pressure construction class).

3.4 HANGERS AND SUPPORT INSTALLATION

- A. Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Chapter 4 "Hangers and Supports," unless otherwise indicated.
 - 1. Support ducts greater than 36 inches with width with trapeze threaded rod and angle or channel supports. Straps not acceptable.
 - 2. Hangers Exposed to View: Threaded rod and channel supports (do not use steel angles).
- B. Building Attachments: Concrete inserts or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
 - 1. Where practical, install concrete inserts before placing concrete.
- C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards-Metal and Flexible," Table4-1 (Table 4-1M), "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. Elbows 36" and larger to be individually supported.

- D. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16' feet.
- E. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
 - 1. Do not attach hangers to metal deck roof assemblies with built-up insulation only (no concrete). Attach only to structural steel members.
- F. Support vertical ducts at maximum intervals of 16 feet and at each floor.

3.5 CONNECTIONS

- A. Make all connections to all fan-bearing equipment with flexible connectors complying with Specification Section "Air Duct Accessories".
- B. Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible" for branch, outlet and inlet, and terminal unit connections. Reference detail for specific additional items required.

3.6 PAINTING

A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Division 09 painting Sections.

3.7 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Leakage Tests:
 - 1. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual." Leakage Class defined in previous sections of specification. Amount of ductwork to be tested to be determined by Engineer or Field Inspector).
 - 2. Test the following systems:
 - a. Supply air: Testing amount to be determined onsite by engineer or field inspector (VAV systems).
 - b. Supply air: Testing amount to be determined onsite by engineer or field inspector. (constant volume systems).
 - 3. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
 - 4. Test for leaks before insulation application.
- C. Duct system will be considered defective if it does not pass tests and inspections.
- D. Contractor to disassemble, reassemble and seal segments of systems to accommodate leakage testing and for compliance with test requirements / leakage rates.
- E. All testing equipment to be calibrated (by manufacturer) within 3 years of onsite duct pressure testing. Documentation to be provided for verification of certification to Engineer through submittal process.
- F. Test Coupons: Cut out three (3) 4x4" test coupons in random locations selected by the design engineer for verification of gage thickness. Coupons shall be taken at the time of pressure testing.

G. Prepare test and inspection reports.

3.8 DUCT SCHEDULE

- A. Fabricate ducts with galvanized sheet steel except as follows:
 - 1. Acid-Resistant (Fume-Handling) Ducts:
 - a. Type 304, stainless-steel sheet welded.
 - b. Exposed to View: No. 4 finish.
 - c. Concealed: No. 2D finish.
 - 2. Moist Environment Ducts: Aluminum.
 - 3. Spaces with pools, spas, hot tubs or water features: Aluminum.
 - 4. Kitchen Exhaust Reference applicable specification.
- B. Intermediate Reinforcement:
 - 1. Galvanized-Steel Ducts: Galvanized steel.
 - 2. Stainless-Steel Ducts: Galvanized steel.
 - 3. Aluminum Ducts: Aluminum or galvanized sheet steel coated with zinc chromate.
- C. Liner:
 - 1. Transfer Ducts: Fibrous glass, Type I 1 inch thick.
- D. Double-Wall Duct Schedule:
 - 1. All exposed Round/Flat Oval Ductwork.
- E. Elbow Configuration:
 - 1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Figure 2-2, "Rectangular Elbows".
 - a. Velocity 1000 fpm or Lower:
 - 1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
 - 2) Mitered Type RE 4 without vanes.
 - b. Velocity 1000 to 1500 fpm:
 - 1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
 - 2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.
 - 3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards – Metal and Flexible," Figure 2-3, "Vanes and Vane Runners," and Figure 2-4, "Vane Support Elbows."
 - c. Velocity 1500 fpm (7.6 m/s) or Higher:
 - 1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
 - 2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
 - 3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards – Metal and Flexible," Figure 2-3, "Vanes and Vane Runners," and Figure 2-4, "Vane Support in Elbows.
 - 2. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Figure 3-3, "Round Duct Elbows".
 - Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards – Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.
 - 1) Velocity 1000 fpm or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
 - 2) Velocity 1000 to 1500 fpm: 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
 - Velocity 1500 fpm or higher: 1.5 radius-to-diameter and five segments for 90-degree elbow.

- b. Round Elbows, 12 inches and smaller diameter: Stamped or pleated.
- c. Round Elbows, 14 inches and larger in diameter: Welded.
- F. Branch Configuration
 - 1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards-Metal and Flexible," Figure 2-6, "Branch Connections."
 - a. Rectangular Main to Rectangular Branch: 45-degree entry.
 - b. Rectangular Main to Round Branch: Side takeoff fitting.
 - Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees." Saddle taps are permitted in existing duct.
 - a. Velocity 1000 fpm or Lower: 90-degree tap.
 - b. Velocity 1000 to 1500 fpm: Conical tap.
 - c. Velocity 1500 fpm or higher: 45-degree lateral.

3.9 CLEANING NEW SYSTEMS

- A. If ductwork is found onsite not protected or the newly installed ductwork is deemed as dirty, engineer can elect for the contractor to clean all duct at no cost to the owner per NADCA 1992.
- B. System Cleaning: (If required)
 - 1. Mark position of dampers and air-directional mechanical devices before cleaning, and perform cleaning before air balancing.
 - 2. Provide service openings (approved duct access doors), as required, for physical and mechanical entry during cleaning and for inspection. All duct access doors to be installed prior to any duct pressure tests.
 - a. Removed and reinstall ceiling sections to gain access during the cleaning process.
 - 3. Vent vacuuming system to the outside. Include filtration to conation debris removed from HVAC systems, and locate exhaust down wind and minimum of 20 feet away from air intakes and other points of entry into building.
 - 4. Clean the following metal duct systems by removing surface contaminants and deposits:
 - a. Air outlets and inlets (registers, grilles and diffusers).
 - b. Supply, return and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers and drive assemblies.
 - c. Air-handling unit internal surfaces and components including mixing box, coil section, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
 - d. Coils and related components.
 - e. Return-air ducts, dampers and actuators except in ceiling plenums and mechanical equipment rooms.
 - f. Supply-air ducts, dampers, actuators and turning vanes.
 - 5. Mechanical Cleaning Methodology:
 - a. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
 - b. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
 - c. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner or duct accessories.
 - d. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do no permit duct liner to get wet.

- e. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
- 6. Cleanliness Verification:
 - a. Visually inspect metal ducts for contaminants.
 - b. Where contaminants are discovered, re-clean and re-inspect ducts.

END OF SECTION

SECTION 23 3300 DUCT ACCESSORIES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Backdraft dampers.
 - 2. Manual-volume dampers.
 - 3. Fire dampers
 - 4. Fire and smoke dampers.
 - 5. Turning vanes.
 - 6. Duct-mounted access doors and panels.
 - 7. Flexible ducts.
 - 8. Flexible connectors.
 - 9. Side takeoff fittings.
 - 10. Duct accessory hardware.
 - 11. Motorized control dampers.
- B. Related Sections include the following:
 - 1. Specification Section "Access Doors" for wall- and ceiling-mounted access doors and panels.
 - 2. Specification Section "Louvers and Vents" for intake and relief louvers and vents connected to ducts and installed in exterior walls.
 - 3. Specification Section "Air Terminals" for constant-volume and variable-air-volume control boxes, and reheat boxes.
 - 4. Specification Section "Air Inlets and Outlets."
 - 5. Specification Section "HVAC Controls" for electric damper actuators.

1.3 SUBMITTALS

- A. Product Data: For the following:
 - 1. Backdraft dampers.
 - 2. Manual-volume dampers.
 - 3. Fire dampers.
 - 4. Fire and smoke dampers.
 - 5. Duct-mounted access doors and panels.
 - 6. Flexible ducts.
 - 7. Motorized control dampers.
 - 8. Side takeoff fittings

1.4 QUALITY ASSURANCE

- A. NFPA Compliance: Comply with the following NFPA standards:
 - 1. NFPA 90A, "Installation of Air Conditioning and Ventilating Systems."
 - 2. NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

1.5 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.
 - 1. Fusible Links: Furnish quantity equal to 10 percent of amount installed.

PART 2 - PRODUCTS

2.1 SHEET METAL MATERIALS

- A. Galvanized, Sheet Steel: Lock-forming quality; ASTM A 653/A 653M, G90 (Z275) coating designation; mill-phosphatized finish for surfaces of ducts exposed to view.
- B. Reinforcement Shapes and Plates: Galvanized steel reinforcement where installed on galvanized, sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.
- C. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for 36-inch length or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.2 BACKDRAFT DAMPERS

- A. Description: Suitable for horizontal or vertical installations.
- B. Frame: 0.063-inch thick extruded aluminum, with mounting flange.
- C. Blades: 0.050-inch thick aluminum sheet.
- D. Blade Seals: Felt.
- E. Blade Axles: Nonferrous.
- F. Tie Bars and Brackets: Aluminum.
- G. Return Spring: Adjustable tension.

2.3 MANUAL-VOLUME DAMPERS

- A. General: Factory fabricated with required hardware and accessories. Stiffen damper blades for stability. Include locking device to hold single-blade dampers in a fixed position without vibration. Close duct penetrations for damper components to seal duct consistent with pressure class.
 - 1. Pressure Classifications of 3-Inch wg or Higher: End bearings or other seals for ducts with axles full length of damper blades and bearings at both ends of operating shaft.
- B. Standard Volume Dampers: Multiple- or single-blade, opposed-blade design, standard leakage rating, with linkage outside airstream, and suitable for horizontal or vertical applications.
 - 1. Roll-Formed Steel Blades: 0.064-inch thick, galvanized, sheet steel.
 - 2. Blade Axles: Galvanized steel.
 - 3. Tie Bars and Brackets: Galvanized steel.
 - 4. 1-1/2-inch insulation buildout with locking quadrant.
- C. Low-Leakage Volume Dampers: Multiple- or single-blade, opposed-blade design, lowleakage rating, with linkage outside airstream, and suitable for horizontal or vertical applications.

- 1. Steel Frames: Hat-shaped, galvanized, sheet steel channels, minimum of 0.064 inch thick, with mitered and welded corners; frames with flanges where indicated for attaching to walls; and flangeless frames where indicated for installing in ducts.
- 2. Roll-Formed Steel Blades: 0.064-inch thick, galvanized, sheet steel.
- 3. Blade Seals: Felt.
- 4. Blade Axles: Galvanized steel.
- 5. Tie Bars and Brackets: Galvanized steel.
- 6. 1-1/2-inch insulation buildout with locking quadrant.
- D. Jackshaft: 1-inch diameter, galvanized steel pipe rotating within a pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
 - 1. Length and Number of Mountings: Appropriate to connect linkage of each damper of a multiple-damper assembly.
- E. Damper Hardware: Zinc-plated, die-cast core with dial and handle made of 3/32-inch thick zinc-plated steel, and a 3/4-inch hexagon locking nut. Include center hole to suit damper operating-rod size. Include elevated platform for insulated duct mounting.

2.4 FIRE DAMPERS

- A. General: Labeled to UL 555 (sixth edition). Ruskin Model D1BD2-B (or design engineer approved equivalent). Dampers shall be marked with a UL-Classified fire protection rating and marked "For Use in Dynamic Systems".
- B. Fire Rating: One and one-half and/or three hours as indicated.
- C. Frame: SMACNA Type B with blades out of airstream; fabricated with roll-formed, 0.034inch- thick galvanized steel; with mitered and interlocking corners.
- D. Mounting Sleeve: Provide factory-mounted sleeve and retaining angles.
 - 1. Minimum Thickness (Sleeve shall not extend more than 6" past wall or floor without factory installed access door): 16 gauge and length to suit application.
- E. Mounting Orientation: Vertical or horizontal as indicated.
- F. Blades: Roll-formed, interlocking, 0.034-inch thick, galvanized, sheet steel. In place of interlocking blades, use full-length, 0.034-inch thick, galvanized steel blade connectors.
- G. Horizontal Dampers: Include a blade lock and stainless-steel negator closure spring.
- H. Fusible Link: Replaceable, 165 deg F rated as indicated.

2.5 COMBINATION FIRE / SMOKE DAMPERS (SFD)

- A. General: Labeled to UL 555/UL 555S (sixth and fourth edition respectively) Combination fire and smoke dampers shall be labeled for one-and-one-half-hour rating to UL 555S. Provide Class II leakage rating. Dampers shall be marked with a UL-classified fire rating. Ruskin FSD-60 or approved equivalent. The SFD shall be listed to operate from the fire alarm control panel (FACP). Each SFD shall have an associated smoke detector that shall be addressable from the FACP. The smoke detector shall be provided by the Fire Alarm Contractor and installed by the Electrical Contractor. Coordinate damper installation with these trades.
- B. Electric Fusible Link (EFL): 165 or 212 deg F rated as applicable.
- C. Frame and Blades: 16 gauge, galvanized, sheet steel. Damper blades shall be airfoilshaped, single-piece construction, with blade seals mechanically locked into blade edge

(adhesive clip-on seals are not acceptable). Ruskin FSD-60 or equivalent. Damper blades shall be minimum 14 gauge. SFD's installed off vertical chases shall have vertical airfoil blades (Ruskin FSD 60-V or equivalent).

- D. Mounting Sleeve: Factory-installed, 16 gauge, galvanized, sheet steel; length to suit wall or floor application. Sleeve shall not extend more than 6" past wall or floor without factory installed access door. SFD shall be capable of mounting on either side of wall and working with airflow in either direction. Provide manufacturer-recommended duct-to-sleeve joints.
- E. Electric controlled closure is not less than 7 seconds or more than 10 seconds to prevent HVAC and duct damage. Damper shall have local reset button and shall have automatic reset after test, smoke detection or power failure conditions. Damper shall close upon loss of power or AHU shut down. Actuator shall be 120V.
- F. Provide with stainless steel jam seals and bearings. (Bronze bearings are not acceptable)
- G. Furnish and install dampers according to manufacturer's instructions and in compliance with the latest edition of the SMACNA Duct Manual and NFPA Standards (90, 92A, and 92B).

2.6 TURNING VANES

- A. Fabricate to comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."
- B. Manufactured Turning Vanes: Fabricate of 1-1/2-inch wide, curved blades set 3/4 inch o.c.; support with bars perpendicular to blades set 2 inches o.c.; and set into side strips suitable for mounting in ducts.

2.7 DUCT-MOUNTED ACCESS DOORS AND PANELS

- A. Provide where indicated on drawings low leakage spin-in access doors for sheet metal applications. Flexmaster Inspector series.
- B. The outer frame shall be constructed of a single piece of 24-gauge G90 galvanized steel roll formed and notched for spin-in applications. The entry side shall be roll formed and double hemmed for safe entry and exit.
- C. The inner door shall be constructed of a 24-gauge draw quality steel, filled with a 1-inch thick polystyrene insulation and held in place by a galvanized steel backplate (stainless steel backplate may be substituted as required).
- D. A continuous .375-inch wide by .1875-inch thick open cell adhesive neoprene gasket shall be installed in the door frame to provide a positive seal upon insertion and locking of the door.
- E. The door shall be held secure with evenly spaced cast aluminum cam latches for even pressure against the gasket.

2.8 FLEXIBLE CONNECTORS

- A. General: Flame-retarded or noncombustible fabrics, coatings, and adhesives complying with UL 181, Class 1.
- B. Standard Metal-Edged Connectors: Factory fabricated with a strip of fabric 3-1/2 inches wide attached to two strips of 2-3/4-inch wide, 0.028-inch thick, galvanized, sheet steel or 0.032-inch aluminum sheets. Select metal compatible with connected ducts.

- C. Conventional, Indoor System Flexible Connector Fabric: Glass fabric double coated with polychloroprene.
 - 1. Minimum Weight: 26 oz./sq. yd.
 - 2. Tensile Strength: 480 lbf/inch in the warp, and 360 lbf/inch in the filling.
- D. Conventional, Outdoor System Flexible Connector Fabric: Glass fabric double coated with a synthetic-rubber, weatherproof coating resistant to the sun's ultraviolet rays and ozone environment.
 - 1. Minimum Weight: 26 oz./sq. yd.
 - 2. Tensile Strength: 530 lbf/inch in the warp, and 440 lbf/inch in the filling.

2.9 INSULATED FLEXIBLE DUCT, LOW PRESSURE

- A. Flexmaster type 1M UL181 Class I Air Duct. (No exceptions)
- B. The duct shall be constructed of a PE fabric supported by helical wound galvanized steel. The fabric shall be mechanically locked to the steel helix without the use of adhesives or chemicals.
- C. The internal working pressure rating shall be at least 6" w.g. positive and 4" w.g. negative, with a bursting pressure of at least 2-1/2 times the working pressure.
- D. The duct shall be rated for a velocity of at least 4000 feet per minute.
- E. The duct must be suitable for continuous operation at a temperature range of -20 deg F to +250 deg F.
- F. Acoustical performance, when tested by an independent laboratory in accordance with the Air Diffusion Council's *Flexible Air Duct Test Code FD 72-R1*, Section 3.0, Sound Properties, shall be as follows:
 - 1. The insertion loss (dB) of a 6-foot length of straight duct when tested in accordance with ASTM E 477, at a velocity of 500 feet per minute, shall be at least:

Octave Band	2	3	4	5	6	7
Hz.	125	250	500	1000	2000	4000
8" diameter	5.6	10.6	23.9	34.0	22.5	17.0
10" diameter	4.4	27.7	25.7	32.0	21.3	12.4
12" diameter	6.6	27.8	22.8	29.0	18.7	10.9

- G. Factory insulate the flexible duct with fiberglass insulation. The R-value shall be at least 6 at a mean temperature of 75 deg F.
- H. Cover the insulation with a fire retardant metalized vapor barrier jacket reinforced with crosshatched scrim (FSK) having a permeance of not greater than 0.05 perms when tested in accordance with ASTM E 96, Procedure A.

2.10 SIDE TAKEOFF FITTINGS

A. Provide Flexmaster Model STOD or SBMD takeoff for sheet metal for all taps connecting to flex duct, except for air devices with OBD's and flow bar. For devices with OBD, use Flexmaster Model STO- or SBM no exceptions.

- B. The side takeoff fittings shall maintain a ratio of 1:1 of inlet to outlet on all units over 7-inch diameter to allow proper sizing of the duct system.
- C. Model STOD side takeoff shall have a 1-inch offset rear edge for enhanced pressure drop characteristics and 1-1/2-inch insulation buildout with locking hand quadrant.
- D. Fittings shall have a 1-inch-wide prepunched mounting flange with corner clips and adhesive gasket for minimal leakage and ease of installation.
- E. The fittings shall be constructed of a two-piece 26-gauge G-90 galvanized steel body and collar.
- F. The overall length of the fitting shall be 13 inches with or without damper to reduce turbulence in the airstream.
- G. The round outlet shall be provided with a rolled stiffener bead for strength and ease of installation and sealing of spiral and flexible ductwork joints.

2.11 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 length to suit duct insulation thickness.
- B. Splitter Damper Accessories: Zinc-plated damper blade bracket; 1/4-inch, zinc-plated operating rod; and a duct-mounted, ball-joint bracket with flat rubber gasket and square-head set screw.
- C. Flexible Duct Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action, in sizes 3 to 18 inches to suit duct size.
- D. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

2.12 MOTORIZED CONTROL DAMPERS

- A. Manufacturers:
 - 1. Greenheck.
 - 2. Nailor Industries Inc.
 - 3. Ruskin Company.
 - 4. Pottorff.
- B. General Description: AMCA-rated, opposed-blade design; minimum of 0.1084-inch thick, galvanized-steel frames with holes for duct mounting; minimum of 0.0635-inch thick, galvanized-steel damper blades with maximum blade width of 8 inches.
 - 1. Secure blades to ½-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.
 - 2. Operating Temperature Range: From minus 40 to plus 200 deg F.
 - 3. Provide parallel- or opposed-blade design with inflatable seal blade edging, or replaceable rubber seals, rated for leakage at less than 10 cfm per sq. ft. of damper area, at differential pressure of 4-inch wg when damper is being held by torque of 50 in.xlbf (5.6 Nxm); when tested according to AMCA 500D.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install duct accessories according to applicable details shown in SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for metal ducts and NAIMA's "Fibrous Glass Duct Construction Standards" for fibrous-glass ducts.
- B. When installing volume dampers in lined duct, avoid damage to and erosion of duct liner.
- C. Install manual volume dampers at all main branch lines for ease of balancing.
- D. Provide test holes at fan inlet and outlet and elsewhere as indicated.
- E. Install fire and smoke dampers according to manufacturer's UL-approved written instructions.
 1. Install fusible links in fire dampers.
- F. Install mounting angles, minimum of 1 ½ "x 1 ½ "x 20 gauge steel on both sides of SFD or FD.
- G. Install duct access panels for access to both sides of duct coils. Install duct access panels downstream from volume dampers, fire dampers, smoke-fire dampers, turning vanes, and equipment.
- H. Install duct access panels to allow access to interior of ducts for cleaning, inspecting, adjusting and maintaining accessories and terminal units.
 - 1. Install access panels on side of duct where adequate clearance is available.
 - 2. Label access doors according to Specification Section "Mechanical Identification."

3.2 ADJUSTING

- A. Adjust duct accessories for proper settings.
- B. Adjust fire and smoke dampers for proper action.
- C. Final positioning of manual-volume dampers is specified in Specification Section "Testing, Adjusting, and Balancing."

END OF SECTION

SECTION 23 3423 HVAC POWER VENTILATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Ceiling-mounting ventilators.
 - 2. Centrifugal roof ventilators
 - 3. Destratification fans
 - 4. In-line centrifugal fans.
 - 5. Propeller fans.

1.3 PERFORMANCE REQUIREMENTS

- A. Project Altitude: Base fan-performance ratings on actual Project site elevations.
- B. Operating Limits: Classify according to AMCA 99.
- C. Fan Unit Schedule: The following information is described in an equipment schedule on the Drawings.
 - 1. Fan performance data including capacities, static pressure, sound power characteristics, motor requirements and electrical characteristics.
 - 2. Fan arrangement, including wheel configuration inlet and discharge configurations and required accessories.

1.4 SUBMITTALS

- A. Product Data: Include rated capacities, furnished specialties and accessories for each type of product indicated and include the following:
 - 1. Certified fan performance curves with system operating conditions indicated.
 - 2. Certified fan sound-power ratings.
 - 3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
 - 4. Material thickness and finishes, including color charts.
 - 5. Dampers, including housings, linkages and operators.
 - 6. Roof curbs.
 - 7. Fan speed controllers.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components and location and size of each field connection.
 - 1. Wiring Diagrams: Power, signal and control wiring.
 - 2. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
 - 3. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails and base weights.

- C. Coordination Drawings: Show roof penetration requirements and reflected ceiling plans drawn to scale and coordinating roof penetrations and units mounted above ceiling. Show the following:
 - 1. Roof framing and support members relative to duct penetrations.
 - 2. Ceiling suspension assembly members.
 - 3. Size and location of initial access modules for acoustical tile.
 - 4. Ceiling-mounted items including light fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
- D. Maintenance Data: For power ventilators to include in maintenance manuals specified in Division 1.

1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. AMAC Compliance: Products shall comply with performance requirements and shall be licensed to use the AMCA-Certified Ratings Seal.
- C. NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards.
- D. UL Standard: Power ventilators shall comply with UL 705.
- E. Listing and labeling: Provide electrically operated fixtures specified in this section that are listed and labels.
 - 1. The terms "Listed" and "Labeled". As defined in the Nations Electrical Code, Article 100.
 - 2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing laboratory" (NTRL) as defined in OSHA Regulation 1910.7.
- F. UL Standard: Provide Power Ventilators that comply with UL 762, grease laden air at 300 deg. F where applicable (kitchen exhaust).

1.6 DELIVERY, STORAGE AND HANDLING

- A. Deliver fans as factory-assembled unit, to the extent allowable by shipping limitations, with protective crating and covering.
- B. Disassemble and reassemble units, are required for moving to final location, according to manufacturer's written instructions.
- C. Lift and support units with manufacturer's designated lifting or supporting points.

1.7 COORDINATION

- A. Coordinate size and location of structural-steel support members.
- B. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Specification Section "Cast-In-Place Concrete".
- C. Coordinate installation of roof curbs, equipment supports and roof penetrations. These items are specified in Specification Section "Roof Accessories".

1.8 EXTRA MATERIALS

Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 Belts: One set for each belt-driven unit.

1.9 PROJECT CONDITIONS

- A. Field Measurements: Verify dimensions by field Measurements. Verify clearances.
- B. Do not operate fans until ductwork is clean, filters are in place, bearings are lubricated and fans have been commissioned.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Centrifugal Roof Ventilators:
 - a. Cook, Loren Company
 - b. Envirofan
 - c. Greenheck Fan Corp.
 - d. Leading Edge

2.2 CEILING-MOUNTING VENTILATORS

- A. Description: Centrifugal fans designed for installing in ceiling or wall or for concealed in-line applications.
- B. Housing: Steel, lined with acoustical insulation
- C. Fan Wheel: Centrifugal wheels directly mounted on motor shaft. Fan shrouds, motor and fan wheel shall be removable for service.
- D. Grille: Painted aluminum, louvered grille with flange on intake and thumbscrew attachment to fan housing.
- E. Electrical Requirements: Junction box for electrical connection on housing and receptacle for motor plug-in.
- F. Accessories:
 - 1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
 - 2. Filter: Washable aluminum to fit between fan and grille.
 - 3. Isolation: Rubber-in-shear vibration isolators.
 - 4. Manufacturer's standard roof jack or wall cap and transition fittings.
- G. Capacities and Characteristics: Refer to drawing schedules.

2.3 CENTRIFUGAL ROOF VENTILATORS – DOWNBLAST

- A. Description: Belt-driven or direct-driven centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor and disconnect switch, drive assembly, curb base and accessories.
- B. Housing: Removable, spun-aluminum, dome top and outlet baffle; square, two-piece, aluminum base with venture inlet cone.
- C. Fan Wheels: aluminum hub and wheel with backward-inclined blades.
- D. Belt-Driven Drive Assembly: Resiliently mounted to housing, with the following features:
 - 1. Fan Shaft: turned, ground, and polished stainless steel; keyed to wheel hub.
 - 2. Shaft Bearings: Heavy-duty re-greasable bail type in a pillow block cast iron housing, selected for a minimum L50 life in excess of 200,000 hours.
 - 3. Pulleys: Cast-iron, adjustable-pitch motor pulley.
 - 4. Fan and motor isolated from exhaust airstream.
 - 5. Belts: Oil and heat resistant, nonstatic.
- E. Accessories: The following items are required as indicated:
 - 1. Variable-Speed Controller: Solid-state control to reduce speed from 100 percent to less than 50 percent (required on direct drive fans only).
 - 2. Disconnect Switch: Nonfusible tube, with thermal-overload protection mounted inside fan housing, factory wired through an internal aluminum conduit.
 - 3. Bird Screens: Removable, 1/2-inch mesh, aluminum or brass wire.
 - 4. Dampers: Counterbalanced, parallel-blade, backdraft dampers mounted in curb base; factory set to close when fan stops.
- F. Roof Curbs: Galvanized steel; mitered and welded corners; 1-1/2-inch- thick, rigid, fiberglass insulation adhered to inside walls; and 1-1/2-inch wood nailer. Size as required to suit roof opening and fan base. Built in cant and mounting flange.
 - 1. Configuration: Built-in cant and mounting flange.
 - 2. Overall Height: 18 inches
 - 3. Pitch Mounting: Manufacture curb for roof slope, if necessary.
 - 4. Metal Liner: Galvanized steel.
- 2.4 CENTRIFUGAL ROOF VENTILATORS UPBLAST
 - A. Description: Belt-driven or direct-driven centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor and disconnect switch, drive assembly, curb base, and accessories. Grease laden fans to comply with UL 762 Grease Laden Air.
 - B. Housing: Removable, spun-aluminum, dome top and outlet baffle; square, two-piece, aluminum base with venturi inlet cone.
 - C. Fan Wheels: Aluminum hub and wheel with backward-inclined blades.
 - D. Belt-Driven Drive Assembly: Resiliently mounted to housing, with the following features:
 - 1. Fan Shaft: Turned, ground and polished stainless steel; keyed to wheel hub.
 - 2. Shaft Bearings: heavy-duty re-greasable ball type in a pillow block cast iron housing, selected for a minimum L50 life in excess of 200,000 hours.
 - 3. Pulleys: Cast-iron, adjustable-pitch motor pulley.
 - 4. Fan and motor isolated from exhaust airstream.
 - E. Accessories: The following items are required as indicated:
 - 1. Disconnect Switch: Non-fusible type, with thermal-overload protection mounted inside fan housing, factory wired through in internal aluminum conduit.

- F. Roof Curbs: Galvanized steel; mitered and welded corners; 1-1/2-inch thick, rigid, fiberglass insulation adhered to inside walls; and 1-1/2-inch wood nailer. Size as required to suit roof opening and fan base.
 - 1. Configuration: Built-in cant and mounting flange.
 - 2. Overall Height: 18 inches
 - 3. Pitch Mounting: Manufacture curb for roof slope, if necessary.
 - 4. Metal Liner: Galvanized steel.
 - 5. Vented Curb Extension, with hinged curb cap.

2.5 DESTRATIFICATION FANS

- A. Ceiling Fans 60" diameter 3 blade fan, dynamically balanced with permanently lubricated ball bearing motor, U.L. listed (UL 507), with all necessary hooks and supports for a complete installation. Provide solid state speed controllers and secondary support cable.
- B. Wall Mount Circulators: 24" 3-blade oscillating fan. Wall bracket, 2-speed motor, powder coated for guards, heavy duty pull chain, 45°-90° sweep. Safety cable mounting kit.

2.6 IN-LINE CENTRIFUGAL FANS

- A. Description: In-line, direct or belt-driven (as scheduled on the drawings) centrifugal fans consisting of housing, wheel, outlet guide vanes, fan shaft, bearings, motor and disconnect switch, drive assembly, mounting brackets and accessories.
- B. Housing: Spilt, spun aluminum with aluminum straightening vanes, inlet and outlet flanges and support bracket adaptable to floor, side wall or ceiling mounting.
- C. Direct-Driven Units: Motor mounted in airstream, factory wired to disconnect switch located on outside of fan housing; with wheel, inlet cone, and motor on swing-out service door.
- D. Belt-Driven Units: Motor mounted on adjustable base, with adjustable sheaves, enclosure around belts within fan housing, and lubricating tubes from fan bearings extended to outside of fan housing.
- E. Fan Wheels: Aluminum, air foil blades welded to aluminum hub.

F. Accessories:

- 1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
- 2. Companion Flanges: For inlet and outlet duct connections.
- 3. Fan Guards: 1/2 by 1 inch mesh of galvanized steel in removable frame. Provide guard for inlet or outlet for units not connected to ductwork.
- 4. Motor and Drive Cover (Belt Guard): Epoxy-coated steel.
- G. Capacities and Characteristics: Refer to drawing schedules.

2.7 PROPELLER FANS

- A. Description: Direct-or belt-driven (as scheduled on the drawings) propeller fans consisting of fan blades, hub, housing, orifice ring, motor, drive assembly and accessories.
- B. Housing: Galvanized-steel sheet with flanged edges and integral orifice ring with baked-enamel finish coat applied after assembly.

- C. Steel Fan Wheels: Formed-steel blades riveted to heavy-gage steel spider bolted to cast-iron hub.
- D. Fan Wheel: Replaceable, extruded-aluminum, airfoil blades fastened to cast-aluminum hub; factor set pitch angle of blades.
- E. Belt-Drive Drive Assembly: Resiliently mounted to housing, statically and dynamically balanced and selected for continuous operation at maximum rated fan speed and motor horsepower, with final alignment and belt adjustment made after installation.
 - 1. Service Factor Based on Fan Motor Size: 1.4.
 - 2. Fan Shaft: Turned, ground and polished steel; keyed to wheel hub.
 - Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.
 a. Ball-Bearing Rating Life: ABMA 9, L₁₀ of 100,000 hours.
 - 4. Pulleys: Cast iron with split, tapered bushing; dynamically balanced at factory.
 - 5. Motor Pulleys: Adjustable pitch for use with motors through 5 hp; fixed pitch for use with larger motors. Select pulley so pitch adjustment is at the middle of adjustment range at fan design conditions.
 - 6. Belts: Oil resistant, nonsparking, and nonstatic; matched sets for multiple belt drives.
 - 7. Belt Guards: Fabricate of steel motors mounted on outside of fan cabinet.
- F. Accessories:
 - 1. Gravity Shutters: Aluminum blades in aluminum fame; interlocked blades with nylon bearings.
 - 2. Motor-Side Back Guard: Galvanized steel, complying with OSHA specifications, removable for maintenance.
 - 3. Wall Sleeve: Galvanized steel to match fan and accessory size.
 - 4. Weathershield Hood: Galvanized steel to match fan and accessory size.
 - 5. Weathershield Front Guard: Galvanized steel with expanded metal screen.
- G. Capacities and Characteristics: Refer to drawing schedules.

2.8 MOTORS

- A. Motor Construction: NEMA MG 1, general purpose, continuous duty, Design B.
- B. Enclosure Type: The following features are required as indicted.
 - 1. Open drip proof motors where satisfactorily housed or remotely located during operation.
 - 2. Guarded drip proof where exposed to contact by employees or building occupants.
- C. All motors shall be pre-wired to the disconnect at the factory.

2.9 SOURCE QUALITY CONTROL

- A. Sound-Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with AMCA-Certified Ratings Seal.
- B. Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation and efficiency by factory tests and ratings according to AMCA 210, "Laboratory Methods of Testing Fans for Rating."

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install power ventilators level and plumb.
- B. Support inline fans with galvanized all thread and spring isolators with a static deflection of 1 inch.
- C. Support suspended units from structure using galvanized threaded steel rods and spring hangers. Vibration –control devices are specified in Specification Section "Mechanical Vibration controls and Seismic Restraints."
- D. Secure roof-mounting fans to roof curbs with stainless steel hardware. Anchor fan to curb with a minimum of two (2) fasteners per side. Refer to Specification Section "Roof Accessories" for installation of roof curbs.
- E. Ceiling Units: Suspect units from structure; use steel wire or metal straps.
- F. Install units with clearances for service and maintenance.
- G. Label units according to requirements specified in Specification Section "Mechanical Identification."

3.2 CONNECTIONS

- A. Duct installation and connection requirements are specified in other Mechanical Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors for all fans; no exceptions. Flexible connectors are specified in Specification Section "Duct Accessories."
- B. Install duct adjacent to power ventilators to allow service and maintenance.
- C. Ground equipment according to Specification Section "Grounding and Bonding."

3.3 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
 - 1. Verify that shipping, blocking and bracing are removed.
 - 2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters and disconnect switches.
 - 3. Verify that cleaning and adjusting are complete.
 - 4. Disconnect fan drive from motor, verify proper motor rotation direction and verity fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts and install belt guards.
 - 5. Adjust belt tension.
 - 6. Adjust damper linkages for proper damper operation.
 - 7. Verity lubrication for bearings and other moving parts.
 - 8. Verity that manual and automatic volume control and fire and smoke dampers in connected ductwork system are in fully open positions.
 - 9. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.
 - 10. Shut unit down and reconnect automatic temperature-control operators.
 - 11. Remove and replace malfunctioning units and retest as specified above.
- B. Starting Procedures:
 - 1. Energize motor and adjust fan to indicated rpm.

- 2. Measure and record motor voltage and amperage.
- C. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation. Remove malfunctioning units, replace with new units, and retest.
- D. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- E. Shut unit down and reconnect automatic temperature-control operators.
- F. Refer to Specification Section "Testing, Adjusting and Balancing" for testing, adjusting, and balancing procedures.
- G. Replace fan and motor pulleys as required to achieve design airflow.
- H. Repair or replace malfunctioning units. Retest as specified above after repairs or replacements are made.

3.4 ADJUSTING

- A. Adjust damper linkages for proper damper operation.
- B. Adjust belt tension.
- C. Refer to Specification Section "Testing, Adjusting and Balancing for HVAC" for testing, adjusting and balancing procedures.
- D. Replace fan and motor pulleys as required to achieve design airflow.
- E. Lubricate bearings.

3.5 CLEANING

- A. On completion of installation, internally clean fans according to manufacturer's written instructions. Remove foreign material and construction debris. Vacuum fan wheel and cabinet.
- B. After completing system installation, including outlet fitting and devices, inspect exposed finish. Remove burns, dirt and construction debris and repair damaged finished.

3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain power ventilators.
 - 1. Train owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting servicing, and maintaining equipment and schedules.
 - 2. Review data in maintenance manuals. Refer to Specification Section "Closeout Procedures."
 - 3. Review data in maintenance manuals. Refer to Specification Section "Operation and Maintenance Data."
 - 4. Schedule training with Owner, through Architect, with at least seven days' advance notice.

3.7 COMMISSIONING

A. Final Checks before Startup: Perform the following operations and checks before startup:

- 1. Verify that shipping, blocking and bracing are removed.
- 2. Verify that unit is secure on mountings and supporting devices and that connections for piping, ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters and disconnects.
- 3. Perform cleaning and adjusting specified in this Section.
- 4. Disconnect fan drive from motor, verify proper motor rotation direction and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts and install belt guards.
- 5. Lubricate bearings, pulleys, belts and other moving parts with factory-recommended lubricants.
- 6. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in the fully open position.
- 7. Disable automatic temperature-control operators.
- B. Starting Procedures for fans are as follows:
 - 1. Energize motor; verify proper operation of motor, drive system and fan wheel. Adjust fan to be indicated RPM.
 - 2. Measure and record motor voltage and amperage.
- C. Shut unit down and reconnect automatic temperature-control operators.
- D. Refer to Specification Section "Testing, Adjusting and Balancing," for procedures for air-handlingsystem testing, adjusting and balancing.
- E. Replace fan and motor pulleys as required to achieve design conditions.

END OF SECTION

SECTION 23 3713 DIFFUSERS, REGISTERS, AND GRILLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes ceiling- and wall-mounted diffusers, registers, and grilles.
- B. Related Sections include the following:
 - 1. Specification Section "Duct Accessories" for fire and smoke dampers and volumecontrol dampers not integral to diffusers, registers, and grilles.
 - 2. Specification Section "Testing, Adjusting, and Balancing" for balancing diffusers, registers and grilles.

1.3 DEFINITIONS

- A. Diffuser: Circular, square, or rectangular air distribution outlet, generally located in the ceiling and comprised of deflecting members discharging supply air in various directions and planes and arranged to promote mixing of primary air with secondary room air.
- B. Grille: A louvered or perforated covering for an opening in an air passage, which can be located in a sidewall, ceiling, or floor.
- C. Register: A combination grille and damper assembly over an air opening.

1.4 SUBMITTALS

- A. Product Data: For each model indicated, include the following:
 - 1. Data Sheet: For each type of air outlet and inlet, and accessory furnished; indicate construction, finish, and mounting details.
 - 2. Performance Data: Include throw and drop, static-pressure drop, and noise ratings for each type of air outlet and inlet.
 - 3. Schedule of diffusers, registers, and grilles indicating drawing designation, model number, size, and accessories furnished.
 - 4. Assembly Drawing: For each type of air outlet and inlet; indicate materials and methods of assembly of components.

1.5 QUALITY ASSURANCE

A. NFPA Compliance: Install diffusers, registers, and grilles according to NFPA 90A, "Standard for the Installation of Air-Conditioning and Ventilating Systems."

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Krueger
 - 2. Metalaire
 - 3. Price
 - 4. Titus
- B. Performance characteristics, specific models, material, features, dimensions and finishes of diffusers, registers, and grilles are scheduled on Drawings.

2.2 SOURCE QUALITY CONTROL

A. Testing: Test performance according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install diffusers, registers, and grilles level and plumb, according to manufacturer's written instructions, Coordination Drawings, original design, and referenced standards.
- B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Coordinate with architectural Reflected Ceiling Plans. Locate devices where indicated, as much as practical. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.
- C. Install diffusers, registers, and grilles with airtight connection to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.3 ADJUSTING

A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

3.4 CLEANING

A. After installation of diffusers, registers, and grilles, inspect exposed finish. Clean exposed surfaces to remove burrs, dirt, and smudges. Replace diffusers, registers, and grilles that have damaged finishes.

END OF SECTION

SECTION 23 6710 CONDENSING UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes air cooled condensing units.

1.3 SUBMITTALS

- A. Product Data: For each condensing unit, include rated capacities, operating characteristics, furnished specialties, and accessories. Include equipment dimensions, weights and structural loads, required clearances, method of field assembly, components, and location and size of each field connection. Provide matching system fan coil/air handler selection at ARI conditions for each condensing unit.
- B. Shop Drawings: Signed and sealed by a qualified professional engineer.
 - 1. Design Calculations: Calculate requirements for selecting vibration isolators and for designing vibration isolation bases (if required).
 - 2. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment (if required).
 - 3. Wiring Diagrams: Power, signal, and control wiring.
- C. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
 - 1. Structural members to which condensing units will be attached (if required).
 - 2. Liquid and suction pipe sizes.
 - 3. Refrigerant specialties.
 - 4. Piping including connections and service valves.
- D. Field quality-control test reports.
- E. Operation and Maintenance Data: For condensing units to include in emergency, operation, and maintenance manuals.
- F. Warranty: Special warranty specified in this Section.
- G. LEED Submittals:
 - 1. Credit EA 4: Manufacturers' product data for refrigerants, including printed statement that refrigerants are free of HCFCs.

1.4 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, and dimensional requirements of condensing units and are based on the specific system indicated. Refer to Specification Section "Product Requirements."

- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Fabricate and label refrigeration system according to ASHRAE 15, "Safety Code for Mechanical Refrigeration."
 - 1. Units shall be designed to operate with HCFC-free refrigerants.

1.5 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3.
- B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Specification Section "Roof Accessories."
- C. Coordinate location of piping and electrical rough-ins.

1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of condensing units that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Compressor failure.
 - b. Condenser coil leak.
 - 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 CONDENSING UNITS, AIR COOLED, 1 TO 5 TONS

- A. Available Manufacturers:
 - 1. Aaon.
 - 2. Carrier Corporation; Carrier Air Conditioning Div.
 - 3. Lennox Industries Inc.
 - 4. Trane Co. (The); Worldwide Applied Systems Group.
 - 5. York International Corp.
- B. Description: Factory assembled and tested, consisting of compressor, condenser coil, fan, motors, refrigerant reservoir, and operating controls.

- C. Compressor: Scroll, hermetically sealed, with rubber vibration isolators.
 - 1. Motor: Single speed, and includes thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.
 - 2. Compressor: automatic-reset, low-pressure switch.
 - 3. Refrigerant Type: See Schedule.
- D. Condenser Coil: Seamless copper-tube, aluminum-fin coil; circuited for integral liquid subcooler, and brass service valves with service ports.
 - 1. Condenser coil hail guard. (Fully Louvered).
- E. Condenser Fan: Direct-drive, aluminum propeller fan; with permanently lubricated ball bearings, totally enclosed fan motor with thermal-overload protection.
- F. Accessories:
 - 1. Crankcase heater.
 - 2. Cycle Protector: Automatic-reset timer to prevent rapid compressor cycling.
 - 3. Low-voltage thermostat and sub-base to control condensing unit and evaporator fan (RE: Schedules).
 - 4. Low Ambient Controller: Cycles condenser fan to permit operation down to 20 deg F.
 - 5. Low-Pressure Switch: Automatic-reset switch cycles compressor off on low refrigerant pressure.
 - 6. Time-Delay Relay: Continues operation of evaporator fan after compressor shuts off.
- G. Unit Casing: Galvanized steel, finished with baked enamel; with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Mount service valves, fittings, and gage ports on exterior of casing.

2.3 CONDENSING UNITS, AIR COOLED, 6 TO 120 TONS

- A. Available Manufacturers:
 - 1. Aaon.
 - 2. Carrier Corporation; Carrier Air Conditioning Div.
 - 3. Lennox Industries Inc.
 - 4. McQuay International.
 - 5. Trane Co. (The); Worldwide Applied Systems Group.
 - 6. York International Corp.
- B. Description: Factory assembled and tested, air cooled; consisting of casing, compressors, condenser coils, condenser fans and motors, and unit controls.
- C. Compressor: Hermetic or semihermetic compressor designed for service with crankcase sight glass, crankcase heater, and backseating service access valves on suction and discharge ports.
 - 1. Capacity Steps: Re: Schedule.
 - 2. Refrigerant Type: Re: Schedule.
 - 3. Compressor Type: Re: Schedule.
- D. Condenser Coil: Seamless copper-tube, aluminum-fin coil, including subcooling circuit and backseating liquid-line service access valve. Factory pressure test coils, then dehydrate by drawing a vacuum and fill with a holding charge of nitrogen or refrigerant.
 - 1. Condenser coil hail guards. (Fully Louvered).
- E. Condenser Fans: Propeller-type vertical discharge; direct driven. Include the following:
 - 1. Permanently lubricated ball-bearing motors.
 - 2. Separate motor for each fan.

- 3. Dynamically and statically balanced fan assemblies.
- F. Operating and safety controls include the following:
 - 1. Manual-reset, high-pressure cutout switches.
 - 2. Automatic-reset, low-pressure cutout switches.
 - 3. Low oil pressure cutout switch.
 - 4. Compressor-winding thermostat cutout switch.
 - 5. Three-leg, compressor-overload protection.
 - 6. Control transformer.
 - 7. Magnetic contactors for compressor and condenser fan motors.
 - 8. Timer to prevent excessive compressor cycling.
 - 9. Liquid and suction line shutoff valve(s).
 - 10. Suction line accumulator.
 - 11. Liquid line receiver.
- G. Accessories:
 - 1. Low-voltage thermostat and sub-base to control condensing unit and evaporator fan (Re: Schedule).
 - 2. Low Ambient Controller: Cycles condenser fan to permit operation down to 20 deg F with time-delay relay to bypass low-pressure switch.
 - 3. Gage Panel: Package with refrigerant circuit suction and discharge gages.
 - 4. Part-winding-start timing relay, circuit breakers, and contactors.
 - 5. Hot-Gas Bypass Valves: Comply with UL 429; listed and labeled by an NRTL (if scheduled).
 - a. Body, Bonnet and Seal Cap: Ductile iron or steel.
 - b. Diaphragm, Piston, Closing Spring and Seat Insert: Stainless Steel.
 - c. Packing and Gaskets: Non-asbestos.
 - d. Solenoid tube, Plunger, Closing Spring and Seat Orifice: Stainless Steel.
 - e. Seat: Polyetrafluorethylene.
 - f. Equalizer:
 - g. Electrical: Molded, watertight coil in NEMA 250 enclosure of type required by location with ½ inch conduit adapter and 120-v ac coil.
 - h. End Connections: Socket.
 - i. Set Pressure:
 - j. Throttling Range: Maximum 5 psig.
 - k. Working Pressure Rating: 500 psig.
 - I. Maximum Operating Temperature 240 deg F.
- H. Unit Casings: Designed for outdoor installation with weather protection for components and controls and with removable panels for required access to compressors, controls, condenser fans, motors, and drives. Additional features include the following:
 - 1. Galvanized for exposed casing surfaces; treated and finished with baked enamel powder finish.
 - 2. Perimeter base rail with forklift slots and lifting holes to facilitate rigging.
 - 3. Gasketed control panel door.

2.4 SOURCE QUALITY CONTROL

- A. Verification of Performance: Rate condensing units according to 365.
 - 1. Coefficient of Performance: Equal to or greater than prescribed by ASHRAE/IESNA 90.1, "Energy Efficient Design of New Buildings except Low-Rise Residential Buildings."
 - 2. Energy-Efficiency Ratio: Equal to or greater than prescribed by ASHRAE/IESNA 90.1, "Energy Efficient Design of New Buildings except Low-Rise Residential Buildings."
- B. Testing Requirements: Factory test sound-power-level ratings according to ARI 270.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of condensing units.
- B. Examine roughing-in for refrigerant piping systems to verify actual locations of piping connections before equipment installation.
- C. Examine walls, floors, and roofs for suitable conditions where condensing units will be installed.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install units level and plumb, firmly anchored in locations indicated; maintain manufacturer's recommended clearances.
- B. Contractor to verify and comply with manufacturers recommended clearances with project conditions prior to installation.
- C. Install condensing units on concrete base. Concrete base is specified in Specification Section "Basic Mechanical Materials and Methods," and concrete materials and installation requirements are specified in Division 3.
 - 1. Vibration Isolation: Mount condensing units on rubber pads with a minimum deflection of 1/4 inch.
- D. Install roof-mounting units on equipment supports specified in Division 7.
- E. Vibration Isolation: Mount condensing units on rubber pads with a minimum deflection of 1/4 inch.
- F. Maintain manufacturer's recommended clearances for service and maintenance.
- G. Loose Components: Install electrical components, devices, and accessories that are not factory mounted.

3.3 CONNECTIONS

- A. Piping installation requirements are specified in other Mechanical Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to machine to allow service and maintenance.
- C. Connect refrigerant piping to air-cooled condensing units; maintain required access to unit. Install furnished field-mounted accessories. Refrigerant piping and specialties are specified in Specification Section "Refrigerant Piping."
- D. Ground equipment according to Specification Section "Grounding and Bonding."
E. Connect wiring according to Specification Section "Conductors and Cables."

3.4 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
 - 1. Perform electrical test and visual and mechanical inspection.
 - 2. Leak Test: After installation, charge systems with refrigerant and oil and test for leaks. Repair leaks, replace lost refrigerant and oil, and retest until no leaks exist.
 - 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation, product capability, and compliance with requirements.
 - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- B. Verify that vibration isolation and flexible connections properly dampen vibration transmission to structure.
- C. Remove and replace malfunctioning condensing units and retest as specified above.

3.5 STARTUP SERVICE

- A. Complete installation and startup checks according to manufacturer's written instructions and perform the following:
 - 1. Inspect for physical damage to unit casing or condenser coil.
 - 2. Verify that access doors move freely and are weathertight.
 - 3. Clean units and inspect for construction debris.
 - 4. Verify that all bolts and screws are tight.
 - 5. Adjust vibration isolation and flexible connections.
 - 6. Verify that controls are connected and operational.
- B. Verify that fan wheel is rotating in the correct direction and is not vibrating or binding.
- C. Start unit according to manufacturer's written instructions and complete manufacturer's startup checklist.
- D. Verify that vibration isolation and flexible connections properly dampen vibration transmission to structure.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain condensing units. Refer to Specification Section "Closeout Procedures or Demonstration and Training."

END OF SECTION

SECTION 23 8126 SPLIT-SYSTEM AIR-CONDITIONING UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes split system air conditioning and heat pump units consisting of separate evaporator fan and compressor condenser components. Units are designed for exposed or concealed mounting, and may be connected to ducts.

1.3 SUBMITTALS

- A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated. Include performance data in terms of capacities, outlet velocities, static pressures, sound power characteristics, motor requirements, and electrical characteristics.
- B. Specification Compliance Review:
 - 1. Manufacturers and bidders must provide the consulting engineer with a Compliance Review of the Specifications and Addenda's. The Compliance Review shall be a paragraph-by-paragraph review of the Specifications and schedule with the following information; "C", "D", or "E" marked in the margin of the original Specifications and any subsequent Addenda's. If the manufacturer or bidder does not provide the Compliance Review to the engineer for review, with the submittal, the submittal will be subject to rejection as non-compliant.
 - a. "C" Comply with no exceptions.
 - b. "D" Comply with deviations. For each and every deviation, provide a numbered footnote with reasons for the proposed deviation and how the intent of the Specification can be satisfied.
 - c. "É" Exception, do not comply. For each and every exception, provide a numbered footnote with reasons and possible alternatives. Non-compliance with the specifications is grounds for rejection as unacceptable. A bid from any alternative or listed equipment manufacturer with any number of exceptions will be reason for rejection for non-compliance without further review.
 - d. Unless a deviation or exception is specifically noted in the Compliance Review, the manufacturer shall provide full compliance with entire specification. Deviations or exceptions taken in letters or cover letters in a bid document, subsidiary documents, by omission or by contradiction do not release the manufacturer or bidder from being in complete compliance, unless the exception or deviation has been specifically noted in the Compliance Review and approved by the consulting engineer.
 - e. Equipment manufacturers or bidders that do not meet the specifications thru the above process will be subject to rejection without further review.
- C. Shop Drawings: Diagram power, signal, and control wiring.
- D. Samples for Initial Selection: For units with factory-applied color finishes.
- E. Field quality-control test reports.

F. Operational and Maintenance Data: For split-system air-conditioning units to include in emergency operation, and maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Product Options: Drawings indicate size, profiles, and dimensional requirements of split-system units and are based on the specific system indicated. Refer to Specification Section "Product Requirements."
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Energy-Efficiency Ratio (EER): Equal to or greater than prescribed by ASHRAE 90.1,"Energy Efficient Design of New Buildings except Low-Rise Residential Buildings."
- D. Coefficient of Performance: Equal to or greater than prescribed by ASHRAE 90.1, "Energy Efficient Design of New Buildings except Low-Rise Residential Buildings."
- E. Units shall be designed to operate with HCFC-free refrigerants.

1.5 COORDINATION

- A. Coordinate size and location of concrete bases for units. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork are specified in Specification Section "Special Conditions for All Mechanical Work."
- B. Coordinate size, location, and connection details with roof curbs, equipment supports, and roof penetrations specified in Specification Section "Special Conditions for All Mechanical Work."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Carrier Air Conditioning; Div. of Carrier Corporation
 - 2. Daikin Industries, Ltd.
 - 3. Lennox Industries, Inc.
 - 4. York International Corp.

2.2 CONCEALED EVAPORATOR-FAN COMPONENTS

- A. Chassis: Galvanized steel with flanged edges, removable panels for servicing, and insulation on back of panel.
 - 1. Insulation: Faced, glass-fiber duct liner.
 - 2. Drain Pans: Galvanized steel, with connection for drain; insulated.
- B. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240, and with thermal-expansion valve.

- C. Electric Coil: Helical, nickel-chrome, resistance-wire heating elements with refractory ceramic support bushings; automatic-reset thermal cutout; built-in magnetic contractors; manual-reset thermal cutout; airflow proving device; and one-time fuses in terminal box for overcurrent protection.
- D. Fan: Forward-curved, double-width wheel of galvanized steel; directly connected to motor.
- E. Fan Motors:
 - 1. Special Motor Features: Multitapped, multispeed with internal thermal protection and permanent lubrication.
- F. Disposable Filters: 1 inch (25 mm) thick, in fiberboard frames.
- G. Wiring Terminations: Connect motor to chassis wiring with plug connection.

2.3 WALL-MOUNTING, EVAPORATOR-FAN COMPONENTS

- A. Cabinet: Enameled steel with removable panels on front and ends, and discharge drain pans with drain connection.
- B. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240, and with thermal expansion valve.
- C. Electric Coil: Helical, nickel chrome, resistance wire heating elements with refractory ceramic support bushings; automatic reset thermal cutout; built in magnetic contactors; manual reset thermal cutout; airflow proving device; and one-time fuses in terminal box for overcurrent protection.
- D. Fan: Direct drive, centrifugal fan.
- E. Fan Motors:
 - 1. Special Motor Features: Multitapped, multispeed with internal thermal protection and permanent lubrication.
- F. Filters: Permanent, cleanable.

2.4 AIR-COOLED, COMPRESSOR-CONDENSER COMPONENTS

- A. Casing: Steel, finished with baked enamel in color selected by Architect, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.
- B. Compressor: Hermetically sealed with crankcase heater and mounted on vibration isolation. Compressor motor shall have thermal- and current sensitive overload devices, start capacitor, relay, and contactor.
 - 1. Compressor Type: Scroll
 - 2. Manual reset high pressure switch and automatic reset low pressure switch.
 - 3. Refrigerant Charge: R-410.
 - 4. 1 Compressor per unit
- C. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240, and with liquid sub-cooler.
- D. Heat Pump Components: Reversing valve and low temperature air cut-off thermostat.

- E. Fan: Aluminum propeller type, directly connected to motor.
- F. Motor: Permanently lubricated, with integral thermal overload protection.
- G. Coordinate with drawing schedule for additional requirements.

2.5 ACCESSORIES

- A. Unit shall have local control unless specified to be part of central control system.
- B. Low-Voltage Control Wiring: Provide plenum-rated cabling (six-conductor) per manufacturer.
- C. Thermostat: Low-voltage, programmable, with the following functions and features:
 - 1. Auto changeover (heat/cool).
 - 2. Seven-day programmable with three (3) different occupied settings per day.
 - 3. Large backlit liquid crystal display indicating temperature, setpoint temperature, time setting, operating mode, and cool/heat mode.
 - 4. Three (3) security levels with keypad lockout.
 - 5. Non-volatile memory.
 - 6. Four-hour override/setback.
 - 7. Seven-day holiday setback.
- D. Automatic reset timer to prevent rapid cycling of compressor.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install units level and plumb.
- B. Install evaporator fan components using manufacturer's standard mounting devices securely fastened to building structure.
- C. Install ground mounting, compressor condenser components on 4-inch- (100-mm-) thick, reinforced concrete base; 4 inches (100 mm) larger on each side than unit. Concrete, reinforcement, and formwork are specified in Specification Section "Special Conditions for All Mechanical Work." Coordinate anchor installation with concrete base.
- D. Install compressor condenser components on equipment supports specified in Specification Section "Special Conditions for All Mechanical Work." Anchor units to supports with removable, cadmium plated fasteners.
- E. Install condensing unit on Korfund or equal pads and secure to housekeeping pad.
- F. Charge unit with manufacturer required refrigerant and amount.
- G. Support refrigerant piping from structure with hangers and saddles.
- H. Insulate refrigerant lines with Armaflex. Provide aluminized jacket for exterior insulation.
- I. Install t-stat in room on wall not in airflow stream. Connect t-stat to compressor/evaporator.
- J. Provide condensate overflow switch to de-energize unit.

K. Provide and install plenum rated control cabling between condensing unit and evaporator.

3.2 CONNECTIONS

- A. Connect condensate line to unit. Route condensate to floor drain. Support piping from structure with pipe hangers. Insulate condensate line with Armaflex.
- B. Connect unit to controls system. Controls shall alarm with unit failure.
- C. Piping installation requirements are specified in other **Mechanical and Plumbing** Sections.
- D. Install piping adjacent to unit to allow service and maintenance.
- E. Duct Connections: Duct installation requirements are specified in Specification Section "Metal Ducts." Drawings indicate the general arrangement of ducts. Connect supply and return ducts to split system air conditioning units with flexible duct connectors. Flexible duct connectors are specified in Specification Section "Duct Accessories."
- F. Ground equipment according to Specification Section "Grounding and Bonding."
- G. Electrical Connections: Comply with requirements in electrical specification sections for power wiring, switches, and motor controls. Install control wiring in conduit per electrical specification sections. All cabling shall be plenum rated. Disconnects shall be provided for the evaporator and condensing unit. Provide conduit and conductors from condensing unit to evaporator in conduit. Minimum #10 wire.

3.3 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
 - 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - 3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- B. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION

SECTION 23 8560 INTAKE AND RELIEF VENTILATORS

PART 1- GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following types of roof-mounting intake and relief ventilators:
 - 1. Roof hoods.
 - 2. Goosenecks
- B. Related Sections include the following:
 - 1. Specification Section "Louvers and Vents" for ventilator assemblies provided as part of the general construction.
 - 2. Specification Section "Power Ventilators" for roof-mounting exhaust fans.

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance: Intake and relief ventilators shall be capable of withstanding the effects of gravity loads, wind loads, and thermal movements without permanent deformation of components, noise or metal fatigue, or permanent damage to fasteners and anchors.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For intake and relief ventilators. Include plans, elevations, sections, details, and ventilator attachments to curbs and curb attachments to roof structure.
- C. Welding certificates.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain ventilators through one source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.
- B. Product Options: Information on Drawings and in Specifications establishes requirements for system's aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance.
- C. Product Options: Drawings indicate size, profiles and dimensional requirements of intake and relief ventilators and are based on the specific equipment indicated. Refer to Section "Product Requirements."
 - 1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

- D. Welding: Qualify procedures and personnel according to the following:
 - 1. AWS D1.2, "Structural Welding Code-Aluminum."
 - 2. AWS D1.3, "Structural Welding Code-Sheet Steel."

1.6 COORDINATION

Α. Coordinate installation of roof curbs and roof penetrations. These items are specified in Section "Roof Accessories."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- Α. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1 Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 MATERIALS

- Α. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063-T5 or T-52.
- Β. Aluminum Sheet: ASTM B 209 (ASTM B 209M), Alloy 3003 or 5005 with temper as required for forming or as otherwise recommended by metal producer for required finish.
- Galvanized-Steel Sheet: ASTM A 653/A 653M, G90 (Z275) zinc coating, mill phosphatized. C.
- D. Stainless-Steel Sheet: ASTM A 666, Type 304, with No. 4 finish.
- Fasteners: Same basic metal and alloy as fastened metal or 300 Series stainless steel, unless Ε. otherwise indicated. Do not use metals that are incompatible with joined materials. Use types and sizes to suit unit installation conditions. 1
- F. Post-Installed Fasteners for Concrete and Masonry: Torque-controlled expansion anchors, made from stainless-steel components, with capability to sustain, without failure, a load equal to 4 times the loads imposed, for concrete, or 6 times the load imposed, for masonry, as determined by testing per ASTM E 488, conducted by a gualified independent testing agency.
- G. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.3 FABRICATION, GENERAL

- Α. Factory or shop fabricate intake and relief ventilators to minimize field splicing and assembly. Disassemble units to the minimum extent as necessary for shipping and handling. Clearly mark units for reassembly and coordinated installation.
- В. Fabricate frames, including integral bases, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.
- C. Fabricate units with closely fitted joints and exposed connections accurately located and secured.
- D. Fabricate supports, anchorages, and accessories required for complete assembly.
- E. Perform shop welding by AWS-certified procedures and personnel.

2.4 ROOF HOODS

- A. Manufacturers:
 - 1. Greenheck.
 - 2. Loren Cook Company.
- B. Factory or shop fabricate according to SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Figures 5-6 and 5-7.
- C. Materials: Aluminum sheet, minimum 0.063-inch- (1.6-mm-) thick base and 0.050-inch- (1.27-mm-) thick hood; suitably reinforced.
- D. Roof Curbs: Galvanized-steel sheet; with mitered and welded comers: 1-1/2-inch- (40-mm-) thick, rigid fiberglass insulation adhered to inside walls; and 1-1/2-inch (40-mm) wood nailer. Size as required to fit roof opening and ventilator base.
 - 1. Configuration: Self-flashing without a cant strip, with mounting flange.
 - 2. Overall Height: 12 inches (300 mm).
- E. Bird Screening: Aluminum, 1/2-inch- (12.7-mm-) square mesh, 0.063-inch (1.6-mm) wire.
- F. Insect Screening: Aluminum, 18-by-16 (1.4-by-1.6-mm) mesh, 0.012-inch (0.30-mm) wire.

2.5 GOOSENECKS

- A. Factory or shop fabricate according to SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Figure 5-5; with a minimum of 0.052-inch- (1.3-mm-) thick, galvanized-steel sheet.
- B. Roof Curbs: Galvanized-steel sheet; with mitered and welded comers: 1-1/2-inch (40-mm-) thick, rigid fiberglass insulation adhered to inside walls; and 1-1/2-inch (40-mm) wood nailer. Size as required to fit roof opening and ventilator base.
 - 1. Configuration: Self-flashing without a cant strip, with mounting flange.
 - 2. Overall Height: 12 inches (300 mm)
- C. Bird Screening: Galvanized steel, 1/2-inch- (12.7-mm-) square mesh, 0.041-inch (1.04-mm) wire.
- D. Insect Screening: Aluminum, 18-by-16 (1.4-by-1.6-mm) mesh, 0.012-inch (0.30-mm) wire.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install intake and relief ventilators level, plumb, and at indicated alignment with adjacent work.
- B. Secure intake and relief ventilation to roof curbs with cadmium-plated hardware. Use concealed anchorages where possible.
- C. Install goosenecks on curb base where throat size exceeds 9 by 9 inches (230 by 230 mm).
- D. Install intake and relief ventilators with clearances for service and maintenance.
- E. Install perimeter reveals and openings of uniform width for sealants and joint fillers as indicated.
- F. Install concealed gaskets, flashings, joint fillers and insulation as installation progresses. Comply with Section "Joint Sealants" for sealants applied during installation.

- G. Label intake and relief ventilators according to requirements specified in Specification Section "Mechanical Identification."
- H. Protect galvanized and nonferrous-metal surfaces from corrosion or galvanic action by applying a heavy coating of bituminous paint on surfaces that will be in contact with concrete, masonry, or dissimilar metals.
- I. Repair finishes damaged by cutting, welding, soldering and grinding. Restore finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations and refinish entire unit or provide new units.

3.2 CONNECTIONS

A. Duct installation and connection requirements are specified in other Mechanical Sections. Drawings indicate general arrangement of ducts and duct accessories.

3.3 ADJUSTING

A. Adjust damper linkages for proper damper operation.

END OF SECTION

SECTION 26 0005 ELECTRICAL DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Demolition and removal of selected portions of building or structure.
 - 2. Demolition and removal of selected site elements.
 - 3. Salvage of existing items to be reused or recycled.
- B. Related Sections include the following:
 - 1. Division 1 Section "Summary" for use of premises, phasing, and Owner-occupancy requirements.
 - 2. Division 1 Section "Photographic Documentation" for preconstruction photographs taken before selective demolition operations.
 - 3. Division 1 Section "Temporary Facilities and Controls" for temporary construction and environmental-protection measures for selective demolition operations.
 - 4. Division 1 Section "Construction Waste Management" for disposal of demolished materials.
 - 5. Division 1 Section "Cutting and Patching" for cutting and patching procedures.
 - 6. Division 2 Section "Building Demolition" for demolition of entire buildings, structures, and site improvements.
 - 7. Division 2 Section "Site Clearing" for site clearing and removal of above- and belowgrade improvements.

1.3 DEFINITIONS

- A. Remove or Demolish: Detach items from existing construction and legally dispose of them off-site, unless indicated to be removed and salvaged or removed and reinstalled.
- B. Remove and Salvage: Detach items from existing construction and deliver them to Owner cleaned, packaged, and ready for reuse.
- C. Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.
- D. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.4 MATERIALS OWNERSHIP

A. Historic items, relics, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques 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 representative, who will establish special procedures for removal and salvage.

1.5 SUBMITTALS

- A. 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.
 - 2. Interruption of utility services. Indicate how long utility services will be interrupted.
 - 3. Coordination for shut-off, capping, and continuation of utility services.
 - 4. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.
 - 5. Means of protection for items to remain and items in path of waste removal from building.
- B. Inventory: After selective demolition is complete, submit a list of items that have been salvaged.
- C. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.
 - 1. Comply with submittal requirements in Division 1 Section "Construction Waste Management."
 - 2. Dispose of ballasts and lamps in accordance with current EPA Standards.

1.6 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Standards: Comply with ANSI A10.6 and NFPA 241.
- C. Predemolition Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination." Review methods and procedures related to selective demolition including, but not limited to, the following:
 - 1. Inspect and discuss condition of construction to be selectively demolished.
 - 2. Review structural load limitations of existing structure.
 - 3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
 - 4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
 - 5. Review areas where existing construction is to remain and requires protection.

1.7 PROJECT CONDITIONS

- A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.
- B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

- C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- D. Hazardous Materials: It is unknown whether hazardous materials will be encountered in the Work.
 - 1. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Owner will remove hazardous materials under a separate contract.
- E. Storage or sale of removed items or materials on-site is not permitted.
- F. 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.

1.8 WARRANTY

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped.
- B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
- C. Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.
- D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.
- E. Trace circuits feeding existing to-remain portions of the building. Do not demolish circuits in these areas. If circuits are in both "to remain" and "to be removed" areas, demolish back to nearest to-remain J-Box.
- F. Provide to the Engineer a diagram and index of circuits traced in the "to remain" areas.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Services/Systems: Maintain services/systems indicated to remain and protect them against damage during selective demolition operations.
 - 1. Comply with requirements for existing services/systems interruptions specified in Division 1 Section "Summary."

- B. Service/System Requirements: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.
 - 1. Arrange to shut off indicated utilities with utility companies.
 - 2. If services/systems are required to be removed, relocated, or abandoned, before proceeding with selective demolition provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
 - 3. Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing.
 - a. Where entire wall is to be removed, existing services/systems may be removed with removal of the wall.

3.3 PREPARATION

- A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
 - 1. Comply with requirements for access and protection specified in Division 1 Section "Temporary Facilities and Controls."

3.4 SELECTIVE DEMOLITION, GENERAL

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
 - 1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
 - 2. 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.
 - 3. Maintain adequate ventilation when using cutting torches.
 - 4. Dispose of demolished items and materials promptly.
- B. Removed and Salvaged items:
 - 1. Clean salvaged items.
 - 2. Pack or crate items after cleaning. Identify contents of containers.
 - 3. Store items in a secure area until delivery to Owner.
 - 4. Transport items to Owner's storage area designated by Owner.
 - 5. Protect items from damage during transport and storage.
- C. Removed and Reinstalled Items:
 - 1. Clean and repair items to functional condition adequate for intended reuse. Paint equipment to match new equipment.
 - 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.
- D. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition [and cleaned] and reinstalled in their original locations after selective demolition operations are complete.

ELECTRICAL DEMOLITION

3.5 DISPOSAL OF DEMOLISHED MATERIALS

- A. General: Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA- approved landfill.
 - 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.
- B. Burning: Do not burn demolished materials.
- C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

END OF SECTION

SECTION 26 0015 GENERAL CONDITIONS FOR ALL ELECTRICAL WORK

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including Conditions of the Contract (General and Supplementary Conditions) and Division 1 specification sections, apply to work of this section.
- B. The requirements of this section apply to all sections of electrical, signal, and life safety, and all sections that are installed by the electrical contractor to include electrical work done under the mechanical contractor.

1.2 DESCRIPTION OF WORK

- A. This section covers the general provisions of the electrical specifications applicable to the following systems:
 - 1. Electrical power and lighting to include generators, UPS Systems, and passive electrical generating equipment (solar).
 - 2. All Special Systems (fire alarm, security, telephone, data, television, and annunciators associated with power).
 - 3. Control wiring associated with electrical or mechanical equipment.
- B. The use of the word "electrical" in any specification contained within the electrical, signal, or lift safety division sections shall include all aspects of each systems complete install. This shall be extended to mechanical or plumbing signal systems.
- C. The use of the work "life safety" shall refer to all fire alarm, fire protection, and mass notification systems installed by the electrical contractor.
- D. The use of the word "mechanical" shall refer to both mechanical and plumbing.
- E. The use of the word "pipe" shall refer to all electrical raceway.

1.3 DRAWINGS

- A. These specifications are accompanied by drawings of the building and details of the installations showing the locations of equipment, lighting, panels, etc. The drawings and these specifications are complementary to each other, and what is called for by one shall be as binding as if called for by both.
- B. Drawings and specification conflicts shall be identified as early as possible to ensure conflict resolution prior to installation. The contractor shall not install any equipment with known conflicts or pending information requests. The contractor shall contact the Engineer of Record or their representative for information clarification prior to installing any item that is in question. The contractor shall not install any equipment that is not consistent with the manufacturers approved installation instructions unless directed by the engineer.
- C. In all cases all installations shall be at least in accordance with all the approved codes and their local amendments. The drawings and specifications may exceed local code allowances and the most stringent applies. The existence or allowance of a practice or product by code

does not supersede requirements of the drawings and specifications. In other words, just because it is allowed by code does not mean that it is allowed on this project.

- D. If any departures from the drawings are deemed necessary by the Contractor, details of such departures and the reasons therefore shall be submitted to the Owner's Representative for approval. No departures shall be made without prior written approval by the Owner's Representative.
- E. There are intricacies of construction which are impractical to specify or indicate in detail; however, in such cases, the current rules of good practice and applicable specifications shall govern. In all cases the requirements specified in the NEC and local jurisdiction shall be followed.
- F. It is the Contractor's responsibility to properly use all information found on the Architectural, Structural, Mechanical, and Electrical drawings and applicable shop drawings where such information affects his work. The contractor shall review the entire construction document set both prior to bid and construction.
- G. All dimensional information related to new structures shall be taken from the appropriate drawings. All dimensional information relative to existing facilities shall be taken from actual measurements made by the Contractor on the site.
- H. Any duplicate circuiting listed on the drawings shall be bid as multiple circuits with the intention of the next available circuit and breaker to be used. The contractor shall bring this to the attention of the engineer for clarification and updating the drawings. The new circuit numbers shall be annotated on both the panel schedules and the record drawings. The contractor is not required to follow the exact circuit numbers on the panel schedules (balancing phases, wiring convenience, or conduit routing installation), however, the contractor is responsible for keeping the panel schedules accurate and up to date in addition to ensuring the circuit numbers are identified correctly.
- I. Any installation that is not in compliance with these requirements shall be corrected at the contractors cost and responsibility.

1.4 BIDDING

- A. The contractor is responsible for bidding complete and working systems. In the event that some part of the system is not included in the construction document or the specifications and it is a necessary part of the system to work properly, the contractor shall include that work as part of the bid amount. This includes, but not limited to:
 - 1. Power for equipment shown on the drawings. Examples include, but are not limited to:
 - a. Equipment Panels
 - b. Controllers
 - c. Electronic Devices
 - d. Mechanical Equipment
 - e. Plumbing Equipment
 - 2. Cabling to communicate with the head end equipment. Examples include, but are not limited to:
 - a. Generator to Annunciator
 - b. Generator and ATS
 - c. Security
 - d. Access Control
 - e. Switching
 - f. Equipment starters and the switching locations
 - g. Monitoring equipment

- B. The contractor is not responsible for interpreting additional accessory options that are not included in the drawings or specifications or equipment that is not shown or indicated as part of the entire contract documents or specifications.
- C. The contractor shall review the entire set of specifications and contract documents for all equipment and connections requiring electrical work.
- D. Equipment Substitutions or Proposed Equivalents:
 - 1. Contractor shall submit proposed substitutions or equivalents to the Architect or engineer during the bidding process prior to any final dates for questions as indicated on the bid forms or RFP's and provide a reasonable time to complete to comparison. All changes to the documents indicated a deviation from the specifications or drawings shall be part of the addenda process or written notification from the engineer of record, architect, owner, or a designated representative. Reasonable time for review is minimum one working week. The contractor shall retain the written notification.
 - 2. The contractor is responsible for providing full comparison information for the products to be substituted. Incomplete information is subject to immediate rejection.
 - 3. Bids taken for equipment that is not approved is under the contractors own risk. Should the equipment be rejected under the post bid submittal process, the contractor is responsible for providing the specified equipment at no cost to the owner.
 - 4. Under no circumstances should the contractor accept bids for non-specified equipment from vendors who do not have prior approval or "speculate" that it will be approved. This is subject to immediate rejection and the specified equipment shall be required to be installed.
 - 5. No response from the architect, owner, or engineer shall not be considered an approval.

1.5 CONSTRUCTION REQUIREMENTS

- A. The architectural, structural, and electrical plans and specifications and other pertinent documents issued by the Architect are a part of these specifications and the accompanying electrical drawings, and shall be complied with in every respect. All the above is included in the Contract Documents, and shall be examined by all bidders. Failure to comply shall not relieve the Contractor of responsibility or be used as a basis for additional compensation because architectural, structural, or mechanical details were not included in the electrical drawings.
- B. It is the intent of the Contract Documents to provide an installation complete in every respect. In the event that additional details or special construction may be required for work indicated or specified in this section or work specified in other sections, it shall be the responsibility of the Contractor to provide same as well as to provide material and equipment usually furnished with such systems or required to complete the installation, whether mentioned or not.
- 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 comply with Codes, to facilitate the work of other trades, to conform to the details of the installation supplied by the manufacturer of the equipment to be installed, and thereby to provide an integrated satisfactory operating installation.
- D. The mechanical, electrical, and associated drawings are necessarily diagrammatic in character and do not show every connection in detail or every pipe or conduit in its exact location. These details are subject to the requirements of ordinances and also structural and

architectural conditions. It shall be the contractor's responsibility to coordinate with other disciplines to facilitate their equipment installation.

- E. 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 laid out so that it will be concealed in furred chases and above suspended ceilings, etc. in finished portions of the building, unless specifically noted to be exposed. Work shall be installed to avoid crippling of structural members; therefore, inserts to accommodate hangers shall be set before concrete is poured, and proper openings through floor, walls, beams, etc. shall be provided as hereinafter specified or as otherwise indicated or required. All work shall be installed parallel or perpendicular to the lines of the building unless otherwise noted.
- F. Conduit and equipment are generally intended to be installed true and square to the building construction, and located as high as possible against the structure in a neat and workmanlike manner. The plans do not show all required offsets, elbows, and other location details. Work shall be concealed in all finished areas. Conduit is intended to be installed with factory fittings or bent in a professional, workmanlike manner.
- G. All parts of equipment requiring adjustment shall be easily accessible. Equipment shall be so located and installed as to permit convenient and safe maintenance and future replacement. The trade furnishing the equipment shall be responsible for notifying the Contractor, who shall notify the Owner's Representative prior to ordering same in the event that equipment specified and/or proposed is incompatible with this requirement.
- H. Location of Lighting and Outlets in Rooms:
 - 1. All lighting, plumbing, acoustical tile, modular lighting outlets, diffusers, sprinkler heads, grilles, registers, and other devices shall be referenced to coordinated, established data points and shall be located to present symmetrical arrangements with these points and to facilitate the proper arrangements of acoustical tile panels and other similar panels with respect to the mechanical outlets and electrical lighting and devices. Those mechanical and electrical outlets shall be referenced to such features as wall and ceiling furring's, balanced border widths, masonry joints, etc. Outlets in acoustical tile shall occur symmetrically in tile joints or in the centers of whole tiles. The final determination of the exact location of each outlet and the arrangements to be followed shall be acceptable to the Owner's Representative.
 - 2. The drawings show diagrammatically the locations of the various outlets and apparatus. Exact locations of these outlets and apparatus shall be determined by reference to the general plans and to all detail drawings, equipment drawings, roughing-in drawings, etc. by measurements at the building, and in cooperation with the other trades. The Owner reserves the right to make any reasonable change in location of any outlet or apparatus before installation, without additional cost to the Owner or the Architect. Contractor shall coordinate work with architectural reflective ceiling plan.
- I. The Contractor, by submitting a bid on this work, sets forth that he has the necessary technical training and ability, and that he will install his work in a satisfactory and workmanlike manner which is up to the best standards of the trade, complete and in good working order. If any of the requirements of the plans and specifications are impossible of performance, or if the installation when made in accordance with such requirements will not perform satisfactorily, he shall report same to the Owner's Representative for correction promptly after discovery of the discrepancy.
- J. No extra compensation will be allowed for extra work or change caused by failure to comply with the above requirements.

1.6 JOB CONDITIONS

- A. Submittal of bid implies bidder has read paragraphs of the specifications and will be bound by their conditions.
- B. Contractor Qualifications: A minimum of five years' experience installing commercial electrical power lighting and special systems, similar to those described in these specifications, and make available at the owner or engineer's request a list of five previous projects including name of project and contact person names and phone numbers as a separate document in addition to the bid or proposal submitted.
- C. Contractor must be licensed and hold a current contracting license that has been valid for a minimum of five years in the local State.
- D. Contractor must be able to bond work for performance of work being bid and provide a written statement from the bonding agency proposed to be used for this project as a separate document in addition to the bid or proposal submitted. The bonding agency proposed to be used shall have a Best's insurance rating of A or A+.

1.7 INSPECTION OF THE SITE

A. The Contractor shall visit the site, verifying all existing items indicated on drawings and/or specified, and familiarize himself with the existing work conditions, hazards, grades, actual formations, soil conditions, structures, utilities, equipment, systems, facilities, and local requirements. The submission of bids shall be deemed evidence of such visits. All proposals shall take these existing conditions into consideration, and the lack of specific information shall not relieve the Contractor of any responsibility.

1.8 PERMITS, UTILITY CONNECTIONS, AND INSPECTIONS

- A. Fees and Costs: The contractor shall obtain and pay for all permits, utility connections, utility extensions, and/or relocations and pay all costs required by the utility, including inspection fees, for all work included therein.
- B. Compliance: The Contractor shall comply in every respect with all requirements of local inspection departments, Board of Fire Underwriters, local ordinances and codes, 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 a higher quality than the requirements of the above-specified offices. Where requirements of the specifications and drawings are below the requirements of the above offices having jurisdiction, the Contractor shall make installations in compliance with the requirements of the above offices.
- C. Utilities: The Contractor shall check with the various utility companies involved in this project and shall provide complete in all respects the required utility relocations, extensions, modifications, and/or changes. Contractor shall verify the location of all existing utilities with the applicable Utility Company. The Contractor shall be responsible for all damages to existing utilities caused by his construction work, whether indicated on drawings or not, and repair all damage to existing utilities as acceptable to the Utility Company concerned.
- D. Utility Services:
 - 1. Power for the building service shall be obtained from local utility service. Contractor shall coordinate with the local utility for shutdowns and transformer installations. Contractor shall coordinate underground feeders with other underground piping and

mark his conduit clearly. Contractor shall install feeders to the building transformer in accordance with

- 2. Contractor shall coordinate meter location and provide access in accordance with local utility requirements.
- 3. Transformer and ductbank rough-ins shall be in accordance with Utility provider requirements.
- E. Contractor Temporary Power: The contractor shall obtain temporary power in their name, from the local utility for the construction trailer and any equipment needed to perform his work. The contractor shall be responsible for the installation and removal of the temporary service at the conclusion of the project.
- F. Certification: Prior to final acceptance, the Contractor shall furnish a certificate of acceptance from the inspection departments having jurisdiction over the work for any and all work installed under this Contract. Any additional labor costs incurred as a result of a substitution shall be the Contractor's responsibility.

1.9 EXISTING FACILITIES

- A. The Contractor shall be responsible for loss or damage to the existing facilities caused by him and his workmen, 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 electrical and special systems 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. Barricades shall clearly indicate with signage that which they are protecting. Contractor shall observe all OSHA rules.
- 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, and equipment, etc. to provide this access and shall reinstall same 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. This is to include but is not limited to temperature controls system devices, electrical switches, relays, fixtures, piping, conduit, etc.
- 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. Unless otherwise scheduled by the Owner, planned shutdowns of the existing facilities shall occur between 6 p.m. Friday through 5 am Monday. The existing building shall be ready for morning start-up by 5 am Monday.

1.10 DEMOLITION AND RELOCATION

- A. The Contractor shall modify, remove, and/or relocate all materials and items so indicated on the drawings or required by the installation of new facilities. All removals and/or dismantling shall be conducted in a manner as to produce maximum salvage. Salvage materials shall remain the property of the Owner, and shall be delivered to such destination or otherwise disposed of as directed by the Owner. Materials and/or items scheduled for relocation and which are damaged during dismantling or reassembly operations shall be repaired and restored to good operative condition. The Contractor may, at his discretion, and upon the approval of the Owner, substitute new materials and/or items of like design and quality in lieu of materials and/or items to be relocated.
- B. All items which are to be relocated shall be carefully removed in reverse to original assembly or placement and protected until relocated. The Contractor shall clean and repair and provide all new materials, fittings, and appurtenances required to complete the relocations and to restore to good operative order. All relocations shall be performed by workmen skilled in the work and in accordance with standard practice of the trades involved.
- C. When items scheduled for relocation and/or reuse are found to be in damaged condition before work has been started on dismantling, the Contractor shall call the attention of the Owner to such items and receive further instructions before removal. Items damaged in repositioning operations are the Contractor's responsibility and shall be repaired or replaced by the Contractor as approved by the Owner, at no additional cost to the Owner.
- D. Service lines and wiring to items to be removed, salvaged, or relocated shall be removed to points indicated on the drawings, specified, or acceptable to the Owner. Service lines and wiring not scheduled for reuse shall be removed to the points at which reuse is to be continued or service is to remain. Such services shall be sealed, capped, or otherwise tied off or disconnected in a safe manner acceptable to the Owner. All disconnections or connections into the existing facilities shall be done in such a manner as to result in minimum interruption of services to adjacent occupied areas. Services to existing areas or facilities which must remain in operation during the construction period shall not be interrupted without prior specific approval of the Owner as hereinbefore specified.

1.11 SUBMITTAL DATA

- A. General: As soon as practical and within 30 days after the date of award of contract and before purchasing or starting installation of any materials or equipment, the Contractor prepare or cause to be prepared shop drawings, product data, materials and equipment lists, diagrams, data, samples, and other submittals as required by the contract documents, hereinafter referred to as "Submittal Data." The Contractor shall review and approve all submittal data for compliance with the contract documents, manufacturer's recommendations, adequacy, clearances, code compliance, safety, and coordination with associated work.
- B. The Contractor shall submit approved submittal data to the Owner's Representative for review and comment as to general conformance with the design concept and general compliance with information given in the contract documents. Owner's Representative's review shall not include review of quantities, dimensions, weights or gauges, fabrication processes, construction methods, coordination with other trades or work, or construction safety and precautions, all of which are the sole responsibility of the Contractor. The reviewers shall make every effort to "catch" discrepancies and identify these to the contractor prior to ordering equipment. However, it shall remain the contractor's responsibility to order and install the equipment as listed in the drawings and specifications. At the owner's representative's discretion a detailed submittal may be required.

- C. Substitutions shall be clearly identified as such in the submittal by a cover sheet indicating that items are different from what is specified or scheduled. It shall be the contractor responsibility to provide complete substitution information so an accurate comparison can be made.
- D. Detail Submittals: Materials and equipment requiring detailed submittal data shall be submitted with sufficient data to indicate that all requirements of the specifications have been met and samples shall be furnished when requested. All manufacturer's data used as part of the submittal shall have all non-applicable features crossed out or deleted in a manner that will clearly indicate exactly what is to be furnished. The detailed submittals shall be accompanied by the same number of sets of pictorial and descriptive data derived from the manufacturer's catalogs and sales literature, or incorporated in the shop drawings. The Contractor may provide a detailed submittal on any item even though not required by the Owner's Representative.
- E. The Engineer's review of Shop Drawings and Brochures shall not relieve the Contractor of the responsibility for dimensions, errors that may be contained therein, or deviations from Contract Document requirements. It shall be clearly understood that the Engineer's noting some errors but overlooking others does not grant the Contractor permission to proceed in error. Regardless of any information contained in the Shop Drawings, the requirements of the Contract Documents shall govern and are not waived or superseded in any way by the submittal data review.
- F. The Contractor shall clearly and specifically identify and call to the attention of the Owner's Representative any deviation from the contract documents for which Owner acceptance is desired. The responsibility for such a deviation accepted by the Owner shall remain with the Contractor.
- G. Timeliness: The burden of timeliness in the complete cycle of submittal data is on the Contractor. The Contractor shall allow a minimum of four (4) weeks' time frame for the submittal cycle of each submission by the Owner's Representative. The Contractor is responsible for allowing sufficient time in the construction schedule to cover the aforementioned cycles of data processing, including time for all re-submission cycles on non-conforming 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 justify any request for scheduled construction time extensions or extra compensation.
- H. Work performed in accordance with approved submittal data that is not in accordance with the Contract Documents and did not have the specific acceptance of the Owner's Representative shall be replaced at Contractor's cost.
- I. Submittals shall be provided in the following format:
 - 1. The submittal brochures shall be contained in a three-ring hard back binder. The cover of the binder and the first page shall be titled "ELECTRICAL SUBMITTAL INFORMATION" and shall list the name and location of project, the Owner, the Engineer(s), the General Contractor, and the Subcontractors installing equipment represented in the brochure.
 - A table of contents will follow the first page and shall list all of the sections contained in the specifications manual. Each section will be tabbed and will include its' respective brochures. All brochures will be three-hole punched and folded (if required). Each submittal section will correspond to the appropriate specification section number.
 - 3. Provide submittal data for all materials to be used on this project as indicated in each specifications manual section.
 - 4. Brochures submitted shall contain only information which is relevant to the particular equipment or materials to be furnished. Do not submit catalogs that describe several

different items other than those items to be used unless all irrelevant information is marked out or relevant information is clearly marked.

- 5. Brochures: Brochures submitted to the Engineer shall be published by the Manufacturers and shall contain complete and detailed engineering and dimensional information to show that the equipment will fit into the allotted space.
- 6. Any submittal that is disapproved must be resubmitted within two (2) weeks following notification of such disapproval. If no satisfactory material is submitted within the two-week period, the Engineer reserves the right to require the Contractor to furnish items exactly as described in the Contract Documents.
- 7. Unless a greater number is indicated within Division 1 of these specifications, submit six (6) copies of all submittal materials for review.
- 8. No allowances will be made for submittals which are not made in a timely fashion or which are turned down because they do not meet the specifications. Should delivery problems arise due to the above, affecting the completion time of the project, the Contractor will furnish and install acceptable alternates until the proper materials arrive and then replace the alternate materials with the approved materials, all at no cost to the Owner, Architect, or Engineer. If the Contractor is not able to furnish an acceptable alternate until the proper materials and installing all alternates as directed by the Engineer.
- 9. Submittal shall have the certification information as listed hereafter.
- 10. Shop Drawings:
 - a. All shop drawings shall have the certification as listed hereafter.
 - b. Each Shop Drawing shall indicate in the lower right hand corner and each Brochure shall indicate on the front cover the following: Title of the Sheet or Brochure; name and location of the building; names of the Engineer, Contractor, Manufacturer, Supplier, Vendor, etc., the date of submittal; and the date of each correction and revision. So far as is practical, each Shop Drawing and/or Brochure shall bear a cross-reference note to the sheet number or numbers of the Contract Drawings and Specifications showing the same work. Shop Drawings shall be prepared as follows:
 - Shop Drawings: Drawings shall be newly prepared and not reproduced from the Contract Documents, drawn to a scale that can be easily read and shall contain sufficient plans, elevations, sections, and isometrics to describe clearly the items in question. Drawings shall be prepared by a draftsman skilled in this type of work. All equipment layouts and similar Shop Drawings shall be drawn to at least 1/e-inch = 1'-0" scale.
 - 2) All Shop Drawings shall indicate the equipment actually purchased. The elevation, location, support points, load imposed on the structure at support and anchor points, shall be indicated. All beam penetrations and slab penetrations shall be indicated and sized and shall be coordinated. All Design Drawing space allocations shall be maintained, such as ceiling height, chase walls, equipment room size, etc., unless proper written authorization is required from the Engineer to change them. All associated equipment shall be coordinated and clearly shown on the Shop Drawings.
- 11. Submittal data for each section must be complete. Partial submittals, or submittals not in the specified format, will be rejected and returned to the Contractor without further review.
- J. All equipment installed on this project shall have **local (within 125 miles)** representation, local factory-authorized service, and a local stock of repair parts. This requirement is essential and will be strictly reviewed by the Owner's Representative prior to concurrence with the Contractor's approval for all submittals covered by electrical division sections.
- K. Physical Size of Equipment: Space is critical; therefore, equipment of larger sizes than shown, even though of approved manufacturer, will not be acceptable unless it can be demonstrated that ample space exists for proper installation, operation, and maintenance.

L. These paragraphs related to electrical divisions submittal data rescind, amend, and supersede any provisions to the contrary contained in the Project Manual.

1.12 CERTIFICATION OF SUBMITTAL DATA

A. The Contractor shall provide the following notarized certificate with all submittal data furnished to the Owner's Representative for review and comment.

Project Title:

Description of Submittal Data:

This is to certify that the above-described submittal data has been reviewed and is approved for compliance with the Contract Documents, manufacturer's recommendation, adequacy, clearances, code compliance, safety, and coordination with other trades and/or work except as follows: (list "none" or itemize and explain). In addition, the Contractor shall submit to the Owner's Representative a signed statement from each representative certifying as follows:

EXCEPTIONS:

"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 and are asbestos free."

Notary

1.13 ACCEPTANCE OF MATERIALS AND EQUIPMENT

- A. Owner's Manual: After the submittals have been accepted the Contractor is requested to include a minimum of three (3) additional copies for insertion in the project's Owner's Manuals at the completion of the project.
- B. NOTICE: The Contractor is responsible for providing materials and equipment that conform to the requirements of the project manual in every respect unless a deviation has been "accepted" in writing. Removal of any nonconforming materials and equipment and the replacement with conforming materials and equipment shall be at the Contractor's sole expense, regardless of when nonconformance was discovered. If the owner or owners representative elects to keep the equipment it shall be contractors responsibility to provide any additional connections or services required to make the equipment function as specified or required by the manufacturer. The contractor shall coordinate with other subs for any different material requirements (wire size, breakers, cooling, mounting requirements, etc.).
- C. Approval of materials and equipment shall be based on manufacturer's published data and shall be tentatively subject to the submission of complete shop drawings which comply with

the contract documents. Approval is also dependent upon the existence of adequate and acceptable clearances for entry, servicing, and maintenance.

D. Approval of materials and equipment under this provision shall not be construed as authorizing any deviations from the specifications, unless the attention of the Owner's Representative has been directed in writing to the specific deviations. Data submitted shall not contain unrelated information unless all pertinent information is properly identified.

1.14 SHOP DRAWINGS

- A. As soon as practicable after the award of contract and approval of materials and equipment, but prior to installation, complete and detailed shop drawings of the following shall be submitted for review and comment:
 - 1. Equipment arrangements.
 - 2. Fire alarm system.
 - 3. Data drops.
 - 4. Security system.
 - 5. Equipment foundations.
 - 6. Factory-fabricated equipment and materials.
 - 7. Anchors.
 - 8. Control.
 - 9. Interlock.
 - 10. Switch gear configuration.
 - 11. Other details as directed by the Owner's Representative. Composite drawings of areas requiring coordination between trades shall be provided and expedited to eliminate conflicts and to ensure maximum cooperation and work progress.
- B. Work performed without benefit of reviewed and approved shop drawings **will not be recommended for payment by the Engineer** until such time as the shop drawings are submitted, reviewed, and approved. Any work performed without the benefit of reviewed and approved shop drawings may require removal, relocation, and/or replacement at the Contractor's sole expense in order to resolve conflicts between the various systems and provide the performance specified.
- C. All installation of equipment, fixtures, terminal devices, etc. shall be made in accordance with approved composite shop drawings. The Contractor shall modify installation and relocate installed work to provide code clearances, service access, and eliminate conflict with other systems.
- D. Submit one copy of shop drawings with each submittal. The shop drawing shall be marked with the A/E comments and returned to the Contractor for printing and distribution. Distribution shall include the return of three (3) prints of the approved shop drawings, with the A/E's comments included, to the A/E for the A/E's and Owner's use.

1.15 SITE OBSERVATION

A. Site observation by the Architect, Engineer, and/or Owner's Representative 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.

1.16 SUPERVISION

- A. In addition to the Superintendent required under the conditions of the contract, each subcontractor shall keep a competent superintendent or foreman on the job at all times.
- B. It shall be the responsibility of each superintendent to study all plans 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 jobsite by the superintendents involved. Where interferences cannot be resolved without major changes to the plans, the matter shall be referred to the Owner's Representative for comments.

1.17 OPERATION PRIOR TO COMPLETION

- A. When any piece of electrical 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 written permission of the Owner's Representative to do so. The contractor shall energize the power distribution in a timely manner to facilitate completion of other trades work. Electrical lighting shall be energized after ceiling has been completed. New permanent fixtures shall not be used as temporary under any circumstances. The warranty period shall not commence, however, 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, properly adjust, and complete all deficiency list items before final acceptance by the Owner. The date of acceptance and the start of the warranty may not be the same date.

1.18 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 Owner's Representative, in writing, of any conflict between the requirements of the contract documents and the manufacturer's directions, and shall obtain the Owner's Representative's comments before proceeding with the work. Should the Contractor perform any such work that does not comply with the manufacturer's directions or applicable comments from the Owner's Representative, he shall bear all costs arising in connection with the correction of such deficiencies.

1.19 CHECKING AND TESTING MATERIALS AND/OR EQUIPMENT

A. Before final acceptance of the work, 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. 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 Owner's Representative 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 and are asbestos free."

1.20 OPERATING AND MAINTENANCE INSTRUCTION

- A. The Contractor shall prepare for the owner's manual hereinafter specified complete sets of operating and maintenance instruction's, control and interlock diagrams, manuals, parts lists, etc. for each item of equipment. These are to be assembled as hereinafter specified for owner's manual.
- B. In addition, the Contractor shall provide the service of a competent engineer or a technician acceptable to the Owner's Representative to instruct a representative of the Owner in the complete and detailed operation of all equipment and systems. These instructions shall be provided for a period of sufficient duration to fully accomplish the desired results. Upon completion of these instructions, a letter of release will be required, acknowledged by the Owner, stating the dates of instruction and personnel to whom instructions were given.
- C. Additional diagrams, operating instructions, etc. shall be provided as specified hereinafter in the other sections of these specifications.

1.21 MATERIAL AND EQUIPMENT SCHEDULES

A. Contractor shall refer to both drawings and specification for schedules. Where reference is made to items "scheduled on drawings" or "scheduled in specifications," same shall include schedules contained in both the drawings and the specifications. The Contractor's attention is directed to the various specification sections and drawings for schedules.

1.22 APPLICABLE CODES AND STANDARDS

- A. 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, except as may be hereinafter specifically modified in these specifications and associated drawings.
 - 1. National Fire Protection Association Standards (NFPA):
 - a. NFPA No. 10, Portable Fire Extinguishers
 - b. NFPA No. 54, National Fuel and Gas Code
 - c. NFPA No. 70, National Electrical Code
 - d. NFPA No. 101, Life Safety Code
 - e. NFPA No. 255, Method of Test of Surface Burning Characteristics of Building Materials
 - 2. American National Standards Institute (ANSI):
 - a. C.2, 1984 National Electrical Safety Code
 - b. A117.1, Handicapped Code
 - 3. American Society of Mechanical Engineers (ASME): Section IV, V, CSD-1
 - 4. American Society of Testing Materials (ASTM): All applicable manuals and standards.
 - 5. National Electrical Manufacturers' Association (NEMA): All applicable manuals and standards.
 - 6. State Occupational Safety Act: All applicable safety standards.
 - 7. Occupational Safety and Health ACT (OSHA): National Sanitation Foundation, Standard No. 2
 - 8. Americans with Disabilities Act, 1990
 - 9. American Gas Association (AGA)
 - 10. Underwriters Laboratories, Inc. (UL)
 - 11. Applicable State Building Codes (Uniform Building Codes, as amended):
 - 12. All County codes related to mechanical, electrical, plumbing, and system equipment; piping; conduit; wiring; etc. furnished and installed under these specifications.
 - 13. All City ordinances related to mechanical, electrical, plumbing, and systems and equipment; piping; conduit; wiring; etc. furnished and installed under these specifications.

- 14. Refer to specification sections heretofore bound for additional codes and standards.
- B. All materials and workmanship shall comply with all applicable city, state, and national codes, specifications, and industry standards. All materials shall be listed by the Underwriters Laboratories, Inc. as conforming to its standards and so labeled in every case where such a standard has been established for the particular type of material in question.
- C. 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 Owner's Representative 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 1 of these contract documents, providing no work or 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.

1.23 DEFINITIONS

- A. Refer to the condition of the contract for Division 1 for additional requirements regarding definitions.
- B. 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."
- C. Where "and/or" is used in these specifications or on the drawings, it shall mean "that situations exist where either one or both conditions occur or are required and shall not be interpreted to permit an option on the part of the Contractor.
- D. Unless specifically indicated otherwise elsewhere in these specifications or on the drawings the word "furnish" or any of its derivatives shall be understood to indicate the purchase, delivery, storage and protection of an item at the job site in a location and manner suitable for use by the recipient who will be responsible for installation of this item. The word "install" or any of its derivatives shall be understood to indicate taking receipt of an item, properly mounting it, and providing the related utilities (electrical, communication, etc.) for proper and complete operation of the item. Installation shall also include calibration, programming and operational testing of said item. The word "provide" or any of its derivatives shall be understood to indicate both furnishing and installing an item.

1.24 SUBSTANTIAL COMPLETION

- A. Refer to Division 1 for additional requirements for substantial completion.
- B. Substantial completion shall be defined as the level of project completion where the owner is ready to occupy the building. The contractor shall have ensured that all mechanical, electrical, plumbing, and building systems (elevators, automatic doors, hardware, security, etc.) are complete and in fully functional working order. This level of completion does not

absolve the contractor from the requirements of final inspection or final acceptance. The contractor shall ensure there are no life safety issues unresolved with the project at the time of substantial completion.

C. All "punch" list items shall have been resolved or shall be identified as pending resolution. Items listed as unresolved shall be either pending information or direction from the owner or owners representative or shall be awaiting parts or supplies that are "on order". The contractor at the owners discretion shall produce documentation of the part or supply on order status.

1.25 FINAL INSPECTION

- A. Refer to Division 1 for additional requirements for final inspection.
- B. It shall be the responsibility of the Contractor to personally conduct a careful inspection, assuring himself that the work on the project is ready for final acceptance and developing his own "punchlists," before calling upon the Owner's Representative to make a final inspection. Failure of the Contractor to conduct such inspections and provide the Owner's Representative with a copy of his "punchlists" prior to the final inspection shall be adequate cause for the Owner's Representative to cancel any Contractor-requested final inspection.
- C. In order not to delay final acceptance of the work, the Contractor shall conduct his own "final inspections" prior to requesting the Owner's Representative to "final" the project; will have all necessary bonds, guarantees, receipts, affidavits, etc. called for in the various articles of this specification prepared and signed in advance; and together with a letter of transmittal listing each paper included, shall deliver the same to the Owner's Representative at or before the time of said final inspection. The Contractor is cautioned to check over each bond, receipt, etc. before preparing same for submission to see that the terms check with the requirements of the specifications.
- D. The final inspection will be made jointly by the Owner's Representative and the Owner.

1.26 REQUIREMENTS FOR FINAL ACCEPTANCE

- A. Requirements for final acceptance shall include but not be limited to the Contractor accomplishing the following:
 - 1. Construction: Complete all construction.
 - 2. Deficiency Lists: Correct all deficiencies listed at time of Substantial Completion.
 - 3. Owner's Manual: Submit at least 30 days prior to final acceptance one (1) copy of the owner's manual for the Owner's Representative's review and comments. Following acceptance, prepare three (3) copies of bound and indexed owner's manual, to be delivered at the time of final acceptance, which shall include but not be limited to the following:
 - a. System operating instructions.
 - b. System control drawings.
 - c. System interlock drawings.
 - d. System maintenance instructions.
 - e. Manufacturers', suppliers', and subcontractors' names, addresses, and telephone numbers, both local representatives and manufacturers' service headquarters.
 - f. Equipment operating and maintenance instructions and parts lists.
 - g. Manufacturers' certifications (see Checking and Testing Materials and/or Equipment, this section).
 - h. Contractor's warranty.
 - i. Acceptance certificates of authorities having jurisdiction.

- j. Log of all tests made during course of work.
- k. Owner's acknowledgment of receipt of instruction, enumerating items in owner's manual.
- I. List of manufacturers' guarantees executed by the Contractor.
- m. Owner's acknowledgment of items of equipment or accessories indicated or specified to be turned over to Owner.
- 4. Instructions:
 - a. Verbal, as herein specified.
 - b. Posted, framed under glass or plastic laminated:
 - 1) System operating instructions.
 - 2) System control drawings.
 - 3) System interlock drawings.
- 5. Record Drawings: Deliver the specified record drawings to the Owner's Representative.

1.27 RECORD DRAWINGS

A. The Contractor shall maintain a set of contract drawings at the job site on which he shall indicate the installed locations of all equipment, electrical lighting, data drops, fire alarm devices, PA system devices, security devices, outlets, and electrical feeders. These drawings shall be used for reference or construction and shall not leave the field office. Upon completion of the work, the Contractor shall obtain and pay for Mylar's and/or disks (if available as CAD files) of the contract drawings from the Owner's Representative and transfer the above information to these Mylar's to provide "Record Drawings." The abovementioned prints and "Record Drawings" shall then be delivered to the Owner's Representative. Refer to paragraph entitled "Record "Drawings" of the Supplemental General Conditions.

1.28 ALLOWANCES

A. Refer to Division 1 for allowances.

1.29 ALTERNATE PROPOSALS

A. Alternate proposals are summarized in Division 1 and on the bid proposal form. Refer to all sections of the specifications and the drawings to determine the exact extent and scope of the various alternate proposals as each pertains to the work of the various trades.

1.30 WARRANTY

- A. General: All work performed (including equipment and materials furnished) under the various sections of these specifications shall be 100% warranted, for a period of one (1) year from the date of substantial completion thereof, against defective materials, design, and unauthorized substitution. Upon receipt of note of failure of any part of the guaranteed equipment and/or facilities during the guaranty period, the affected part(s) or facilities shall be replaced promptly with new parts, etc. by and at the expense of the Contractor. Further, the Contractor shall properly obtain, execute, and forward any and all manufacturer's warranties on equipment furnished under the Contract. Refer to Division 1 for additional requirements.
- B. Extended Period: The Contractor shall provide all extended time warranties available from the manufacturer of the equipment provided as standard at no additional cost. This includes all extended warranties where specified with certain equipment as directed in other sections of this Specification.

1.31 SPARE PARTS

A. Spare Parts Data: As soon as practicable after approval of materials and equipment and, if possible, not later than four months prior to the date of beneficial occupancy, the Contractor shall furnish spare parts data for each different item of equipment listed. The data shall include a complete list of parts and supplies with current unit prices and sources of supply, a list of parts and supplies that are either normally furnished at no extra cost with the purchase of the equipment or specified hereinafter to be furnished as part of the Contract, and a list of additional items recommended by the manufacturer to assure efficient operation for a period of 120 days at the particular installation. The foregoing shall not relieve the Contractor of any responsibilities under the warranty specified.

PART 2 - PRODUCTS

2.1 MATERIALS AND WORKMANSHIP

- A. All materials, unless otherwise specified, shall be current United States manufacture, new, free from all defects, and of the best quality. Foreign goods specifically approved for use by the Owner's Representative prior to bidding may be furnished.
- B. 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 electricians skilled in their respective trades, and the installations shall present a neat, precise appearance.
- C. The responsibility for the furnishing and intended installation of the proper electrical equipment and/or material as intended rests entirely upon the Contract. The Contractor shall request advice and supervisory assistance from the representative of specific manufacturers during the installation.

2.2 MATERIAL AND EQUIPMENT REQUIREMENTS

- A. Manufacturer's Instructions: The manufacturer's published instructions shall be followed for preparing, assembling, installing, erecting, and cleaning manufacturer materials or equipment, unless otherwise indicated. The Contractor shall promptly notify the Owner's Representative in writing of any conflict between the requirements of the Contract Documents and the manufacturer's direction and shall obtain the clarification of the Owner's Representative before proceeding with the work. Should the Contractor perform any such work that does not comply with the manufacturer's directions or such clarification by the Owner's Representative, he shall bear all costs arising in connection with the correction of the deficiencies.
- B. Storage at Site: The Contractor shall not receive material or equipment at the jobsite until there is suitable space provided to properly protect equipment from rust, drip, humidity, and dust damage from surrounding work. All new or relocated equipment shall be stored inside or protected from the environment. Equipment that is not properly stored shall be replaced by the contractor at no cost to the owner.
- C. Capacities shall be not less than those indicated and shall be such that no component or system becomes inoperative or is damaged because of startup or other overload conditions.
- D. Conformance to 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 as listed in the NEC, 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.

- E. Nameplates: Each major component of equipment shall have the manufacturer's name, address, and model-identification number embossed on a plate securely attached to the item of equipment. All data on nameplates shall be legible at the time of Final Inspection. All equipment starters and disconnects shall be tagged with the equipment designated mark and circuit.
- 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. 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 inch 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 coatings 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.
- G. Protection of Connections: Switches, breaker handles, keys setscrews, handles and other parts not listed for normal occupied operation (light switches, etc.) shall be located accessible to but out of paths to prevent their accidental shutoff.
- H. Verifications 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 thoroughly familiarize himself with all details of the work and working conditions, to verify all dimensions in the field, and to advise the Owner's Representative 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, Architect, or Engineer.
- I. Standard Products: Materials and equipment to be provided shall be the standard catalog products of manufacturers regularly engaged in the manufacture of products conforming to these specifications, and shall essentially duplicate materials and equipment that have been in satisfactory use at least two years.

2.3 SUBSTITUTION OF MATERIALS AND EQUIPMENT

- A. No substitution of materials or equipment herein specified or called for on the drawings will be permitted, except by written permission of the Owner's Representative. Where several makes of equipment or material are mentioned, any item named may be bid upon provided it meets space, capacity specifications, finish, usage (switching, ballasts, similar operation), and looks and functions as what was specified.
- B. Do not submit substitutions that do not match in whole what was specified or scheduled. Deviations from scheduled or specified items are installed at the contractors risk and are subject to replacement if the owner/engineer deems the product different from the specified item.
- C. If the specified item is no longer available, it is the contractors responsibility to contact the architect/engineer and notify that the item is not available and suggest a suitable substitution that matches in whole the form, function, and appearance of the scheduled or specified item.

D. Refer to Conditions of the Contract and Division 1 for additional requirements regarding substitutions.

2.4 FLAME SPREAD AND SMOKE DEVELOPED PROPERTIES OF MATERIALS

A. Plenum cable, conduit, insulation, equipment support and mounting hardware, tapes, adhesives, core materials, jackets, and other materials in concealed locations, including any above-ceiling area, shall have a flame spread rating not over 25 without evidence of continued progressive combustion and a smoke developed rating no higher than 50. Flame spread and smoke developed ratings shall be in accordance with NFPA Standard No. 255.

2.5 MOTORS

A. The Contractor shall provide all motors required for equipment supplied under each portion of the work. Motors shall be built in accordance with the latest ANSI, IEE, and NEMA standards, shall be fully coordinated with the equipment served, shall be of sizes and electrical characteristics scheduled.

2.6 STARTING EQUIPMENT

A. Each motor shall be provided with proper starting equipment. This equipment, unless hereinafter specified or scheduled to the contrary, shall be provided by the trade furnishing the motor. All motor starting equipment provided by any one trade shall be of the same manufacture unless such starting equipment is an integral part of the equipment on which the motor is mounted.

2.7 SLEEVES, INSERTS, AND FASTENINGS

- A. General: Proper openings through floors, masonry walls, roofs, etc. for the passage of conduits shall be provided. All conduit through floors and walls must pass through sleeves, except conduit that is cast-in-place. Sleeves shall be set in new construction before concrete is poured, as cutting holes through any part of the concrete will not be permitted unless acceptable to the Owner's Representative.
- B. Materials: Sleeves shall be of standard weight galvanized iron pipe, except heavy-gauge galvanized iron sleeves may be utilized in concrete pours where acceptable to the Owner's Representative for size and metal gauge. Sleeves in fittings, grade beams, and where pipes enter or leave the building or pass through concrete or masonry shall be Schedule 40 PVC along the pipe route from the underground installation to the insulating coupling installed above ground.

2.8 FOUNDATIONS

- A. General: All special foundations and supports required for the proper installation of equipment and pipe shall be provided as hereinafter specified and under the section of the specifications covering the equipment, unless otherwise indicated on the drawings.
- B. Concrete foundations for the support of equipment such as floor-mounted transformers, switchgear, equipment, etc. shall be not less than 5 inches high and 4 inches beyond the equipment, unless otherwise noted, and shall be poured in forms built of new dressed lumber. All corners of the foundations shall be neatly chamfered by means of sheet metal or triangular wood strips nailed to the form. Foundation bolts shall be placed in the forms when

the concrete is poured, the bolts being correctly located by means of templates. Allow 1 inch below the equipment bases for alignment and grouting. Foundations for equipment located on the exterior of the building shall be provided as indicated. Foundations shall be constructed in accordance with approved shop drawings and shall be reinforced with #4 bars at 12 inches on center both ways (minimum). Refer to Division 3: Concrete Work for materials, placement, etc. Coordinate with the equipment manufacturer for heavy (greater than 1000 pounds) pieces of equipment.

2.9 ACCESS DOORS

- A. General: Provide wall, ceiling, or duct access doors for unrestricted access to all concealed items of electrical equipment.
- B. Manufacturers shall be Inland-Milcor, Bilco, Miami Carey, or approved equal.
- C. UL labeled when in fire-rated construction, one and one-half hour rating.
- D. Equipment access doors shall be of sufficient size to remove/replace equipment and provide routine maintenance as necessary, unless otherwise noted. All doors shall have wedge-type latches except where cylinder locks are otherwise indicated or specified. Doors shall be set flush with adjacent finish surfaces. Exterior doors shall be provided with cylinder locks.
- E. Access doors into ductwork shall be 14-gauge insulated galvanized steel with 16-gauge galvanized gasketed steel frame and cam-type locks. Access door shall be a minimum of 12" H 12" in size.

2.10 CONDITION OF MATERIALS

A. All materials required for the installation of the electrical systems shall be new and unused. Any material or equipment damaged in transit from the factory, during delivery to premises, while in storage on premises, while being erected and installed, or while being tested, until time of final acceptance, shall be replaced by this Contractor without extra cost to Owner.

PART 3 - EXECUTION

3.1 SPACE AND EQUIPMENT ARRANGEMENTS

- A. The size of electrical equipment indicated on the drawings is based on the dimensions of a particular manufacturer. While other manufacturers will be acceptable, it is the responsibility of the Contractor to determine whether the equipment he proposes to furnish will fit in the space. Shop drawings shall be prepared when required by the Owner's Representative to indicate a suitable arrangement.
- B. All equipment shall be installed in a manner to permit access to all surfaces.

3.2 LARGE APPARATUS

A. Any large piece of apparatus which is to be installed in any space in the building, and which is too large to permit access through 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.

3.3 HOISTING, SCAFFOLDING, AND TRANSPORTATION

A. Provide hoisting and scaffolding facilities as required to set materials and equipment in place.

3.4 PROTECTION

- A. The Contractor shall 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 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 uncompleted building with tarpaulins or other protective covering. 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. The Contractor shall protect existing facilities, the work of others, and the premises from any and all damages that may be made possible by the execution of work.
- 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.

3.5 COOPERATION BETWEEN TRADES AND WITH OTHER CONTRACTORS

- A. Each trade, subcontractor, and/or Contractor must work in harmony with the various 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.
- B. It shall be the responsibility of each trade to cooperate fully with the other trades on the job to help keep the jobsite in a clean and safe condition. At the end of each day's work, each trade shall properly store all of its tools, equipment, and materials and shall clean its debris from the job. Upon the completion of the job, each trade shall immediately remove all of its tools, equipment, any surplus materials, and all debris caused by its portion of the work.

3.6 PRECEDENCE OF MATERIALS

- A. These specifications and the accompanying drawings are intended to cover systems which will not interfere with the structural design of the building, which will fit into the several available spaces, and which will ensure complete and satisfactory systems. Each subcontractor and/or trade shall be responsible for the proper fitting of his material and apparatus into the building.
- B. The work of the various trades shall be performed in the most direct and workmanlike manner without hindering or handicapping the work of other trades. Piping interferences shall be handled by giving precedence to pipe lines which require a stated grade for proper operation. Where space requirements conflict, the following order or precedence shall, in general, be observed:
 - 1. Building lines.
 - 2. Structural members.
 - 3. Soil and drain piping.
 - 4. Condensate drains.
- 5. Vent piping.
- 6. Supply, return, and outside air ductwork.
- 7. Exhaust ductwork.
- 8. HVAC water and steam piping.
- 9. Steam condensate piping.
- 10. Fire protection piping.
- 11. Natural gas piping.
- 12. Domestic water (cold and hot).
- 13. Refrigerant piping.
- 14. Electrical conduit.

3.7 CONNECTIONS FOR OTHERS

- A. This Contractor shall rough-in for and make all electrical connections to all fixtures, equipment, machinery, etc. provided by others in accordance with detailed roughing-in drawings provided by the equipment suppliers, by actual measurements of the equipment connections, or as detailed.
- B. After the equipment is set in place, this Contractor shall make all final connections and shall provide all required conduit, fittings, whips, connectors, etc.
- C. The Mechanical Contractors will set in place, ready for connection, all motors to be provided under their Contracts. The Mechanical Contractors will furnish and deliver all starter and control equipment not shown in motor control centers for any motors which they furnish. The Mechanical Contractor shall be responsible for the complete installation of all automatic temperature control systems, including wire, conduit, and interlocking connections.
- D. The Electrical Contractor shall connect all motors and shall set in place all control devices, furnishing supports if and as necessary, and shall furnish and install all interconnecting line voltage wiring and make all connections ready for operation between motors, starters, and disconnect switches, as required. The Electrical Contractor shall furnish and install all motor control centers, including breakers, starters, etc. The Contractor shall refer to the Mechanical drawings and specifications for his scope of the connections to equipment furnished under these Contracts.

3.8 INSTALLATION METHODS

- A. Where to Conceal: All conduits shall be concealed in chases, walls, furred spaces, below suspended floors, or above the ceilings of the building unless otherwise indicated. All concealed conduit shall be run in a professional manner, and parallel or perpendicular to the building lines.
- B. Where to Expose: In mechanical rooms, only where necessary, conduit may be run exposed. All exposed conduit shall be run in the neatest, most inconspicuous manner, and parallel or perpendicular to the building lines. Conduit shall be bent in a manner as to run parallel to other conduits and not cross at angles.
- C. Support: All conduit shall be adequately and properly supported from the building structure by means of hangers or clamps to walls as herein specified.
- D. Maintaining Clearance: Where limited space is available above the ceilings and below concrete beams or other deep projections, conduit 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 Owner's Representative for each penetration.

- E. All conduits, etc. shall be cut accurately to measurements established at the building and shall be worked into place without springing or forcing. All conduits run exposed in machinery and equipment rooms shall be installed parallel to the building lines. Conduits in furred ceilings and in other concealed spaces may be run at angles to the construction but shall be neatly grouped and racked indicating good workmanship. All conduit openings shall be kept closed until the systems are closed with final connections.
- F. Special Requirements:
 - 1. The Contractor shall study all construction documents and carefully lay out all work in advance of fabrication and erection in order to meet the requirements of the extremely limited spaces. Where conflicts occur the Contractor shall meet with all involved trades and the Owner's Representative and resolve the conflict prior to erection of any work in the area involved.
 - 2. All conduit not directly buried in the ground or installed outside shall be considered as "interior."
 - 3. Prior to the installation of any ceiling material, gypsum, plaster, or acoustical board, the Contractor shall notify the Owner's Representative so that arrangements 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 up to ten (10) working days, but in no case less than five (5) working days.
 - 4. The purpose of this inspection is to verify the completeness and quality of the installation of the electrical systems and any other special above-ceiling systems, such as data, fire alarm, security. The ceiling supports (tee bar or lath) should 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 material shall be installed until the deficiencies listed from this inspection have been corrected to the satisfaction of the Owner's Representative.

3.9 CUTTING AND PATCHING

- A. General: Cut and patch walls, floors, etc. resulting from work in existing construction or where made necessary 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 Owner's Representative. Impact-type equipment will not be used except where specifically acceptable to the Owner's Representative. Openings in concrete for pipes, conduits, outlet boxes, etc. shall be core drilled to exact size. **Determine location of embedded conduit and reinforcing bars prior to cutting.**
- 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 Owner's Representative.
- E. Plaster: All mechanical work in area containing plaster shall be completed prior to the application of the finish plaster coat. Cutting of finish plaster coat will not be permitted.

F. Weakening: No cutting, boring, or excavating which will weaken the structure shall be undertaken.

3.10 SLEEVES, INSERTS, AND FASTENINGS

- A. Sleeves: The minimum clearance between horizontal conduit and sleeve shall be 1/4 inch, except that the minimum clearance shall be 1/2 inch where piping contacts the ground. Sleeves through floors shall extend 3/4 inch above the floor; sleeves through walls and partitions shall be installed flush with exposed surfaces. Sleeves are not required for piping indicated to the cast-in-concrete slabs-on-fill.
- B. Inserts: Suitable concrete inserts for conduit and equipment hangers shall be set and properly located for all conduit and equipment to be suspended from concrete construction.
- C. Fasteners: Fastening of pipes, conduits, etc. in the building shall be as follows:
 - 1. To wood members: by wood screws.
 - 2. To masonry and concrete: by threaded metal inserts, metal expansion screws, or toggle bolts, whichever is appropriate for the particular type of masonry or concrete.
 - 3. To steel: machine screws or welding (when specifically permitted or directed), or bolts.
- D. Weatherproofing: The annular space between a conduit and its sleeve in exterior walls or through floor to below grade shall be filled with polyurethane foam rods 50% greater in diameter than the space as backing and fill material and made watertight with a permanent elastic polysulfide compound. Seal both surfaces of wall or floor with a fire-resistant sealant.

3.11 FLOOR AND CEILING PLATES

A. Except as otherwise noted, provide one-piece chrome-plated brass floor and ceiling plates (or escutcheons) around all pipes, conduits, etc. passing through walls, floors, or ceilings in any spaces, except underfloor and attic spaces. Plates shall be sized to fit snugly against the outside of the conduit. Plates will not be required for piping where sleeves extend ³/₄ of an inch above finish floor and are concealed. Plates shall be one piece.

3.12 FIRE AND SMOKE PARTITION, WALL, AND/OR FLOOR PENETRATIONS

- A. Conduit passing through fire- or smoke-rated floors, partitions, walls, or other barriers within a UL-listed assembly which shall maintain the rating of the applicable wall, floor, partition, or barrier. Flexible conduit shall not be used in rated walls. Provide connections between "hard" pipe and flexible whips on either side of wall. Fireproof around conduits.
- B. The Contractor shall review the architectural and structural drawings and determine the location of the fire-rated building elements. Where these elements are penetrated, UL-listed fire-rated penetration assemblies approved by the local authority shall be provided in accordance with the manufacturer's instructions to obtain the required rating.

3.13 METAL BUILDING SYSTEMS/ELECTRICAL SUPPORTS

- A. Metal building systems are required to be designed by the manufacturer to accommodate and support the electrical systems indicated on the electrical drawings and specifications.
- B. The metal building systems manufacturer is required to provide the following:
 - 1. Framed openings through the roofs with supports, roof curbs, and flashings for roofmounted equipment, fans, vents, and air intakes.

- 2. Structural support for piping, conduits, and suspended equipment consisting of beam, joists, purlins, and/or blocking above and perpendicular to conduit routes and equipment hangers at intervals not to exceed 8 feet.
- 3. Structural support for suspended ceilings and light fixtures, including associated raceways.
- C. The electrical trade shall:
 - 1. Provide all routes, weights, installation heights, opening locations, etc. for all equipment, conduits, sleeves, etc. to the metal building system manufacturer and coordinate requirements for structural supports, hangers, attachments, etc. with the metal building systems manufacturer.
 - 2. Provide all supporting devices (hangers, attachments, brackets, cross beams, etc.) to attach to the metal building structural system.

3.14 CONDUIT SUPPORT

- A. Conduit Support: All conduits throughout the building, both horizontal and vertical, shall be adequately supported from the construction to line of grade, with proper provision for expansion, contraction, vibration elimination, and anchorage. Vertical conduits shall be supported from floor lines with riser clamps sized to fit the lines and to adequately support their weight. At the bases of lines, where required for proper support, provide anchor base fittings or other approved supports.
- B. Conduit shall not be supported from any other system.

3.15 HANGERS

- A. General: Each hanger shall be properly sized to fit the supported pipe or to fit the outside of the insulation on lines where specified.
- B. Attachment:
 - The load on each hanger and/or insert shall not exceed the safe allowable load for any component of the support system, including the concrete which holds the inserts. Reinforcement at inserts shall be provided as required to develop the strength required.
 - 2. Where pipes are supported under steel beams, approved-type beam clamps shall be used.
 - 3. Where conduit is supported under wood joists, hanger rods shall be attached to joists with side beam brackets or angle clips.
- C. Spacing: All hangers shall be so located as to properly support horizontal lines without appreciable sagging of these lines. All PVC shall be supported at intervals recommended by the manufacturer, or as otherwise specified or indicated.
- D. Trapezes: Where multiple lines are run horizontally at the same elevation and grade, they may be supported on trapezes of Kindorf, Elcen, or approved equal, channel-suspended on rods or pipes. Trapeze members including suspension rods shall each be properly sized for the number, size, and loaded weight of the lines they are to support.
- E. Ceiling-Mounted Devices: All lighting and devices or assemblies mounted in lay-in-type ceilings and which are supported by the ceiling grid, directly or indirectly, and which weigh in excess of 2 lbs., shall be provided with at least two 12-gauge minimum wire supports connected securely between the device or assembly and the structure, to serve as a safety support in the event of the collapse of or a disturbance in the support of the ceiling system that might cause the device or assembly to fall through the ceiling. This includes, but is not

limited to, light fixtures, J-boxes, and heavy speakers. Provide additional support as required where the weight of the device or assembly will exceed the safe limits of the wire supports.

- F. Perforated strap iron or wire will not be acceptable as hanger material.
- G. Miscellaneous: Provide any other special foundations, hangers, and supports indicated on the drawings, specified elsewhere herein, or required by conditions at the site. Hangers and supporting structures for suspended equipment shall be provided as required to support the load from the building structure in a manner acceptable to the Owner's Representative.

3.16 ACCESS DOORS

- A. Provide in walls, floors, and ceilings to permit access to all equipment and piping requiring service or adjustment. Examples of such equipment needing access are disconnects, actuators, contacts, and equipment needing periodic or replacement maintenance.
- B. Use panels equal to Milcor Style M for masonry and drywall construction, equal to Milcor Style K for plastered masonry walls and ceilings. Stainless steel panels shall be used in ceramic tile or glazed structural tile.
- C. Access doors located outside or in a moisture-laden environment (e.g., toilet room, dressing area, shower area, etc.) shall be stainless steel.

3.17 ROOF PENETRATIONS AND FLASHING

- A. The contractor shall obtain from the Owner all warranty requirements for new or existing roofing systems and shall have all work on roof penetrations, curbs or equipment supports performed by a subcontractor acceptable to the Owner and the new or existing roofing system installer and manufacturer in order that all roofing system and materials warranties are preserved.
- B. Pipe and conduit ducts, pitch pockets, curb bases, and flashing compatible with the roofing installation shall be provided for roof penetrations. Provide framing or other support around all openings through roof as required to preserve the structural integrity of the roof system and make the penetration weathertight.
- C. Roof curbs for all roofs except standing seam metal roofs shall be provided by the equipment supplier supplying the roof-mounted equipment, etc., and such curbs shall be installed by the roofing trades. Contractor shall coordinate all roof curb requirements with all trades and the roofing trades at the earliest possible stage of the project.
- D. Roof curbs for standing seam metal roofs shall be provided by the roofing trades. Curb base size, height, and type shall be coordinated with the roofing trades at the earliest possible stage of the project.
- E. Flashing for pipe and conduit penetrations of standing seam metal roofs shall be provided and installed by the roofing trades.
- F. See Division 7: Thermal and Moisture Protection for metal roof curbs, flashing, etc.

3.18 ROOFTOP EQUIPMENT

A. Install all starters and disconnects within 5 feet of equipment being served.

- B. Mount starters and disconnects on the equipment only if allowed or recommended by the manufacturer. Otherwise, mount disconnects on unistrut-style framing in an "L" configuration. Secure unistrut to roof with a flashed wood nailer. Provide cross bracing.
- C. Run "hard" conduit (IMC) through conduit curb to starter or disconnect. Install IMC from starter or disconnect to equipment. Flexible watertight conduit is acceptable only for equipment on a vibration-type (spring) curb or that has movement. This does not include AHU, chillers, fans on factory non-spring curbs, package units, or other internally isolated rooftop equipment.

3.19 TESTS AND INSPECTIONS

- A. Refer to conditions of the contract and Division 1 for additional requirements regarding tests and inspections.
- B. General: The Contractor shall make all tests deemed necessary by the inspection departments of the authority having jurisdiction, Board of Underwriters, etc. He shall provide all equipment, materials, and labor for making such tests. Fuel and electrical energy for system operational tests following beneficial occupancy by the Owner will be paid for by the Owner.
- C. Other: Additional tests specified hereinafter under the various specifications sections shall be made.
- D. Notification: The Owner's Representative shall be notified at his office 36 hours prior to each test and other specifications requirements requiring action on the part of the Owner, Architect, Engineer, and/or Owner's Representative.
- E. Test Logs: All tests which the Contractor conducts 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 any other pertinent data. Data shall be delivered to the Owner's Representative as specified under "Requirements for Final Acceptance.
- F. Inspections: In general, an inspection by the Owner's Representative shall be required prior to closing up any work and prior to beneficial occupancy or final project completion. The closing up of work includes, but is not limited to, conduit installations prior to backfilling; electrical and fire protection work prior to placement of concrete; or closing up walls and overhead electrical and fire protection work prior to installation of the ceiling.

3.20 CLEANING AND PAINTING

- A. The contractor shall at all times keep the premises free from accumulations of waste material or rubbish. Debris shall be removed from the site and from any street or alley adjacent to the site.
- B. Thoroughly clean and touch up the finish on all parts of the materials and equipment. Exposed parts in equipment rooms, and all other spaces except sealed chases and attics shall be thoroughly cleaned of cement, plaster, and other materials, and all oil and grease spots shall be removed. Such surfaces shall be carefully wiped and all cracks and corners scraped out.
- C. Exposed metal work which is not galvanized shall be carefully brushed down with steel brushes to remove rust and other spots and left smooth and clean and then painted with a suitable rust resistant primer. Exposed metal work includes work exterior to the building;

exposed in mechanical or electrical equipment rooms and storage rooms; and other areas where occupants could see the work, whether normally occupied or not.

- D. All other painting shall be accomplished under the Painting Section of Division 9 of the specifications.
- E. At completion of the project, the Contractor shall remove all tools, scaffolding, and surplus materials. Contractor shall leave the area "broom clean". Before final acceptance, vacuum all panels, switchboards, starters, and other electrical devices. Wipe clean all fixture lenses and reflectors, all panelboard and switchboard interior and exterior surfaces, being careful to remove all stray paint, construction materials, dust, and particles. Touch-up all marred surfaces to restore existing conditions to those provided by the manufacturer.

3.21 IDENTIFICATION AND LABELING

A. General: 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, disconnects, panels, etc. by marking them. All disconnects/starters/panels shall be labeled for the equipment they serve. Marks shall be the same as the drawings.

3.22 COORDINATION OF WORK

- A. The light fixture grid layout as indicated on the drawings must be maintained. This Contractor shall refer to all light fixture plans and details indicated on the drawings.
- B. The electrical trades shall locate all junction boxes, pull boxes, conduits, etc. to avoid interference with the diffusers, dampers, grilles, etc. The mechanical trades shall furnish to all other trades copies of approved ductwork shop drawings to assist in the coordination of the rough-in and installation of all items of work.
- C. The order of space allocation priority in plan and in elevation shall be as follows.
 - 1. 1st Light Fixtures, at Ceiling Soffit + 6"
 - 2. 2nd Grade Plumbing Waste and Vent Systems
 - 3. 3rd Ductwork
 - 4. 4th Pressurized Piping Systems
 - 5. 5th Electrical Conduit
 - 6. 6th Ceiling Support System, where required

3.23 DISCHARGE OF WASTES FROM CONSTRUCTION SITE

- A. The Contractor shall comply with all applicable provisions of local, state, and federal laws regarding the discharge of wastes into sewer and waterways. Special caution shall be exercised to prevent the discharge of wastes which contain oil, tar, asphalt, roofing compound, kerosene, gasoline, paint, mud, cement, lime, or other materials which would degrade the water quality of the receiving water course.
- B. Disposal of Lamps and Ballasts: The proper disposal of all ballasts and lamps from the demolition of lighting fixtures as part of this project will be the responsibility of the Electrical Contractor. All lamps and ballasts found to contain hazardous contaminants will be removed from the site and transported to a licensed disposal facility by a contractor licensed in this field. All work shall be performed in accordance with current state and Federal rules and regulations pertaining to the processing of contaminated waste materials. A certificate of proper disposal from the licensed waste contractor shall be provided to the Engineer.

3.24 OPERATING AND MAINTENANCE MANUAL

- A. The Contractor shall furnish indexed operating and maintenance manuals with complete technical data for each electrical system, piece of equipment, and material installed under this Contract.
- B. The manuals shall be identified on the cover as "Operating and Maintenance Manual" and shall list the name and location of project, the Owner, the Engineers, the General Contractor, and the Subcontractors installing equipment represented in the brochure.
- C. Two (2) copies of the manual, bound in three-ring hardback binders shall be provided. One copy shall be completed and delivered to the Engineer prior to the time that system and equipment tests are performed. The second copy shall be delivered prior to final acceptance. The manual shall have a Table of Contents and shall be grouped in tabbed sections according to the specification sections. Each section shall be organized as follows:
 - 1. Approved engineering submittals with complete performance and technical data.
 - 2. Manufacturer's local representative and/or distributor's name and address.
 - 3. Manufacturer's installation instructions and brochures.
 - 4. Manufacturer's operating and maintenance brochures.
 - 5. Manufacturer's installation wiring diagram.
 - 6. Contractor's field wiring diagram, if different.
 - 7. Manufacturer's brochure listing recommended spare parts.
 - 8. Manufacturer's brochure listing replacement part numbers and descriptions.
- D. Provide a final section entitled, "Warranties and Guarantees", for all equipment as well as Contractor's warranty.

3.25 CONDITIONS OF EQUIPMENT AT FINAL ACCEPTANCE

- A. At the time of acceptance, the Contractor shall have inspected all installed systems to assure the following has been completed:
 - 1. Fixtures are operating, and lenses and reflectors are free of dust, debris, and fingerprints.
 - 2. Panelboards have all conductors neatly formed, bundled, and made-up tight. Cans shall be vacuum cleaned and surfaces cleaned of stray paint, dust, grease, and fingerprints. All circuit directories to be neatly typed and in place.
 - 3. Wall plates and exposed switch and receptacle parts to be clean, free of paint, plaster, etc.
 - 4. Safety and disconnect switches and motor starters to be vacuum cleaned of debris and dust, and all surfaces free of stray paint, grease, and fingerprints.
 - 5. Switchgear, transformers, and system devices shall be cleaned internally and externally and have all surfaces restored to original surface conditions.
 - 6. Touch-up all scratched surfaces using paint matching the existing equipment paint. Where paint cannot be matched, the entire surface shall be repainted in a color and manner approved by the Engineer.

END OF SECTION

SECTION 26 0050 BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Raceways.
 - 2. Building wire and connectors.
 - 3. Supporting devices for electrical components.
 - 4. Electricity-metering components.
 - 5. Concrete equipment bases.
 - 6. Electrical demolition.
 - 7. Cutting and patching for electrical construction.
 - 8. Touchup painting.

1.3 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. FMC: Flexible metal conduit.
- C. IMC: Intermediate metal conduit.
- D. LFMC: Liquidtight flexible metal conduit.
- E. RNC: Rigid nonmetallic conduit.

1.4 SUBMITTALS

- A. Product Data: For electricity-metering equipment.
- B. Shop Drawings: Dimensioned plans and sections or elevation layouts of electricity-metering equipment.
- C. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

1.5 QUALITY ASSURANCE

- A. Electrical Components, Devised, 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.
- B. Comply with NFPA 70.

1.6 COORDINATION

- A. Coordinate chases, slots, inserts, sleeves, and openings with general construction work and arrange in building structure during progress of construction to facilitate the electrical installations that follow:
 - 1. Set inserts and sleeves in poured-in-place concrete, masonry work, and other structural components as they are constructed.
- B. Sequence, coordinate, and integrate installing electrical materials and equipment for efficient flow of the Work. Coordinate installing large equipment requiring positioning before closing in the building.
- C. Coordinate electrical service connections to components furnished by utility companies.
 - 1. Coordinate installation and connection of exterior underground and overhead utilities and services, including provision for electricity-metering components.
 - 2. Comply with requirements of authorities having jurisdiction and of utility company providing electrical power and other services.
- D. Coordinate location of access panels and doors for electrical items that are concealed by finished surfaces. Access doors and panels are specified in Division 8 Section "Access Doors."
- E. Where electrical identification devices are applied to field-finished surfaces, coordinate installation of identification devices with completion of finished surface.
- F. Where electrical identification markings and devices will be concealed by acoustical ceilings and similar finishes, coordinate installation of these items before ceiling installation.

PART 2 - PRODUCTS

2.1 RACEWAYS

A. See Section "Raceways and Boxes."

2.2 CONDUCTORS

A. See Section "Conductors and Cables."

2.3 SUPPORTING DEVICES

- A. Material: Cold-formed steel, with corrosion-resistant coating acceptable to authorities having jurisdiction.
- B. Metal items for Use Outdoors or in Damp Locations: Hot-dip galvanized steel.
- C. Slotted-Steel Channel Supports: Flange edges turned toward web, and 9/16-inch- diameter slotted holes at a maximum of 2 inches o.c., in webs.
- D. Nonmetallic Channel and Angle Systems: Structural-grade, factory-formed, glass-fiber-resin channels and angles with 9/16-inch- diameter holes at a maximum of 8 inches o.c., in at least one surface.
 - 1. Fittings and Accessories: Products of the same manufacturer as channels and angles.

- 2. Fittings and Accessory Materials: Same as channels and angles, except metal items may be stainless steel.
- E. Raceways and Cable Supports: Manufactured clevis hangers, riser clamps, straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring-steel clamps or click-type hangers.
- F. Pipe Sleeves: ASTM A 53, Type E, Grade A, Schedule 40, galvanized steel, plain ends.
- G. Cable Supports for Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug for nonarmored electrical cables in riser conduits. Plugs have number and size of conductor gripping holes as required to suit individual risers. Body constructed of malleable-iron casting with hot-dip galvanized finish.
- H. Expansion Anchors: Carbon-steel wedge or sleeve type.
- I. Toggle Bolts: All-steel springhead type.
- J. Powder-Driven Threaded Studs: Heat-treated steel.

2.4 EQUIPMENT FOR UTILITY COMPANY'S ELECTRICITY METERING

- A. Current-Transforming Cabinets: Comply with requirements of electrical power utility company.
- B. Meter Sockets: Comply with requirements of electrical power utility company.
- C. Modular Meter Centers: Factory-coordinated assembly of a main meter center circuitbreaker unit with wireways, tenant meter socket modules, and tenant branch circuit breakers arranged in adjacent vertical sections complete with interconnecting buses.
 - 1. Housing: NEMA 250, Type 3R enclosure
 - 2. Tenant Branch Circuit Breakers: Series combination rated to protect circuit breakers in downstream panelboards that have 10,000-A interrupting capacity, minimum.
- D. Provide power utility company communication conduit to meter.
- E. Relocate communication conduit with meter as required to maintain minimum utility company clearances.

2.5 EQUIPMENT FOR ELECTRICITY METERING BY OWNER

- A. Meter: Electronic kilowatt-hour/demand measuring to record electricity used and highest peak demand over a time period according to electric utility. Meter is designed for used on the type and rating of circuit indicated for its application.
 - 1. Kilowatt-Hour Display: Digital liquid crystal.
 - 2. Kilowatt-Demand Display: Digital, liquid-crystal type to register highest peak demand.
 - 3. Enclosure: NEMA 250, Type 1, Minimum, with hasp for padlocking or sealing.
 - 4. Memory Backup: Self-contained to maintain memory throughout power outages of 72 hours, minimum.
 - Sensors: Current-sensing type, with current or voltage output, selected for optimum range and accuracy for the ratings of the circuits indicated for this application.
 a. Type: Solid core.
 - 6. Accuracy: Nationally recognized testing laboratory certified to meet ANSI C12.16 specifications.

- 7. Demand Signal Communication Interface: Match signal to building automation system input that conveys data on instantaneous/integrated demand level measured by meter used for load switching to control demand.
- B. Current-Transformer Cabinets: Listed or recommended by metering equipment manufacturer for use with sensors indicated.
- C. Available Metering Equipment Manufacturers: Subject to compliance with requirement, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. E-MON Corporation.
 - 2. National Meter Industries, Inc.
 - 3. Osaki Meter Sales, Inc.

2.6 CONCRETE BASES

- A. Concrete: 3000-psi, 28-day compressive strength as specified in Division 3 Section "Cast-in-Place Concrete."
- 2.7 TOUCHUP PAINT
 - A. For Equipment: Equipment manufacturer's paint selected to match installed equipment finish.
 - B. Galvanized Surfaces: Zinc-rich paint recommended by item manufacturer.

PART 3 - EXECUTION

3.1 ELECTRICAL EQUIPMENT INSTALLATION

- A. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide the maximum possible headroom.
- B. Materials and Components: Install level, plumb, and parallel and perpendicular to other building systems and components, unless otherwise indicated.
- C. Equipment: Install to facilitate service, maintenance, and repair or replacement of components. Connect for ease of disconnecting, with minimum interference with other installations.
- D. Right of Way: Give to raceways and piping systems installed at a required slope.
- E. Mount all non-wall mounted equipment minimum of:
 - 1. Two (2) inches off the wall for switchboards, free standing distribution boards, disconnects, panels and all other non-vibrating equipment.
 - 2. Minimum of four (4) inches for vibrating equipment to include transformers.

3.2 ELECTRICAL SUPPORTING DEVICE APPLICATION

- A. Damp Locations and Outdoors: Hot-dip galvanized materials or nonmetallic, U-channel system components.
- B. Dry Locations: Steel materials.

- C. Support Clamps for PVC Raceways: Click-type clamp system.
- D. Selection of Supports: Comply with manufacturer's written instructions.
- E. Strength of Supports: Adequate to carry present and future loads, times a safety factor of at least four; minimum of 200-lb design load.

3.3 SUPPORT INSTALLATION

- A. Install support devices to securely and permanently fasten and support electrical components.
- B. Install individual and multiple raceway hangers and riser clamps to support raceways. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assemblies and for securing hanger rods and conduits.
- C. Support parallel runs of horizontal raceways together on trapeze- or bracket-type hangers.
- D. Size supports for multiple raceway installations so capacity can be increased by a 25 percent minimum in the future.
- E. Support individual horizontal raceways with separate, malleable-iron pipe hangers or clamps.
- F. Install ¼-inch-diameter or larger threaded steel hanger rods, unless otherwise indicated.
- G. Spring-steel fasteners specifically designed for supporting single conduits or tubing may be used instead of malleable-iron hangers for 1½ inch and smaller raceways serving lighting and receptacle branch circuits above suspended ceilings and for fastening raceways to slotted channel and angle supports.
- H. Arrange supports in vertical runs so the weight of raceways and enclosed conductors is carried entirely by raceway supports, with no weight load on raceway terminals.
- I. Simultaneously install vertical conductor supports with conductors.
- J. Separately support cast boxes that are threaded to raceways and used for fixture support. Support sheet-metal boxes directly from the building structure or by bar hangers. If bar hangers are used, attach bar to raceways on opposite sides of the box and support the raceway with an approved fastener not more than 24 inches from the box.
- K. Install metal channel racks for mounting cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices unless components are mounted directly to structural elements of adequate strength.
- L. Install sleeves for cable and raceway penetrations of concrete slabs and walls unless coredrilled holes are used. Install sleeves for cable and raceway penetrations of masonry and fire-rated gypsum walls and of all other fire-rated floor and wall assemblies. Install sleeves during erection of concrete and masonry walls.
- M. Securely fasten electrical items and their supports to the building structure, unless otherwise indicated. Perform fastening according to the following unless other fastening methods are indicated:
 - 1. Wood: Fasten with wood screws or screw-type nails.

- 2. Masonry: Toggle bolts on hollow masonry units and expansion bolts on solid masonry units.
- 3. New Concrete: Concrete inserts with machine screws and bolts.
- 4. Existing Concrete: Expansion bolts.
- 5. Steel: Welded threaded studs or spring-tension clamps on steel.
 - a. Field Welding: Comply with AWS D1.1.
- 6. Welding to steel structure may be used only for threaded studs, not for conduits, pipe straps, or other items.
- 7. Light Steel: Sheet-metal screws.
- 8. Fasteners: Select so the load applied to each fastener does not exceed 25 percent of its proof-test load.

3.4 UTILITY COMPANY ELECTRICITY-METERING EQUIPMENT

A. Install equipment according to utility company's written requirements. Provide grounding and empty conduits as required by utility company.

3.5 FIRESTOPPING

A. Apply firestopping to cable and raceway penetrations of fire-rated floor and wall assemblies to achieve fire-resistance rating of the assembly. Firestopping materials and installation requirements are specified in Division 7 Section "Firestopping."

3.6 CONCRETE BASES

- A. Construct concrete bases of dimensions indicated, but not less than 6 inches larger, in both directions, than supported unit and bollards.
- B. Follow supported equipment manufacturer's anchorage recommendations and setting templates for anchor-bolt and tie locations, unless otherwise indicated. Use 3000-psi, 28-day compressive-strength concrete and reinforcement as specified in Sections "Cast-in-Place Concrete," "Concrete Reinforcement," and "Concrete Formwork."
- C. Bollards: Provide bollards around utility provider pad mount transformer. Protect equipment on road or driveway sides.
- D. Provide bollards around owner genset if within 10 feet of roadway.
- E. Provide 36 inch concrete pads in front of exterior switchboards full length of switchboard.
- F. Provide 30 inch concrete pads in front of ground mounted disconnect racks.

3.7 DEMOLITION

- A. Protect existing electrical equipment and installations indicated to remain. If damaged or disturbed in the course of the Work, remove damaged portions and install new products of equal capacity, quality, and functionality.
- B. Accessible Work: Remove exposed electrical equipment and installations, indicated to be demolished, in their entirety.
- C. Abandoned Work: Cut and remove buried raceway and wiring, indicated to be abandoned in place, 2 inches below the surface of adjacent construction. Cap raceways and patch surface to match existing finish.

- D. Remove demolished material from Project site.
- E. Remove, store, clean, reinstall, reconnect, and make operational components indicated for relocation.

3.8 CUTTING AND PATCHING

- A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces required to permit electrical installations. Perform cutting by skilled mechanics of trades involved.
- B. Repair and refinish disturbed finish materials and other surfaces to match adjacent undisturbed surfaces. Install new fireproofing where existing firestopping has been disturbed. Repair and refinish materials and other surfaces by skilled mechanics of trades involved.

3.9 FIELD QUALITY CONTROL

- A. Inspect installed components for damage and faulty work, including the following:
 - 1. Raceways.
 - 2. Building wire and connectors.
 - 3. Supporting devices for electrical components.
 - 4. Electrical identification.
 - 5. Electricity-metering components.
 - 6. Concrete bases.
 - 7. Electrical demolition.
 - 8. Cutting and patching for electrical construction.
 - 9. Touchup painting.
- B. Test Owner's electricity-metering installation for proper operation, accuracy, and usability of output data.
 - 1. Connect a load of known kW rating, 1.5 kW minimum, to a circuit supplied by the metered feeder.
 - 2. Turn off circuits supplied by the metered feeder and secure them in the "off" condition.
 - 3. Run the test load continuously for eight hours, minimum, or longer to obtain a measurable meter indication. Use a test load placement and setting that ensure continuous, safe operation.
 - 4. Check and record meter reading at end of test period and compare with actual electricity used based on test load rating, duration of test, and sample measurements of supply voltage at the test load connection. Record test results.
 - 5. Repair or replace malfunctioning metering equipment or correct test setup; then retest. Repeat for each meter in installation until proper operation of entire system is verified.

3.10 REFINISHING AND TOUCHUP PAINTING

- A. Refinish and touch up paint. Paint materials and application requirements are specified in Division 9 Section "Painting."
 - 1. Clean damaged and disturbed areas and apply primer, intermediate, and finish coats to suit the degree of damage at each location.
 - 2. Follow paint manufacturer's written instructions for surface preparation and for timing and application of successive coats.
 - 3. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 4. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.11 CLEANING AND PROTECTION

- A. On completion of installation, including outlets, fittings, and devices, inspect exposed finish. Remove burrs, dirt, paint spots, and construction debris.
- B. Protect equipment and installations and maintain conditions to ensure that coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 26 0519 CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes building wires and cables and associated connectors, splices, and terminations for wiring systems rated 600 V and less.
- B. Related Sections include "Control/Signal Transmission Media" for transmission media used for control and signal circuits.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Qualification Data: For testing agency.
- C. Field Quality-Control Test Reports: From Contractor.

1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, all conductors shall be listed for the application, temperature, and insulation rating to which they are intended.
- 2.2 CONDUCTORS AND CABLES
 - A. Refer to Part 3 "Conductor and Insulation Applications" Article for insulation type, cable construction, and ratings.
 - B. Conductor Material:
 - 1. Copper complying with NEMA WC 5 or 7.
 - 2. Solid conductors, sizes 10 and 12, uncoated copper per ASTM B3.
 - 3. Stranded conductor, all other sizes, uncoated copper per ASTM B3, ASTM B787, and ASTM B8.

- C. Conductor Insulation Types: Type THHN-THWN and complying with NEMA WC 5 or 7.
 - 1. Rated for sunlight resistance all colors.
 - 2. Conductors shall be color coded for voltage and phase as per NEC and any local amendments.
 - 3. Larger conductors shall have taped color coding.
 - 4. Size, rating, temperature, and type shall be permanently marked on conductor jacket.
 - 5. Insulation shall be PVC, heat and moisture resistant, flame retardant compound as per UL-83 and UL-1063.
 - 6. Jacket shall be polyamide outer nylon covering per UL-83 and UL-1063.
- D. Rated for sunlight resistance all colors.

2.3 CONNECTORS

- A. Wire Connectors:
 - 1. Description: Factory-fabricated UL listed connected and of size, ampacity rating, material, type, and class for application and service indicated.
 - 2. Provide self-locking square wire spring grab screw on wire connectors sized as per NEC and the number of conductors to be connected.
 - 3. Thermoplastic deep shell design, with wings on smaller connectors, rated for application temperature, Minimum 105 degrees C.
 - 4. Copper to copper connection, 600V.
 - 5. Provide high temp wire connectors for all high temperature equipment applications.
- B. Push-in wire connectors are **Not Approved** and shall not be used for any power or lighting circuits above 50V.

2.4 ALTERNATES

- A. Blue Jacketed steel MC Cable is only permitted for 6 foot (maximum) lighting whips. It shall be used for **no** other purpose.
- B. AC cable is **not** permitted at all.

PART 3 - EXECUTION

- 3.1 CONDUCTOR AND INSULATION APPLICATIONS
 - A. Service Entrance: Type THHN-THWN, single conductors in raceway.
 - B. Exposed Feeders: Type THHN-THWN, suitable for use in air return plenums.
 - C. Feeders Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway.
 - D. Feeders Concealed in Concrete, below Slabs-on-Grade, and in Crawlspaces: Type THHN-THWN, single conductors in raceway.
 - E. Exposed Branch Circuits, including in Crawlspaces: Type THHN-THWN, single conductors in raceway.

- F. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway.
- G. Branch Circuits Concealed in Concrete and below Slabs-on-Grade: Type THHN-THWN, single conductors in raceway.
- H. Underground Feeders and Branch Circuits: Type THHN-THWN, single conductors in raceway.
- I. Cord Drops and Portable Appliance Connections: Type SO, hard service cord.
- J. Fire Alarm Circuits: Power-limited, fire-protective, signaling circuit cable.
- K. Class 1 Control Circuits: Type THHN-THWN, in raceway.
- L. Class 2 Control Circuits: Type THHN-THWN, in raceway.

3.2 INSTALLATION

- A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.
- B. Minimum line voltage conductor size is #12.
- C. Neutrals shall not be shared on any single pole circuit.
- D. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- E. Use pulling means; including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage cables or raceway.
- F. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- G. Support cables according to Section "Basic Electrical Materials and Methods."
- H. Seal around cables penetrating fire-rated elements according to Section "Through-Penetration Firestop Systems."
- I. Identify and color-code conductors and cables according to Section "Electrical Identification" and adhere to local color code requirements.

3.3 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturers published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
 1. Use oxide inhibitor in each splice and tap conductor for aluminum conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 12 inches of slack.

3.4 FIELD QUALITY CONTROL

- A. Testing: Engage a qualified testing agency to perform the following field quality-control testing:
 - 1. After installing conductors and cables and before electrical circuitry has been energized, test for compliance with requirements.
 - 2. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.3.1. Certify compliance with test parameters.
- B. Test Reports: Prepare a written report to record the following:
 - 1. Test procedures used.
 - 2. Test results that comply with requirements.
 - 3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

END OF SECTION

SECTION 26 0526 GROUNDING AND BONDING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes grounding of electrical systems and equipment. Grounding requirements specified in this Section may be supplemented by special requirements of systems described in other Sections.
- B. Related Sections include Section "Lightning Protection" for additional grounding and bonding materials.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Qualification Data: For firms and persons specified in "Quality Assurance" Article.
- C. Field Test Reports: Submit written test reports to include the following:
 - 1. Test procedures used.
 - 2. Test results that comply with requirements.
 - 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

1.4 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Testing agency as defined by OSHA in 29 CFR 1910.7 or a member company of the International Electrical Testing Association and that is acceptable to authorities having jurisdiction.
 - 1. Testing Agency's Field Supervisor: Person currently certified by the International Electrical Testing Association to supervise on-site testing specified in Part 3.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
 - 1. Comply with UL 467.
- C. Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Grounding Conductors, Cables, Connectors, and Rods:
 - a. Apache Grounding/Erico Inc.
 - b. Boggs, Inc.
 - c. Chance/Hubbell.
 - d. Copperweld Corp.
 - e. Dossert Corp.
 - f. Erico Inc.; Electrical Products Group.
 - g. Framatome Connectors/Burndy Electrical.
 - h. Galvan Industries, Inc.
 - i. Harger Lightning Protection, Inc.
 - j. Hastings Fiber Glass Products, Inc.
 - k. Heary Brothers Lightning Protection, Co.
 - I. Ideal Industries, Inc.
 - m. ILSCO.
 - n. Kearney/Cooper Power Systems.
 - o. Korns: C.C. Korns Co.; Division of Robroy Industries.
 - p. Lightning Master Corp.
 - q. Lyncole XIT Grounding.
 - r. O-Z/Gedney Co.; a business of the EGS Electrical Group.
 - s. Raco, Inc.; Division of Hubbell.
 - t. Robbins Lightning, Inc.
 - u. Salisbury: W.H. Salisbury & Co.
 - v. Superior Grounding Systems, Inc.
 - w. Thomas & Betts, Electrical.
- 2.2 GROUNDING CONDUCTORS
 - A. For insulated conductors, comply with Section "Conductors and Cables."
 - B. Material: Copper.
 - C. Equipment Grounding Conductors: Insulated with green-colored insulation.
 - D. Isolated Ground Conductors: Insulated with green-colored insulation with yellow stripe. On feeders with isolated ground, use colored tape, alternating bands of green and yellow tape to provide a minimum of three bands of green and two bands of yellow.
 - E. Grounding Electrode Conductors: Stranded cable.
 - F. Underground Conductors: Bare, tinned, stranded, unless otherwise indicated.
 - G. Bare Copper Conductors: Comply with the following:
 - 1. Solid Conductors: ASTM B 3.
 - 2. Assembly of Stranded Conductors: ASTM B 8.
 - 3. Tinned Conductors: ASTM B 33.
 - H. Copper Bonding Conductors: As follows:
 - 1. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG copper conductor, ¼ inch in diameter.
 - 2. Bonding Conductor: No. 4 or No. 6 AWG, stranded copper conductor.
 - 3. Bonding Jumper: Bare copper tape, braided bare copper conductors, terminated with copper ferrules; 1_inches wide and 1/16 inches thick.

- 4. Tinned Bonding Jumper: Tinned-copper tape, braided copper conductors, terminated with copper ferrules; 1_inches wide and 1/16 inches thick.
- I. Ground Conductor and Conductor Protector for Wood Poles: As follows:
 - 1. No. 4 AWG minimum, soft-drawn copper conductor.
 - 2. Conductor Protector: Half-round PVC or wood molding. If wood, use pressuretreated fir, or cypress or cedar.
- J. Grounding Bus: Bare, annealed copper bars of rectangular cross section, with insulators.

2.3 CONNECTOR PRODUCTS

- A. Comply with IEEE 837 and UL 467; listed for use for specific types, sizes, and combinations of conductors and connected items.
- B. Bolted Connectors: Bolted-pressure-type connectors, or compression type.
- C. Welded Connectors: Exothermic-welded type, in kit form, and selected per manufacturer's written instructions.

2.4 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad steel.
- B. Ground Rods: Sectional type; copper-clad steel.
 1. Size: ³/₄ by 120 inches.
- C. Test Wells: Provide handholes for test wells.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Use only copper conductors for both insulated and bare grounding conductors in direct contact with earth, concrete, masonry, crushed stone, and similar materials.
- B. In raceways, use insulated equipment grounding conductors.
- C. Exothermic-Welded Connections: Use for connections to structural steel, ground rods, and for underground connections, except those at test wells.
- D. Equipment Grounding Conductor Terminations: Use bolted pressure clamps.
- E. Ground Rod Clamps at Test Wells: Use bolted pressure clamps with at least two bolts.
- F. Grounding bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.
 - 1. Use insulated spacer; space 1 inch from wall and support from wall 6 inches above finished floor, unless otherwise indicated.
 - 2. At doors, route the bus up to the top of the door frame, across the top of the doorway, and down to the specified height above the floor.

G. Underground Grounding Conductors: Use tinned-copper conductor, No. 2/0 AWG minimum. Bury at least 24 inches below grade or bury 12 inches above duct bank when installed as part of the duct bank.

3.2 EQUIPMENT GROUNDING CONDUCTORS

- A. Comply with NFPA 70, Article 250, for types, sizes, and quantities of equipment grounding conductors, unless specific types, larger sizes, or more conductors than required by NFPA 70 are indicated.
- B. Install equipment grounding conductors in all feeders and circuits.
- C. Busway Supply Circuits: Install insulated equipment grounding conductor from the grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.
- D. Computer Outlet Circuits: Install insulated equipment grounding conductor in branch-circuit runs from computer-area power panels or power-distribution units.
- E. X-Ray Equipment Circuits: Install insulated equipment grounding conductor in circuits supplying x-ray equipment.
- F. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate grounding conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.
- G. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate equipment grounding conductor. Isolate equipment grounding conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.
- H. Nonmetallic Raceways: Install an equipment grounding conductor in nonmetallic raceways unless they are designated for telephone or data cables.
- I. Air-Duct Equipment Circuits: Install an equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners and heaters. Bond conductor to each unit and to air duct.
- J. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate equipment grounding conductor to each electric water heater, heat-tracing, and antifrost heating cable. Bond conductor to heater units, piping, connected equipment, and components.
- K. Signal and Communication Systems: For telephone, alarm, voice and data, and other communication systems, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.
 - 1. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a ¼-x2x12-inch grounding bus.
 - 2. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.
- L. Metal Poles Supporting Outdoor Lighting Fixtures: Provide a grounding electrode in addition to installing a separate equipment grounding conductor with supply branch-circuit conductors.

M. Common Ground Bonding with Lightning Protection System: Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.

3.3 COUNTERPOISE

A. Ground the steel framework of the building with a driven ground rod at the base of every corner column and at intermediate exterior columns at distances not more than 60 feet apart. Provide a grounding conductor (counterpoise), electrically connected to each ground rod and to each steel column, extending around the perimeter of the building. Use tinned-copper conductor not less than No. 2/0 AWG for counterpoise and for tap to building steel. Bury counterpoise not less than 18 inches below grade and 24 inches from building foundation.

3.4 INSTALLATION

- A. Ground Rods: Install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes.
 - 1. Drive ground rods until tops are 2 inches below finished floor or final grade, unless otherwise indicated.
 - 2. Interconnect ground rods with grounding electrode conductors. Use exothermic welds, except at test wells and as otherwise indicated. Make connections without exposing steel or damaging copper coating.
- B. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- C. Bonding Straps and Jumpers: Install so vibration by equipment mounted on vibration isolation hangers and supports is not transmitted to rigidly mounted equipment. Use exothermic-welded connectors for outdoor locations, unless a disconnect-type connection is required; then, use a bolted clamp. Bond straps directly to the basic structure taking care not to penetrate any adjacent parts. Install straps only in locations accessible for maintenance.
- D. Metal Water Service Pipe: Provide insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes by grounding clamp connectors. Where a dielectric main water fitting is installed, connect grounding conductor to street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
- E. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with grounding clamp connectors.
- F. Bond interior metal piping systems and metal air ducts to equipment grounding conductors of associated pumps, fans, blowers, electric heaters, and air cleaners. Use braided-type bonding straps.
- G. Bond each aboveground portion of gas piping system upstream from equipment shutoff valve.
- H. Install one test well for each service at the ground rod electrically closest to the service entrance. Set top of well flush with finished grade or floor.

I. Ufer Ground (Concrete-Encased Grounding Electrode): Fabricate according to NFPA 70, Paragraph 250-81(c), using a minimum of 20 feet of bare copper conductor not smaller than No. 4 AWG. If concrete foundation is less than 20 feet long, coil excess conductor within the base of the foundation. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building grounding grid or to a grounding electrode external to concrete.

3.5 CONNECTIONS

- A. General: Make connections so galvanic action or electrolysis possibility is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.
 - 1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer to order of galvanic series.
 - 2. Make connections with clean, bare metal at points of contact.
 - 3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
 - 4. Make aluminum-to-galvanized steel connections with tin-plated copper jumpers and mechanical clamps.
 - 5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
- B. Exothermic-Welded Connections: Comply with manufacturer's written instructions. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.
- C. Equipment Grounding Conductor Terminations: For No. 8 AWG and larger, use pressure-type grounding lugs. No. 10 AWG and smaller grounding conductors may be terminated with winged pressure-type connectors.
- D. Noncontact metal Raceway Terminations: If metallic raceways terminate at metal housings without mechanical and electrical connection to housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to grounding bus or terminal in housing. Bond electrically non-continuous conduits at entrances and exits with grounding bushings and bare grounding conductors, unless otherwise indicated.
- E. Connections at Test Wells: Use compression-type connectors on conductors and make bolted- and clamped-type connections between conductors and ground rods.
- F. Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturers published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- G. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by connector manufacturer. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.
- H. Moisture Protection: If insulated grounding conductors are connected to ground rods or grounding buses, insulate entire area of connection and seal against moisture penetration of insulation and cable.

3.6 UNDERGROUND DISTRIBUTION SYSTEM GROUNDING

- A. Duct Banks: Install a grounding conductor with at least 50 percent ampacity of the largest phase conductor in the duct bank.
- B. Manholes and Handholes: Install a driven ground rod close to wall and set rod depth so 4 inches will extend above finished floor. If necessary, install ground rod before manhole is placed and provide a No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive tape or heat-shrunk insulating sleeve from 2 inches above to 6 inches below concrete. Seal floor opening with waterproof, nonshrink grout.
- C. Connections to Manhole Components: Connect exposed-metal parts, such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum, stranded, hard-drawn copper conductor. Train conductors level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields as recommended by manufacturer of splicing and termination kits.
- D. Pad-Mounted Transformers and Switches: Install two ground rods and counterpoise circling pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Use tinned-copper conductor not less than No. 2 AWG for counterpoise and for taps to equipment ground pad. Bury counterpoise not less than 18 inches below grade and 6 inches from the foundation.

3.7 FIELD QUALITY CONTROL

- A. Testing: Perform the following field quality-control testing:
 - 1. After installing grounding system but before permanent electrical circuitry has been energized, test for compliance with requirements.
 - 2. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at ground test wells. Measure ground resistance not less than two full days after the last trace of precipitation, and without the soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance. Perform tests, by the fall-of-potential method according to IEEE 81.
 - 3. Provide drawings locating each ground rod and ground rod assembly and other grounding electrodes, identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.
 - a. Equipment Rated 500 kVA and Less: 10 ohms.
 - b. Equipment Rated 500 to 1000 kVA: 5 ohms.
 - c. Equipment Rated More Than 1000 kVA: 3 ohms.
 - d. Substations and Pad-Mounted Switching Equipment: 5 ohms.
 - e. Manhole Grounds: 10 ohms.
 - 4. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

3.8 GRADING AND PLANTING

A. Restore surface features, including vegetation, at areas disturbed by Work of this Section. Reestablish original grades, unless otherwise indicated. If sod has been removed, replace it as soon as possible after backfilling is completed. Restore areas disturbed by trenching, storing of dirt, cable laying, and other activities to their original condition. Include application of topsoil, fertilizer, lime, seed, sod, sprig, and mulch. Comply with Division 2 Section "Landscaping." Maintain restored surfaces. Restore disturbed paving as indicated.

END OF SECTION

SECTION 26 0533 RACEWAYS AND BOXES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.
- B. Related Sections include the following:
 - 1. Division 7 Section "Firestopping" for firestopping materials and installation at penetrations through walls, ceilings, and other fire-rated elements.
 - 2. Section "Basic Electrical Materials and Methods" for supports, anchors, and identification products.
 - 3. Section "Wiring Devices" for devices installed in boxes and for floor-box service fittings.

1.3 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. ENT: Electrical nonmetallic tubing.
- C. FMC: Flexible metal conduit.
- D. IMC: Intermediate metal conduit.
- E. LFMC: Liquidtight flexible metal conduit.
- F. LFNC: Liquidtight flexible nonmetallic conduit.
- G. RNC: Rigid nonmetallic conduit.
- H. PVC-GRS: PVC-Coated galvanized rigid steel.

1.4 SUBMITTALS

- A. Product Data:
 - 1. For surface raceways, wireways and fittings.
 - 2. Floor boxes.
 - 3. Hinged-cover enclosures and cabinets.
 - 4. Conduit spacers.
 - 5. Conduit rack supports.
- B. Shop Drawings: Show fabrication and installation details of components for raceways, fittings, boxes, enclosures, and cabinets.
- 1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.

1.6 COORDINATION

A. Coordinate layout and installation of raceways, boxes, enclosures, cabinets, and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.
 - 2. Refer to 3.1, RACEWAY APPLICATION, for materials to be used.

2.2 METAL CONDUIT AND TUBING

- A. Available Manufacturers:
 - 1. AFC Cable Systems, Inc.
 - 2. Alflex, Inc.
 - 3. Anamet Electrical, Inc.; Anaconda Metal Hose.
 - 4. Electri-Flex Co.
 - 5. Grinnell Co./Tyco International; Allied Tube and Conduit Div.
 - 6. Republic Conduit.
 - 7. Manhattan/CDT/Cole-Flex.
 - 8. O-Z Gedney; Unit of General Signal.
 - 9. Wheatland Tube Co.
 - 10. Perma-Cote
 - 11. Plasti Bond
 - 12. KorKap
- B. Rigid Steel Conduit: ANSI C80.1.
- C. IMC: ANSI C80.6.
- D. PVC--Coated Steel Conduit and Fittings: UL514b NEMA RN 1.
- E. PVC- Coated IMC and Fittings: ETL PVC-001 NEMA RN 1 UL6.
- F. EMT: ANSI C80.3.
- G. FMC: Zinc-coated steel.
- H. LFMC: Flexible steel conduit with PVC jacket.

- I. Fittings: NEMA FB 1; compatible with conduit and tubing materials. Provide fittings factory matched with conduit types.
 - 1. Indoor Fittings: Steel Set Screw or Steel Compression
 - 2. Outdoor Fittings: Threaded fittings on IMC or Rigid Conduit
 - 3. Outdoor Fittings: Compression fittings with gaskets on all transitions to flexible conduit.
 - 4. Die cast fittings are not acceptable anywhere.
 - 5. Provide factory fittings with MC cable where allowed.
 - 6. EMT crimp type fittings are not acceptable.

2.3 NONMETALLIC CONDUIT AND TUBING

- A. Available Manufacturers:
 - 1. American International.
 - 2. Anamet Electrical, Inc.; Anaconda Metal Hose.
 - 3. Amco Corp.
 - 4. Cantex, Inc.
 - 5. Certainteed Corp.; Pipe & Plastics Group.
 - 6. Condux International.
 - 7. ElecSYS, Inc.
 - 8. Electri-Flex Co.
 - 9. Lamson & Sessions; Carlon Electrical Products.
 - 10. Manhattan/CDT/Cole-Flex.
 - 11. RACO; Division of Hubbell, Inc.
 - 12. Thomas & Betts Corporation.
- B. ENT: NEMA TC 13.
- C. RNC: NEMA TC 2, Schedule 40 and Schedule 80 PVC.
- D. LFNC: UL 1660.
- E. Fittings: NEMA TC 3; match to conduit or tubing type and material. Provide fittings factory matched with conduit types.
 - 1. Indoor/Outdoor Fittings: Compression.
 - 2. Outdoor Fittings: Compression fittings with gaskets on all transitions to flexible conduit.

2.4 METAL WIREWAYS

- A. Available Manufacturers:
 - 1. Hoffman.
 - 2. Square D.
- B. Material and Construction: Sheet metal sized and shaped as indicated, NEMA 1.
- C. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
- D. Select features, unless otherwise indicated, as required to complete wiring system and to comply with NFPA 70.
- E. Wireway Covers: Hinged type, or as indicated.
- F. Finish: Manufacturer's standard enamel finish.

2.5 NONMETALLIC WIREWAYS

- A. Available Manufacturers:
 - 1. Hoffman.
 - 2. Lamson & Sessions; Carlon Electrical Products.
- B. Description: Fiberglass polyester, extruded and fabricated to size and shape indicated, with no holes or knockouts. Cover is gasketed with oil-resistant gasket material and fastened with captive screws treated for corrosion resistance. Connections are flanged, with stainless-steel screws and oil-resistant gaskets.
- C. Description: PVC plastic, extruded and fabricated to size and shape indicated, with snap-on cover and mechanically coupled connections with plastic fasteners.
- D. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
- E. Select features, unless otherwise indicated, as required to complete wiring system and to comply with NFPA 70.

2.6 SURFACE RACEWAYS

- A. Surface Metal Raceways: Galvanized steel with snap-on covers. Finish with manufacturer's standard prime coating.
 - 1. Available Manufacturers:
 - a. Airey-Thompson Sentinel Lighting; Wiremold Company (The).
 - b. Thomas & Betts Corporation.
 - c. Walker Systems, Inc.; Wiremold Company (The).
 - d. Wiremold Company (The); Electrical Sales Division.
- B. Surface Nonmetallic Raceways: Two-piece construction, manufactured of rigid PVC compound with matte texture and manufacturer's standard color.
 - 1. Available Manufacturers:
 - a. Butler Manufacturing Co.; Walker Division.
 - b. Enduro Composite Systems.
 - c. Hubbell, Inc.; Wiring Device Division.
 - d. Lamson & Sessions; Carlon Electrical Products.
 - e. Panduit Corp.
 - f. Walker Systems, Inc.; Wiremold Company (The).
 - g. Wiremold Company (The); Electrical Sales Division.
- C. Types, sizes, and channels as indicated and required for each application, with fittings that match and mate with raceways.
- D. Provide raceway base, cover, base coupling, coupling covers, angle fittings, end caps at ends, and entrance end fittings. Provide divider wall throughout raceway. Provide device brackets and snap-on bezels at all devices shown on drawings. Provide blank covers at all non-used bezels.
- E. Provide raceway full length, mounted as per drawings or 6" above counters if height is not indicated, as shown on drawings. Provide elbows and raceway to 6 inches above ceiling if risers are indicated on the drawings.
- 2.7 BOXES, ENCLOSURES, AND CABINETS

- A. Available Manufacturers:
 - 1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
 - 2. Emerson/General Signal; Appleton Electric Company.
 - 3. Erickson Electrical Equipment Co.
 - 4. Hoffman.
 - 5. Hubbell, Inc.; Killark Electric Manufacturing Co.
 - 6. O-Z/ Gedney; Unit of General Signal.
 - 7. RACO; Division of Hubbell, Inc.
 - 8. Stahlin
 - 9. Scott Fetzer Co.; Adalet-PLM Division.
 - 10. Spring City Electrical Manufacturing Co.
 - 11. Thomas & Betts Corporation.
 - 12. Walker Systems, Inc.; Wiremold Company (The).
 - 13. Woodhead, Daniel Company; Woodhead Industries, Inc. Subsidiary.
- B. Sheet Metal Outlet and Device Boxes: NEMA OS 1.
- C. Cast-Metal Outlet and Device Boxes: NEMA FB 1, Type FD, with gasketed cover.
- D. Nonmetallic Outlet and Device Boxes: NEMA OS 2.
- E. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- F. Cast-Metal Pull and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover.
- G. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous hinge cover and flush latch.
 - 1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
 - 2. Nonmetallic Enclosures: Plastic, finished inside with radio-frequency-resistant paint.
- H. Cabinets: NEMA 250, Type 1, galvanized steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel. Hinged door in front cover with flush latch and concealed hinge. Key latch to match panelboards. Include metal barriers to separate wiring of different systems and voltage and include accessory feet where required for freestanding equipment.

2.8 FACTORY FINISHES

- A. Finish: For raceway, enclosure, or cabinet components, provide manufacturer's standard prime-coat finish ready for field painting.
- B. Finish: For raceway, enclosure, or cabinet components, provide manufacturer's standard paint applied to factory-assembled surface raceways, enclosures, and cabinets before shipping.

PART 3 - EXECUTION

- 3.1 RACEWAY APPLICATION
 - A. Outdoors:
 - 1. Exposed: Rigid steel or IMC.
 - 2. Concealed: Rigid steel or IMC.
 - 3. Underground Secondary, Single Run: PVC Schedule 40 with long radius elbows.
 - 4. Underground Secondary, Grouped: PVC Schedule 40 with long radius elbows.

- 5. Underground Primary: PVC Schedule 80 with long radius elbows.
- 6. Primary Risers: PVC Schedule 80. With long radius elbows.
- 7. Underground Data: PVC Schedule 40 with long radius elbows.
- 8. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFNC.
- 9. Boxes and Enclosures: NEMA 250, Type 3R.
- 10. Under Canopies: IMC with sealed fittings.
- 11. Coastal or Corrosive Locations or where specifically indicated on drawings: ETL PVC-001 PVC-GRS
- B. Indoors:
 - 1. Exposed in Mechanical/Electrical/Unfinished Spaces: EMT.
 - 2. Exposed in Finished Spaces: Metal Surface Raceway painted/finished to match space finishes.
 - 3. Concealed: EMT.
 - 4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC; except use LFNC in damp or wet locations or with water equipment.
 - 5. Damp or Wet Locations: Sealed EMT with sealed fittings.
 - 6. Underfloor: Sealed EMT with sealed fittings or IMC.
 - 7. Boxes and Enclosures: NEMA 250, Type 1, except as follows:
 - a. Damp or Wet Locations: NEMA 250, Type 4, nonmetallic.
- C. Minimum Raceway Size: 1/2-inch for single 20A or less circuits; otherwise, 3/4-inch trade size.
- D. Raceway Fittings: Compatible with raceways and suitable for use and location.
 - 1. Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.
 - 2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings approved for use with that material. Patch all nicks and scrapes in PVC coating using the manufacturer's PVC touch up compound after installing conduits.
- E. Install nonferrous conduit or tubing for circuits operating above 60 Hz.
- F. Aluminum conduit will not be accepted on this project.

3.2 INSTALLATION

- A. Conduit Routing:
 - 1. All branch circuit conduit shall be run overhead unless specifically directed by the engineer.
 - a. Exceptions:
 - 1) Conduit to floor boxes.
 - 2) Conduit to locations otherwise inaccessible overhead (exposed or not).
 - 3) Conduit to exterior slab locations without overhead cover.
 - 4) Conduit to column mounted lighting, devices, or equipment inaccessible from above.
 - 2. Panel feeder conduits may be run in the floor or underfloor ONLY IF indicated on the drawings or directed by the engineer.
 - 3. Service secondary conduits may be run underfloor or in-ground.
 - 4. Conduit for exterior equipment or lighting may be run underfloor or in-ground.
 - 5. All conduit serving any equipment or devices (to include panels, transformers, and switchboards, or any other electrical distribution equipment) within the perimeter of the building shall be run within the perimeter of the building. Conduit shall not run across

courtyards or underground from one section of the building to another section of the contiguous building.

- a. Exception: Service entrance conduit.
- 6. All conduit shall be run at right angles or parallel to the building lines to the limits that the structure will allow. Raceways shall not be run diagonal or curved.
- B. Installation of the PVC Coated Conduit System shall be performed in accordance with the Manufacturer's Installation Manual. To assure correct installation, the installer shall be certified by Manufacturer to install coated conduit
- C. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- D. Install raceways as high as possible and coordinate installation with other equipment.
- E. Install raceways to equipment mounted on the floor away from walls from overhead down to the equipment or disconnects. Do not run across the floor creating a tripping hazard. Rack support conduit at the disconnect.
- F. Provide clear access to all pull and j-boxes. Provide access doors over hard (non-lay-in ceilings) to all pull boxes. Minimum access required 1.5 x box cover size or 18 inches.
- G. Label all j-box and pull box covers with circuits contained within box.
- H. Under no circumstances shall power and data be shared in the same raceway, tray, channel, or sleeve.
- I. Install raceways for power conductors (any conductor over 50V) 12 inches from any signal/communications conductor (data, fiber optics, telephone, fire alarm, PA, community antenna and radio distribution (CATV), low power or network powered broadband communications, systems controls, and any other system operating under 50V) not in conduit on J-hooks.
- J. Install raceways for power conductors (any conductor over 50V) 12 inches from communications raceways. Communications raceways include; data, fiber optics, telephone, fire alarm, PA, community antenna and radio distribution (CATV), low power or network powered broadband communications, systems controls, and any other system operating under 50V.
 - 1. Exception: Data and power raceways shall be permitted to be 2 inches apart only at the wall drop to the devices. Above the ceiling or overhead the minimum 12 inch spacing shall be maintained.
 - 2. Exception: Within the surface raceways. When not within the surface raceway, the power and communications raceways shall be 12 inches apart.
 - 3. Underground: Data and power conduit/raceway shall be allowed in the same trench only if specifically allowed by the engineer and then there shall be a minimum of 12 inches of fill between the power and communications raceways. Magnetic marking tape shall be placed above the level of the highest (closest to grade) raceway.
- K. Exterior Exposed Raceways:
 - 1. See application schedule for raceway types.
 - 2. Provide non-flexible raceways through roofs to disconnects, panels, or receptacles as per application schedule.
 - 3. Provide transitions from non-flexible raceways to flexible raceways within 3 feet of the equipment.
 - a. Exception: Flexible raceways may exceed 3 feet only to accommodate the drip legs.

- 4. Penetrate roofing membranes with approved methods only for the type of roof used. See roofing or architectural details.
- 5. Provide chem-curbs on built-up roofs unless otherwise directed from roofing or architectural details.
- 6. Support all exposed raceway on roofs with manufactured neoprene blocks with integral galvanized channel, conduit hangers as part of a manufactured assembly with galvanized channel (portable pipe hangers or equal), or approved method as per architectural.
- 7. Exposed raceways on roofs shall not be unsupported in any areas nor attached directly to the roof.
- 8. Provide roof hoods for multiple conduits through roofs as indicated.
- 9. Provide drip legs for all exterior exposed raceways from disconnects to equipment.
- L. Buried Raceways:
 - 1. See application schedule for raceway types.
 - 2. Label all buried conduits.
 - 3. Provide spacers between all buried conduits for a neat and uniform installation. Conduit shall not be "stacked" on top of each other without manufactured spacers.
 - 4. IF telecommunications conduits and power conduits (only under 600V) are allowed in the same trench by owner or engineer, provide a minimum of 12 inches between the conduit racks. Provide magnetic marking tape between the communications conduits and the power conduits.
 - 5. Under NO circumstances shall power conduits over 600V be in the same trench as the communications conduits.
 - 6. All communications conduits shall have long radius elbows 10x the conduit diameter, but no less than 30", rising up into the building or communications equipment.
 - 7. Provide concrete encasement for all primary building feeders unless directed by utility company.
 - 8. Provide concrete encasement for all secondary building feeders unless otherwise noted.
 - 9. Provide pull strings/tape (per size and distance) for all empty conduits.
 - 10. Minimum depth of primary or medium voltage conduits 42 inches. (600V and above).
 - 11. Minimum depth of secondary or low voltage conduits 30 inches. (0 to 600V).
 - 12. All 90 degree changes in direction shall be long radius.
 - 13. Provide metal backed marking tape at 12 inches below grade and 6 inches above all buried raceways.
 - 14. Clean and swab out all conduits prior to installing conductors.
 - 15. Any metallic conduit coming in contact with earth, insulate with approved tape or asphalt paint.
- M. All underfloor conduits shall be supported as per NEC.
 - 1. See application schedule for conduit types.
 - 2. All conduit supports shall be anchored to structure.
 - 3. Provide support for multiple conduits with galvanized kindorf rack, conduit straps, all thread rod to angles, and mount angles to structure.
 - 4. ONLY IF specifically directed by owner or engineer to use RNC underfloor;
 - a. Provide support for 2" and below conduit every 48 inches.
 - b. Provide support for 2-1/2" and above every 60 inches.
- N. Complete raceway installation before starting conductor installation.
- O. Support raceways as specified in Section "Basic Electrical Materials and Methods."
- P. Install temporary closures to prevent foreign matter from entering raceways during construction. Remove prior to completion of conduit.
- Q. Sleeves: Provide metallic raceway sleeves through walls or floors for all conductors/cabling not in raceways. Provide bushings at both ends of sleeves prior to installing any conductors or wiring. Firestop as per requirements.
- R. Protect stub-ups from damage where conduits rise through floor slabs. Arrange so curved portions of bends are not visible above the finished slab.
- S. Make bends and offsets so ID is not reduced. Keep legs of bends in the same plane and keep straight legs of offsets parallel, unless otherwise indicated.
- T. Firestop: Firestop all raceway penetrations in rated walls. Provide intumescent fill in all sleeve openings. Contractor shall be responsible for all wall repair and damage. Excessive firestop for holes too large (1/2 inch beyond the edge of the raceway) is unacceptable. Holes shall be repaired with suitable wall materials to maintain the integrity of the wall construction.
- U. Cut openings in walls as per the outer edges of the raceway. Openings made with hammers or other wall damaging tools are not acceptable. Holes too large (1/2 inch beyond the edge of the raceway) are unacceptable and shall be repaired with suitable wall materials to maintain the integrity of the wall construction. Contractor shall be responsible for repair to match existing.
- V. Provide manufactured elbows of conduit type specified for PVC raceways. Field constructed elbows are not allowed. Rigid Non-metallic tubing shall not have any field fabricated 90 degree bends. Provide manufactured elbows at all 90 degree changes in direction.
- W. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.
 - 1. Install concealed raceways with a minimum of bends in the shortest practical distance, considering type of building construction and obstructions, unless otherwise indicated.
- X. Raceways Embedded in Slabs are allowed ONLY where specifically called out or ALLOWED by structural and electrical engineer: Install in middle one-third of slab thickness where practical and leave at least 2 inches of concrete cover on the top and bottom.
 - 1. Secure raceways to reinforcing rods to prevent sagging or shifting during concrete placement.
 - 2. Space raceways laterally to prevent voids in concrete.
 - 3. Run raceways parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
- Y. Expansion Joints: Provide flexible connections suitable for use with conduit type for all conduit in structural expansion joints or independent slabs that are within another structural assembly.
- Z. Raceways Through Slabs to Interior Spaces: Install where practical and leave at least 2 inches from any walls unless required to come up in the wall. Coordinate with grade or perimeter beams prior to installation.
 - 1. Secure raceways to concrete with conduit clamps.
 - 2. Change from nonmetallic raceways to rigid steel conduit or IMC before rising above the floor.
 - a. Exception: Raceways from below grade into transformers and switchgear enclosures shall be RNC with bushings.
 - b. Exception: Raceways from below grade for telephone boards and data/signal equipment shall be RNC with bushings.
 - 3. Tape conduit from minimum 3 inches below transition to 3 inches above the floor so that no portion of the rigid steel conduit or IMC is in contact with the concrete.

- AA. Raceways Through Floors: Install where practical and leave at least 2 inches from any walls. Coordinate with grade or perimeter beams prior to installation.
 - 1. Secure raceways to concrete with conduit clamps.
 - 2. Provide sleeve seals for conduit penetrations through floors. Provide firestopping at all floor penetrations.
- BB. Install ALL exposed raceways parallel or at right angles to nearby surfaces or structural members and follow surface contours as much as possible.
 - 1. Run parallel or banked raceways together on common supports.
 - 2. Make parallel bends in parallel or banked runs. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for parallel raceways.
 - 3. Install conduit as high as possible.
 - 4. Flexible cable or raceway for general circuiting is allowed exposed in mechanical or electrical spaces only. Not allowed in finished spaces.
 - a. Exception: As equipment connection only.
- CC. Join raceways with fittings designed and approved for that purpose and make joints tight.1. Use insulating bushings to protect conductors.
- DD. Tighten set screws of threadless fittings with suitable tools.
- EE. Terminations:
 - 1. Where raceways are terminated with locknuts and bushings, align raceways to enter squarely and install locknuts with dished part against box. Use two locknuts, one inside and one outside box.
 - 2. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into hub so end bears against wire protection shoulder. Where chase nipples are used, align raceways so coupling is square to box; tighten chase nipple so no threads are exposed.
- FF. Install pull tape/wires in empty raceways.
 - 1. For raceways under 2 inches and under less than 100 feet, use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire.
 - 2. Raceways under 2 inches and over 100 feet without intermediate pull boxes, provide mule tape. With intermediate pull boxes use pull wire.
 - 3. For raceways over 2 inches and use mule tape.
 - 4. Sleeves under 36 inches do not require pull tape/wire.
- GG. Telephone and Signal System Raceways, 2-Inch Trade Size and Smaller: In addition to above requirements, install raceways in maximum lengths of 150 feet and with a maximum of two 90-degree bends or equivalent. Separate lengths with pull or junction boxes where necessary to comply with these requirements.
- HH. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with UL-listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Label boxes "seal-off". Install raceway sealing fittings at the following points:
 - 1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 - 2. Where otherwise required by NFPA 70.
- II. Stub-up Connections: Extend conduits through concrete floor for connection to freestanding equipment. Install with an adjustable top or coupling threaded inside for plugs set flush with finished floor. Extend conductors to equipment with rigid steel conduit; FMC may be used 6

inches above the floor. Install screwdriver-operated, threaded plugs flush with floor for future equipment connections.

- JJ. Flexible Connections: Use maximum of 72 inches of flexible conduit for recessed and semirecessed lighting fixtures if not using MC Cable for lighting whips; for equipment subject to vibration, noise transmission, or movement, and for all motors indoors of non-water operating equipment. Use LFNC in damp or wet locations or to any water operating equipment. Install separate ground conductor across flexible connections.
- KK. Prime and Paint exposed conduit in finished spaces, unless pre-painted surface raceways is provided, as per owner/architect. Provide with paintable surface.
- LL. Surface Raceways: Install a separate, green, ground conductor in raceways from junction box supplying raceways to receptacle or fixture ground terminals.
- MM. Floor Boxes:
 - 1. Set floor boxes level. Grout around floor box to fill in area around box opening.
 - 2. Trim after installation to fit flush with finished floor surface.
 - 3. Ground floor box with circuit grounding conductor.
 - 4. Coordinate covers with floor finishes. Provide covers with inserts for tile or carpet.
 - 5. Floor boxes shall be flush with finish floor.
- NN. Install hinged-cover enclosures and cabinets plumb. Support at each corner.
- OO. Cap all un-used/spare conduits. Does not include sleeves.

3.3 PROTECTION

- A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.
 - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.
 - 3. Provide cover over conduits during storage to prevent dirt and debris from entering conduits during storage.

3.4 CLEANING

- A. After completing installation of exposed, factory-finished raceways and boxes, inspect exposed finishes and repair damaged finishes.
- B. Remove debris from conduits prior to capping any spare conduits.
- C. Blow-out empty conduits that are future spares in any exterior or underground installation prior to capping.

3.5 RECORD

A. Record the location of all spare conduits buried for future use by the owner.

END OF SECTION

SECTION 26 0553 ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes electrical identification materials and devices required to comply with ANSI C2, NFPA 70, OSHA standards, and authorities having jurisdiction.

1.3 SUBMITTALS

- A. Product Data: For each electrical identification product indicated.
- B. Schedule of Nomenclature: An index of electrical equipment and system components used in identification signs and labels.
- C. Samples: For each type of label and sign to illustrate color, lettering style, and graphic features of identification products.

1.4 QUALITY ASSURANCE

- A. Comply with ANSI C2.
- B. Comply with NFPA 70.
- C. Comply with ANSI A13.1 and NFPA 70 for color-coding.

PART 2 - PRODUCTS

2.1 RACEWAYS AND CABLE LABELS

- A. Comply with ANSI A13.1, Table 3, for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.
 - 1. Color: Black letters on orange field.
 - 2. Legend: Indicates voltage and service.
- B. Adhesive Labels: Preprinted, flexible, self-adhesive vinyl with legend overlaminated with a clear, weather- and chemical-resistant coating.
- C. Pretensioned, Wraparound Plastic Sleeves: Flexible, preprinted, color-coded, acrylic band sized to suit the diameter of the line it identifies and arranged to stay in place by pretensioned gripping action when placed in position.
- D. Colored Adhesive Tape: Self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.

- E. Underground-Line Warning Tape: Permanent, bright-colored, continuous-printed, vinyl tape.
 - 1. Not less than 6 inches wide by 4 mils thick.
 - 2. Compounded for permanent direct-burial service.
 - 3. Embedded continuous metallic strip or core.
 - 4. Printed legend indicating type of underground line.
- F. Tape Markers: Vinyl or vinyl-cloth, self-adhesive, wraparound type with preprinted numbers and letters.
- G. Aluminum, Wraparound Marker Bands: Bands cut from 0.014-inch- thick aluminum sheet, with stamped or embossed legend, and fitted with slots or ears for permanently securing around wire or cable jacket or around groups of conductors.
- H. Plasticized Card-Stock Tags: Vinyl cloth with preprinted and field-printed legends. Orange background, unless otherwise indicated, with eyelet for fastener.
- I. Aluminum-Faced, Card-Stock Tags: Weather-resistant, 18-point minimum card stock faced on both sides with embossable aluminum sheet, 0.002 inch thick, laminated with moisture-resistant acrylic adhesive, punched for fasteners, and preprinted with legends to suit each application.
- J. Brass or Aluminum Tags: 2×2×0.05-inch metal tags with stamped legend, punched for fastener.

2.2 NAMEPLATES AND SIGNS

- A. Safety signs: Comply with 29 CFR, Chapter XVII, Part 1910.145.
- B. Engraved Plastic Nameplates and Signs: Engraving stock, melamine plastic laminate, minimum 1/16 inch thick for signs up to 20 sq. in. and 1/8 inch thick for larger sizes.
 - 1. Engraved legend with black letters on white face.
 - 2. Punched or drilled for mechanical fasteners.
- C. Baked-Enamel Signs for Interior Use: Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for the application. ¹/₄-inch grommets in corners for mounting.
- D. Exterior, Metal-Backed, Butyrate Signs: Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch galvanized-steel backing; and with colors, legend, and size required for the application. ¹/₄-inch grommets in corners for mounting.
- E. Fasteners for Nameplates and Signs: Self-tapping, stainless-steel screws or No. 10/32, stainless-steel machine screws with nuts and flat and lock washers.

2.3 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Cable Ties: fungus-inert, self-extinguishing, one-piece, self-locking, Type 6/6 nylon cable ties.
 - 1. Minimum Width: 3/16 inch.
 - 2. Tensile Strength: 50 lb minimum.
 - 3. Temperature Range: Minus 40 to plus 185 deg F.
 - 4. Color: According to color-coding.
- B. Paint: Formulated for the type of surface and intended use.

- 1. Primer for Galvanized Metal: Single-component acrylic vehicle formulated for galvanized surfaces.
- 2. Primer for Concrete Masonry Units: Heavy-duty-resin block filler.
- 3. Primer for Concrete: Clear, alkali-resistant, binder-type sealer.
- 4. Enamel: Silicone-alkyd or alkyd urethane as recommended by primer manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Identification Materials and Devices: Install at locations for most convenient viewing without interference with operation and maintenance of equipment.
- B. Lettering, Colors, and Graphics: Coordinate names, abbreviations, colors, and other designations with corresponding designations in the Contract Documents or with those required by codes and standards. Use consistent designations throughout Project.
- C. Sequence of Work: If identification is applied to surfaces that require finish, install identification after completing finish work.
- D. Self-Adhesive Identification Products: Clean surfaces before applying.
- E. Install painted identification according to manufacturer's written instructions and as follows:
 - 1. Clean surfaces of dust, loose material, and oily films before painting.
 - 2. Prime surfaces using type of primer specified for surface.
 - 3. Apply one intermediate and one finish coat of enamel.
- F. Color Banding Raceways and Exposed Cables: Band exposed and accessible raceways of the systems listed below:
 - 1. Bands: Pretensioned, wraparound plastic sleeves; colored adhesive tape; or a combination of both. Make each color band 2 inches wide, completely encircling conduit, and place adjacent bands of two-color markings in contact, side by side.
 - 2. Band Locations: At changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.
 - 3. Apply the following colors to the systems listed below:
 - a. Fire Alarm System: Red.
 - b. Fire-Suppression Supervisory and Control System: Red and yellow.
 - c. Combined Fire Alarm and Security System: Red and blue.
 - d. Security System: Blue and yellow.
 - e. Mechanical and Electrical Supervisory System: Green and blue.
 - f. Telecommunication System: Green and yellow.
- G. Caution Labels for Indoor Boxes and Enclosures for Power and Lighting: Install pressure-sensitive, self-adhesive labels identifying system voltage with black letters on orange background. Install on exterior of door or cover.
- H. Circuit Identification Labels on Boxes: Install labels externally.
 - 1. Exposed Boxes: Pressure-sensitive, self-adhesive plastic label on cover.
 - 2. Concealed Boxes: Plasticized card-stock tags.
 - 3. Labeling Legend: Permanent, waterproof listing of panel and circuit number or equivalent.

- I. Paths of Underground Electrical Lines: During trench backfilling, for exterior underground power, control, signal, and communication lines, install continuous underground plastic line marker located directly above line at 6 to 8 inches below finished grade. Where width of multiple lines installed in a common trench or concrete envelope does not exceed 16 inches overall, use a single line marker. Install line marker for underground wiring, both direct-buried cables and cables in raceway.
- J. Color-Coding of Secondary Branch Circuit Conductors: Use the following colors for service, feeder, and branch-circuit branch circuit conductors:
 - 1. 120/208V 3 Phase Conductors:
 - a. Phase A: Black.
 - b. Phase B: Red.
 - c. Phase C: Blue.
 - d. Neutral: White.
 - e. Ground: Green.
 - 2. 120/240V 3 Phase Conductors:
 - a. Phase A: Black.
 - b. Phase B: Orange (High Leg Only).
 - c. Phase C: Blue.
 - d. Neutral: White.
 - e. Ground: Green.
 - 3. 120/240V Single Phase Conductors:
 - a. Phase A: Black.
 - b. Phase B: Red or Blue.
 - c. Neutral: White.
 - d. Ground: Green.
 - 4. 277/480V 3 Phase Conductors:
 - a. Phase A: Purple.
 - b. Phase B: Brown.
 - c. Phase C: Yellow.
 - d. Neutral: Gray.
 - e. Ground: Green.
 - 5. Factory apply color the entire length of conductors, except the following field-applied, color-coding methods may be used instead of factory-coded wire for sizes larger than No. 10 AWG:
 - a. Colored, pressure-sensitive plastic tape in half-lapped turns for a distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Use 1-inch-wide tape in colors specified. Adjust tape bands to avoid obscuring cable identification markings.
 - b. Colored cable ties applied in groups of three ties of specified color to each wire at each terminal or splice point starting 3 inches from the terminal and spaced 3 inches apart. Apply with a special tool or pliers, tighten to a snug fit, and cut off excess length.
- K. Power-Circuit Identification: Metal tags or aluminum, wraparound marker bands for cables, feeders, and power circuits in vaults, pull and junction boxes, manholes, and switchboard rooms.
 - 1. Legend: ¼-inch- steel letter and number stamping or embossing with legend corresponding to indicated circuit designations.
 - 2. Tag Fasteners: Nylon cable ties.
 - 3. Band Fasteners: Integral ears.
- L. Apply identification to conductors as follows:
 - 1. Conductors to Be Extended in the Future: Indicate source and circuit numbers.

- 2. Multiple Power or Lighting Circuits in the Same Enclosure: Identify each conductor with source, voltage, circuit number, and phase. Use color-coding to identify circuits' voltage and phase.
- 3. Multiple Control and Communication Circuits in the Same Enclosure: Identify each conductor by its system and circuit designation. Use a consistent system of tags, color-coding, or cable marking tape.
- M. Apply warning, caution, and instruction signs as follows:
 - 1. Warnings, Cautions, and Instructions: Install to ensure safe operation and maintenance of electrical systems and of items to which they connect. Install engraved plastic-laminated instruction signs with approved legend where instructions are needed for system or equipment operation. Install metal-backed butyrate signs for outdoor items.
 - 2. Emergency Operation: Install engraved laminated signs with white legend on red background with minimum 3/8-inch- high lettering for emergency instructions on power transfer, load shedding, and other emergency operations.
- N. Equipment Identification Labels: Engraved plastic laminate. Install on each unit of equipment, including central or master unit of each system. This includes power, lighting, communication, signal, and alarm systems, unless units are specified with their own self-explanatory identification. Unless otherwise indicated, provide a single line of text with ½-inch- high lettering on 1½-inch-high label; where two lines of text are required, use labels 2 inches high. Use white lettering on black field. Apply labels for each unit of the following categories of equipment using mechanical fasteners:
 - 1. Panelboards, electrical cabinets, and enclosures.
 - 2. Access doors and panels for concealed electrical items.
 - 3. Electrical switchgear and switchboards.
 - 4. Electrical substations.
 - 5. Emergency system boxes and enclosures.
 - 6. Motor-control centers.
 - 7. Disconnect switches.
 - 8. Enclosed circuit breakers.
 - 9. Motor starters.
 - 10. Push-button stations.
 - 11. Power transfer equipment.
 - 12. Contactors.
 - 13. Remote-controlled switches.
 - 14. Dimmers.
 - 15. Control devices.
 - 16. Transformers.
 - 17. Inverters.
 - 18. Rectifiers.
 - 19. Frequency converters.
 - 20. Battery racks.
 - 21. Power-generating units.
 - 22. Telephone switching equipment.
 - 23. Clock/program master equipment.
 - 24. Call system master station.
 - 25. TV/audio-monitoring master station.
 - 26. Fire alarm master station or control panel.
 - 27. Security-monitoring master station or control panel.

END OF SECTION

SECTION 26 0923 LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Time switches.
 - 2. Photoelectric switches.
 - 3. Standalone daylight-harvesting switching controls.
 - 4. Indoor occupancy sensors.
 - 5. Outdoor motion sensors.
 - 6. Lighting contactors.
 - 7. Emergency shunt relays.
- B. Related Requirements:
 - 1. Section "Wiring Devices" for wall-box dimmers, wall-switch occupancy sensors, and manual light switches.
- 1.3 ACTION SUBMITTALS
 - A. Product Data: For each type of product.
 - B. Specification Compliance Review:
 - Manufacturers and bidders must provide the consulting engineer with a Compliance Review of the Specifications and Addenda's. The Compliance Review shall be a paragraph-by-paragraph review of the Specifications and schedule with the following information; "C", "D", or "E" marked in the margin of the original Specifications and any subsequent Addenda's. If the manufacturer or bidder does not provide the Compliance Review to the engineer for review, with the submittal, the submittal will be subject to rejection as non-compliant.
 - a. "C" Comply with no exceptions.
 - b. "D" Comply with deviations. For each and every deviation, provide a numbered footnote with reasons for the proposed deviation and how the intent of the Specification can be satisfied.
 - c. "E" Exception, do not comply. For each and every exception, provide a numbered footnote with reasons and possible alternatives. Non-compliance with the specifications is grounds for rejection as unacceptable. A bid from any alternative or listed equipment manufacturer with any number of exceptions will be reason for rejection for non-compliance without further review.
 - d. Unless a deviation or exception is specifically noted in the Compliance Review, the manufacturer shall provide full compliance with entire specification. Deviations or exceptions taken in letters or cover letters in a bid document, subsidiary documents, by omission or by contradiction do not release the manufacturer or bidder from being in complete compliance, unless the exception or deviation has

been specifically noted in the Compliance Review and approved by the consulting engineer.

- e. Equipment manufacturers or bidders that do not meet the specifications thru the above process will be subject to rejection without further review.
- C. Shop Drawings: Contractor to submit entire lighting control system shop drawings showing locations of devices, coverage areas delineated with contour style lines, power pack or controller locations, connections, photocells and locations, and control wiring required.
 - 1. Show installation details for occupancy and light-level sensors.
 - 2. Interconnection diagrams showing field-installed wiring.
 - 3. Include diagrams for power, signal, and control wiring.
 - 4. Sensors shall overlap in coverage areas requiring multiple sensors.

1.4 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.
- 1.5 CLOSEOUT SUBMITTALS
 - A. Operation and Maintenance Data: For each type of lighting control device to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 TIME SWITCHES

- A. Manufacturers: subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1. Cooper Industries, Inc.
 - 2. Intermatic, Inc.
 - 3. Invensys Controls.
 - 4. Leviton Manufacturing Co., Inc.
 - 5. NSi Industries, LLC: TORK Products
 - 6. Lithonia
- B. Electronic Time Switches: Solid state, programmable, with alphanumeric display; complying with UL 917.
 - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - 2. Contact Configuration: SPST.
 - 3. Contact Rating: 30-A inductive or resistive.
 - 4. Programs: See drawings for number of channels, minimum one channel per circuit plus one spare; each channel is individually programmable with 40 on-off operations per week and an annual holiday schedule that overrides the weekly operation on holidays.
 - 5. Circuitry: Allow connection of a photoelectric relay as substitute for on-off function of a program.
 - 6. Astronomic Time: All channels.
 - 7. Automatic daylight savings time changeover.
 - 8. Battery Backup: Not less than seven days reserve, to maintain schedules and time clock.

2.2 OUTDOOR PHOTOELECTRIC SWITCHES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work includes, but are not limited to, the following:
 - 1. Cooper Industries, Inc.
 - 2. Intermatic, Inc.
 - 3. NSi Industries, LLC; TORK Products.
- B. Description: Solid state, with SPST dry contacts rated for 1800 VA to operate connected relay, contactor coils, or microprocessor input; complying with UL 773A.
 - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - 2. Light-Level Monitoring Range: 1.5 to 10 fc (16.14 to 108 lux), with an adjustment for turn-on and turn-off levels within that range, and a directional lens in front of the photocell to prevent fixed light sources from causing turn-off.
 - 3. Time Delay: Fifteen second minimum, to prevent false operation.
 - 4. Surge Protection: Metal-oxide varistor.
 - 5. Mounting: Twist lock complies with NEMA C136.10, with base-and-stem mounting or stem-and-swivel mounting accessories as required to direct sensor to the north sky exposure.

2.3 DAYLIGHT-HARVESTING SWITCHING CONTROLS

- A. Manufacturers: Subject to compliance with requirements. Products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Cooper Industries, Inc.
 - 2. Eaton Corporation.
 - 3. Hubbell Building Automation, Inc.
 - 4. Leviton Manufacturing Co., Inc.
 - 5. Lithonia Lighting; Acuity Brands Lighting, Inc.
 - 6. NSi Industries, LLC: TORK Products.
 - 7. Sensor Switch, Inc.
 - 8. Tyco Electronics; ALR Brand.
 - 9. Watt Stopper.
- B. Ceiling-Mounted Switching Controls: Solid-state, light-level sensor unit, with separate power pack, to detect changes in indoor lighting levels that are perceived by the eye.
- C. Electrical Components, Devices, and Accessories:
 - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - 2. Operating Ambient Conditions: Dry interior conditions, 32 to 120 deg F (0 to 49 deg C).
 - 3. Sensor Output: Contacts rated to operate the associated power pack, complying with UL 773A. Sensor is powered by the power pack.
 - 4. Power Pack: Dry contacts rated for 20-A load at 120- and 277-V ac. Sensor has 24-V dc, 150-mA, Class 2 power source, as defined by NFPA 70.
 - 5. General Space Sensors Light-Level Monitoring Range: 10 to 200 fc (108 to 2152 lux), with an adjustment for turn-on and turn-off levels within that range.
 - 6. Atrium Space Sensors Light-Level Monitoring Range: 50 to 500 fc (1080 to 10 800 lux), with an adjustment for turn-on and turn-off levels within that range.
 - 7. Time Delay: Adjustable from 5 to 300 seconds to prevent cycling.
 - 8. Set-Point Adjustment: Equip with deadband adjustment of 25, 50, and 75 percent above the "on" set point, or provide with separate adjustable "on" and "off" set points.
 - 9. Test Mode: User selectable, overriding programmed time delay to allow settings check.
 - 10. Control Load Status: User selectable to confirm that load wiring is correct.

11. Indicator: Two digital displays to indicate the beginning of on-off cycles.

2.4 DAYLIGHT-HARVESTING DIMMING CONTROLS

- Α. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work includes, but are not limited to, the following:
 - 1. Cooper Industries, Inc.
 - 2. Hubbell Building Automation, Inc.
 - 3. Leviton Mfg. Company, Inc.
 - 4. Lithonia Lighting; Acuity Lighting Group, Inc.
 - 5. Watt Stopper.
- Β. System Description: Sensing daylight and electrical lighting levels, the system adjusts the indoor electrical lighting levels. As daylight increases, the lights are dimmed. 1
 - Lighting control set point is based on two lighting conditions:
 - When no daylight is present (target level). a.
 - When significant daylight is present. b.
 - System programming is done with two hand-held, remote-control tools. 2.
 - Initial setup tool. a.
 - b. Tool for occupants to adjust the target levels by increasing the set point up to 25 percent, or by minimizing the electric lighting level.
- C. Ceiling-Mounted Dimming Controls: Solid-state, light-level sensor unit, with separate controller unit, to detect changes in lighting levels that are perceived by the eye.
 - Listed and labeled as defined in NFPA 70, by a gualified testing agency, and marked 1. for intended location and application.
 - 2. Sensor Output: 0- to 10-V dc to operate electronic dimming ballasts. Sensor is powered by controller unit.
 - 3. Power Pack: Sensor has 24-V dc, Class 2 power source, as defined by NFPA 70.
 - 4. Light-Level Sensor Set-Point Adjustment Range: 20 to 60 fc (120 to 640 lux).
- 2.5 ROOM CONTROLLER: Manufacturers standard complete assembly in one enclosure rated for location. Unit shall contain controls, connections, relays, and wiring.
 - A. The following features:
 - Individual control of each switch leg (zone). See floor plan for number of zones. 1. Provide minimum 1 zones with one spare.
 - Zone control relav fails closed. 2.
 - Occupancy sensor input. 3.
 - Contacts for HVAC (VAV) enable. 4.
 - Capable of network (Owner) controllable. 5.
 - Zones capable of either vacancy occupancy operation. 6.
 - Provide factory matched to room controller switching of each zone with either pushbutton Β. backlit touch screen or digital wall switching of each zone. See floor plan for type.

2.6 CEILING MOUNTED OCCUPANCY SENSORS

- Manufacturers: Subject to compliance with requirements, available manufacturers offering Α. products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Cooper Industries, Inc.
 - 2. Hubbell Building Automation, Inc.
 - 3. Leviton Manufacturing Co., Inc.
 - 4. Lithonia Lighting; Acuity Brands Lighting, Inc.

- 5. Lutron Electronics Co., Inc.
- 6. NSi Industries LLC; TORK Products.
- 7. Sensor Switch, Inc.
- 8. Square D.
- 9. Watt Stopper.
- B. General Requirements for Sensors: Ceiling-mounted, 360 degree, solid-state indoor occupancy sensors with a separate power pack.
 - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - 2. Operation: Turn lights on or enable wall manual switch when coverage area is occupied, and turn them off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 30 minutes.
 - 3. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor is powered from the power pack.
 - 4. Power Pack: Dry contacts rated for 20-A load at 120- and 277-V ac, and for 1 hp at 120-V ac. Sensor has 24-V dc, 150-mA, Class 2 power source, as defined by NFPA 70.
 - 5. Mounting:
 - a. Sensor: Suitable for mounting in any position on a standard outlet box.
 - b. Relay: Internal dry contact closure for SPDT.
 - c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
 - 6. Indicator: Digital display, to show when motion is detected during testing and normal operation of sensor.
 - 7. Bypass Switch: Override the "on" function in case of sensor failure.
 - 8. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc (21.5 to 2152 lux); turn lights off when selected lighting level is present.
 - 9. Dimming output to control 0-10 VDC.
 - 10. Provides second occupancy time out period enabling lighting to go dim prior to off.
 - 11. Adjustable maximum minimum.
 - 12. Can be series or parallel connected.
 - 13. Photo Cell:
 - a. Auto set point
 - b. On/Off mode during occupancy
 - c. Dimming control
- C. Standard Dual-Technology Type: Ceiling mounted; detect occupants in coverage area using PIR and ultrasonic detection methods. The particular technology or combination of technologies that control on-off functions is selectable in the field by operating controls on unit.
 - 1. Sensitivity Adjustment: Separate for each sensing technology.
 - Detector Sensitivity: Detect occurrences of 6-inch- (150-mm-) minimum movement of any portion of a human body that presents a target of not less than 36 sq. in. (232 sq. cm), and detect a person of average size and weight moving not less than 12 inches (305 mm) in either a horizontal or a vertical manner at an approximate speed of 12 inches/s (305 mm/s).
 - 3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 15 ft. radius when mounted on a 108-inch high ceiling.
- D. Extended Range Dual-Technology Type: Ceiling Mounted
 - 1. Sensitivity Adjustment: Separate for each sensing technology.
 - Detector Sensitivity: Detect occurrences of 6-inch- (150-mm-) minimum movement of any portion of a human body that presents a target of not less than 36 sq. in. (232 sq. cm), and detect a person of average size and weight moving not less than 12 inches (305 mm) in either a horizontal or a vertical manner at an approximate speed of 12 inches/s (305 mm/s).

3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 28 ft. radius when mounted on a 108-inch high ceiling.

2.7 SWITCHBOX-MOUNTED OCCUPANCY SENSORS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - 1. Bryant Electric.
 - 2. Cooper Industries, Inc.
 - 3. Hubbell Building Automation, Inc.
 - 4. Leviton Manufacturing Co., Inc.
 - 5. Lightolier Controls.
 - 6. Lithonia Lighting; Acuity Brands Lighting, Inc.
 - 7. Lutron Electronics Co., Inc.
 - 8. NSi Industries LLC; TORK Products.
 - 9. RAB Lighting.
 - 10. Sensor Switch, Inc.
 - 11. Square D.
 - 12. Watt Stopper.
- C. General Requirements for Sensors: Automatic-wall-switch occupancy sensor, suitable for mounting in a single gang switchbox.
 - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - 2. Operating Ambient Conditions: Dry interior conditions, 32 to 120 deg F (0 to 49 deg C).
 - 3. Switch Rating: Not less than 800-VA fluorescent at 120 V, 1200-VA fluorescent at 277 V, and 800-W incandescent.
- D. Wall-Switch Sensor:
 - 1. Standard Range: 180-degree field of view, field adjustable from 180 to 40 degrees; with a minimum coverage area of 2100 sq. ft (196 sq. m).
 - 2. Sensing Technology: Dual technology PIR and ultrasonic.
 - 3. Switch Type: SP. SP, field selectable automatic "on," or manual "on" automatic "off."
 - 4. Voltage: Dual voltage, 120 and 277 V.
 - 5. Ambient-Light Override: Concealed, field-adjustable, light-level sensor from 10 to 150 fc (108 to 1600 lux). The switch prevents the lights from turning on when the light level is higher than the set point of the sensor.
 - 6. Concealed, field-adjustable, "off" time-delay selector at up to 30 minutes.
 - 7. Concealed "off" time-delay selector at 30 seconds, and 5, 10, and 20 minutes.
 - 8. Adaptive Technology: Self-adjusting circuitry detects and memorizes usage patterns of the space and helps eliminate false "off" switching.
 - 9. Programmable for occupancy or vacancy mode.

2.8 HIGH-BAY OCCUPANCY SENSORS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - 1. Hubbell Building Automation, Inc.

- C. General Description: Solid-state unit. The unit is designed to operate with the lamp and ballasts indicated.
 - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - 2. Operation: Turn lights on when coverage area is occupied, and to half-power when unoccupied; with a time delay for turning lights to half-power that is adjustable over a minimum range of 1 to 16 minutes.
 - Continuous Lamp Monitoring: When lamps are dimmed continuously for 24 hours, automatically turn lamps on to full power for 15 minutes for every 24 hours of continuous dimming.
 - 4. Operating Ambient Conditions: 32 to 149 deg F (0 to 65 deg C).
 - 5. Mounting: Threaded pipe.
 - 6. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
 - 7. Detector Technology: PIR.
 - 8. Power and dimming control from the lighting fixture ballast that has been modified to include the dimming capacitor and MyzerPORT option.
- D. Detector Coverage: User selectable by interchangeable PIR lenses, suitable for mounting heights from 12 to 50 feet (3.7 to 15.2 m).
- E. Accessories: Obtain manufacturer's installation and maintenance kit with laser alignment tool for sensor positioning and power port connectors.

2.9 EXTREME-TEMPERATURE OCCUPANCY SENSORS

- A. Manufacturers: Subject to compliance with requirements. Products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Cooper Industries, Inc.
 - 2. Sensor Switch, Inc.
- B. Description: Ceiling-mounted, solid-state, extreme-temperature occupancy sensors with a separate power pack.
 - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended application in damp locations.
 - 2. Operation: Turn lights on when coverage area is occupied, and turn them off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 30 minutes.
 - 3. Operating Ambient Conditions: From minus 40 to plus 125 deg F (minus 40 to plus 52 deg C).
 - 4. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor is powered from the power pack.
 - 5. Power Pack: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Sensor has 24-V dc, 150-mA, Class 2 power source, as defined by NFPA 70.
 - 6. Mounting:
 - a. Sensor: Suitable for mounting in any position on a standard outlet box.
 - b. Relay: Externally mounted through a 1/2-inch (13-mm) knockout in a standard electrical enclosure.
 - c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind cover.
 - 7. Bypass Switch: Override the "on" function in case of sensor failure.
 - 8. Automatic Light-Level Sensor: Adjustable from 2 to 10 fc (21.5 to 108 lux); keep lighting off when selected lighting level is present.
- C. Detector Technology: PIR. Ceiling mounted; detect occupants in coverage area by their heat and movement.

- 1. Detector Sensitivity: Detect occurrences of 6-inch- (150-mm-) minimum movement of any portion of a human body that presents a target of not less than 36 sq. in. (232 sq. cm).
- 2. Detection Coverage (Room): Detect occupancy anywhere in a circular area of 1500 sq. ft. (139 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.
- 3. Detection Coverage (High Bay): Detect occupancy within 25 feet (7.6 m) when mounted on a 25-foot- (7.6-m-) high ceiling.

2.10 OUTDOOR MOTION SENSORS

- A. Manufacturers: Subject to compliance with requirements. Products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Bryant Electric.
 - 2. Cooper Industries, Inc.
 - 3. Hubbell Building Automation, Inc.
 - 4. Leviton Manufacturing Co., Inc.
 - 5. Lithonia Lighting; Acuity Brands Lighting, Inc.
 - 6. NSi Industries, LLC: TORK Products.
 - 7. RAB Lighting.
 - 8. Sensor Switch, Inc.
 - 9. Watt Stopper.
- B. General Requirements for Sensors: Solid-state outdoor motion sensors.
 - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - 2. Dual-technology (PIR and infrared) type, weatherproof. Detect occurrences of 6-inch-(150-mm-) minimum movement of any portion of a human body that presents a target of not less than 36 sq. in. (232 sq. cm). Comply with UL 773A.
 - 3. Switch Rating:
 - a. Separately Mounted Sensor: Dry contacts rated for 20-A load at 120- and 277-V ac. Sensor has 24-V dc, 150-mA, Class 2 power source, as defined by NFPA 70.
 - 4. Switch Type: SP, field selectable automatic "on," or manual "on" automatic "off." With bypass switch to override the "on" function in case of sensor failure.
 - 5. Voltage: Match the circuit voltage.
 - 6. Detector Coverage:
 - a. Standard Range: 210-degree field of view, with a minimum coverage area of 900 sq. ft. (84 sq. m).
 - b. Long Range: 180-degree field of view and 110-foot (34-m) detection range.
 - 7. Ambient-Light Override: Concealed, field-adjustable, light-level sensor from 10 to 150 fc (108 to 1600 lux). The switch prevents the lights from turning on when the light level is higher than the set point of the sensor.
 - 8. Concealed, field-adjustable, "off" time-delay selector at up to 30 minutes.
 - 9. Adaptive Technology: Self-adjusting circuitry detects and memorizes usage patterns of the space and help eliminate false "off" switching.
 - 10. Operating Ambient Conditions: Suitable for operation in ambient temperatures ranging from minus 40 to plus 130 deg F (minus 40 to plus 54 deg C), rated as "raintight" according to UL 773A.

2.11 LIGHTING CONTACTORS

- A. Manufacturers: Subject to compliance with requirements. Products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Allen-Bradley/Rockwell Automation.
 - 2. ASCO Power Technologies, LP.

- 3. Eaton Corporation.
- 4. General Electric Company.
- 5. Square D.
- B. Description: Electrically operated and electrically held, combination-type lighting contactors with nonfused disconnect, complying with NEMA ICS 2 and UL 508.
 - 1. Current Rating for Switching: Listing or rating consistent with type of load served, including tungsten filament, inductive, and high-inrush ballast (ballast with 15 percent or less total harmonic distortion of normal load current).
 - 2. Fault Current Withstand Rating: Equal to or exceeding the available fault current at the point of installation.
 - 3. Enclosure: Complete sized for contactor poles indicated with continuous hinged cabinet door rated for location (NEMA 1 indoor, NEMA 3R = exterior). Comply with NEMA 250.
 - 4. Provide with integral H-O-A switch unless one switch operates multiple contactor cabinets.
- C. Interface with DDC System for HVAC: Provide hardware interface to enable the DDC system for HVAC to monitor and control lighting contactors.
 - 1. Monitoring: On-off status, current sensing.
 - 2. Control: On-off operation, relay.
 - 3. See drawings for operation.

2.12 EMERGENCY SHUNT RELAY

- A. Description: Normally closed, electrically held relay, arranged for wiring in parallel with manual or automatic switching contacts; complying with UL 924.
 1. Coil Rating: See drawing detail.
- 2.13 CONDUCTORS AND CABLES
 - A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Section "Conductors and Cables."
 - B. Classes 2 and 3 Control Cable: Plenum rated, multiconductor cable with stranded-copper conductors.
 - C. Class 1 Control Cable: Plenum rated, multiconductor cable with stranded-copper conductors.
 - D. All exterior or underground cabling shall be rated for location.

PART 3 - EXECUTION

- 3.1 SENSOR INSTALLATION
 - A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression systems, and partition assemblies.
 - B. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

- C. Provide factory representative to locate and calibrate daylight sensors for daylight harvesting (dimming). Verify operation and document settings.
- D. Contractor to verify all sensors intended operation and calibrate sensor field of view and sensitivity.
- E. Coordinate with owner for delay times.

3.2 CONTACTOR INSTALLATION

- A. Mount electrically held lighting contactors with elastomeric isolator pads to eliminate structure-borne vibration, unless contactors are installed in an enclosure with factory-installed vibration isolators.
- B. Mount cabinet to wall or unistrut frame.

3.3 WIRING INSTALLATION

- A. Wiring Method: Comply with Section "Control/Signal Transmission Media." Minimum conduit size is 1/2 inch (13 mm).
- B. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpowerlimited conductors according to conductor manufacturer's written instructions.
- C. Size conductors according to lighting control device manufacturer's written instructions unless otherwise indicated.
- D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.4 ROOM CONTROLLER INSTALLATION

- A. Room Controller:
 - 1. Coordinate switch/touch pad location in room.
 - 2. Locate room controller above ceiling in accessible location.
 - 3. Provide plenum rated control cable to each devices.
 - 4. Provide above ceiling switch.

3.5 IDENTIFICATION

- A. Identify components and power and control wiring according to "Electrical Identification."
 - 1. Identify controlled circuits in lighting contactors.
 - 2. Identify circuits or luminaires controlled by photoelectric and occupancy sensors at each sensor.
- B. Label time switches and contactors with a unique designation.

3.6 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

- B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
 - 1. Operational Test: After installing time switches and sensors, and after electrical circuitry has been energized, start units to confirm proper unit operation.
 - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- C. Lighting control devices will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.

3.7 ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting sensors to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.
 - 1. For occupancy and motion sensors, verify operation at outer limits of detector range. Set time delay to suit Owner's operations.
 - 2. For daylighting controls, adjust set points and deadband controls to suit Owner's operations.
 - 3. Align high-bay occupancy sensors using manufacturer's laser aiming tool.

3.8 DEMONSTRATION

- A. Coordinate demonstration of products with Owner prior to substantial completion.
- B. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain lighting control devices.

END OF SECTION

SECTION 26 1310 PULL AND JUNCTION BOXES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work covered by this Section includes furnishing of and paying for all materials, labor, services, equipment, licenses, taxes, other items, and appliances necessary for the execution, installation and completion of all work specified herein and/or shown on the drawings.
- B. Pull and junction boxes of appropriate size and depth as indicated on the drawings and as specified hereinafter.

1.2 SUBMITTALS

A. Submittals for products furnished under this section are not required.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. For interior work, provide galvanized sheet metal boxes of code thickness with lapped and welded joints, ³/₄-inch flanges, screw covers, etc.
- B. For exterior work, provide galvanized sheet metal boxes of code thickness with lapped and welded joints, ³/₄-inch flanges, bolted covers with full gaskets forming a completely raintight assembly for above ground installations. Provide concrete boxes with screw fittings and drains for in ground pull boxes. Boxes shall be sized as per NEC or as indicated on the drawings.
- C. See drawings for pull boxes requiring racks.
- D. Boxes with concentric knockouts are not acceptable.
- E. Provide ground terminal strip and ground pull box and circuits.
- F. As shown on Drawings.

PART 3 - EXECUTION

- 3.1 INSTALLATION
 - A. Provide junction boxes as shown on drawings and otherwise where required, sized according to number of conductors in box or type of service to be provided. Minimum junction box size 4 inches square and 2¹/₈ inches deep. Provide screw covers for junction boxes.
 - B. Use minimum 16-gauge steel for pull boxes and provide with screw cover.

- C. Install boxes in conduit runs wherever necessary to avoid too long runs or too many bends. Do not exceed 100-foot runs without pull boxes.
- D. Rigidly secure boxes to walls or ceilings. Conduit runs will not be considered adequate support.
- E. Install boxes with covers in accessible locations.
- F. Observe maximum conductor fill as required by the National Electrical Code.

END OF SECTION

SECTION 26 2416 PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes load centers and panel boards, overcurrent protective devices, and associated auxiliary equipment rated 600 V and less for the following types:
 - 1. Lighting and appliance branch-circuit panel boards.
 - 2. Distribution panel boards.
 - 3. Transient voltage surge suppressor panel boards.
- B. Related Sections include Section "Fuses."

1.3 DEFINITIONS

- A. EMI: Electromagnetic interference.
- B. GFCI: Ground-fault circuit interrupter (GFI).
- C. RFI: Radio-frequency interference.
- D. RMS: Root mean square.
- E. SPDT: Single pole, double throw.
- F. TVSS: Transient voltage surge suppressor.

1.4 SUBMITTALS

- A. Product Data: For each type of panel board, overcurrent protective device, TVSS device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Specification Compliance Review:
 - 1. Manufacturers and bidders must provide the consulting engineer with a Compliance Review of the Specifications and Addenda's. The Compliance Review shall be a paragraph-by-paragraph review of the Specifications and schedule with the following information; "C", "D", or "E" marked in the margin of the original Specifications and any subsequent Addenda's. If the manufacturer or bidder does not provide the Compliance Review to the engineer for review, with the submittal, the submittal will be subject to rejection as non-compliant.
 - a. "C" Comply with no exceptions.
 - b. "D" Comply with deviations. For each and every deviation, provide a numbered footnote with reasons for the proposed deviation and how the intent of the Specification can be satisfied.

- c. "E" Exception, do not comply. For each and every exception, provide a numbered footnote with reasons and possible alternatives. Non-compliance with the specifications is grounds for rejection as unacceptable. A bid from any alternative or listed equipment manufacturer with any number of exceptions will be reason for rejection for non-compliance without further review.
- d. Unless a deviation or exception is specifically noted in the Compliance Review, the manufacturer shall provide full compliance with entire specification. Deviations or exceptions taken in letters or cover letters in a bid document, subsidiary documents, by omission or by contradiction do not release the manufacturer or bidder from being in complete compliance, unless the exception or deviation has been specifically noted in the Compliance Review and approved by the consulting engineer.
- e. Equipment manufacturers or bidders that do not meet the specifications thru the above process will be subject to rejection without further review.
- C. Shop Drawings: For each panelboard and related equipment.
 - 1. Dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings. Include the following:
 - a. Enclosure types and details for types other than NEMA 250, Type 1.
 - b. Bus configuration, current, and voltage ratings.
 - c. Short-circuit current rating of panelboards and overcurrent protective devices.
 - d. UL listing for series rating of installed devices.
 - e. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
 - 2. Wiring Diagrams: Diagram power, signal, and control wiring and differentiate between manufacturer-installed and field-installed wiring.
- D. Field Tests Reports: Submit written test reports and include the following:
 - 1. Test procedures used.
 - 2. Test results that comply with requirements.
 - 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.
- E. Panel board Schedules: For installation in panel boards. Submit final versions after load balancing.
- F. Maintenance Data: For panel boards and components to include in maintenance manuals specified in Division 1. In addition to requirements specified in Division 1 Section "Closeout Procedures," include the following:
 - 1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
 - 2. Time-current curves, including selectable ranges for each type of overcurrent protective device.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Testing agency that is a member company of the International Electrical Testing Association and that is acceptable to authorities having jurisdiction.
 - 1. Testing Agency's Field Supervisor: Person currently certified by the International Electrical Testing Association or National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NEMA PB 1.
- D. Comply with NFPA 70.

1.6 COORDINATION

A. Coordinate layout and installation of panel boards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, and encumbrances to workspace clearance requirements.

1.7 EXTRA MATERIALS

A. Keys: Six (6) spares of each type of panel board cabinet lock.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, the following:
 - 1. Panel boards, Overcurrent Protective Devices, Controllers, Contactors, and Accessories:
 - a. Siemens
 - b. Square D Co.
 - c. Eaton
 - 2. Electronic Grade Panel boards:
 - a. Liebert Corporation.
 - b. Square D Co.
 - c. Eaton
 - d. Siemens

2.2 FABRICATION AND FEATURES

- A. Enclosures: Flush- and surface-mounted cabinets as indicated on drawings. NEMA PB 1, Type 1, to meet environmental conditions at installed location.
 - 1. Outdoor Locations: NEMA 250, Type 3R.
 - 2. Kitchen Areas: NEMA 250, Type 4X, stainless steel.
 - 3. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
- B. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.
- C. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
- D. Finish: Manufacturer's standard enamel finish over corrosion-resistant treatment or primer coat.

- E. Directory Card: With transparent protective cover, mounted inside metal frame, inside panelboard door.
- F. Bus: Hard-drawn copper, 98 percent conductivity. Aluminum is **NOT** acceptable.
- G. Main and Neutral Lugs:
 - 1. Compression type suitable for use with conductor material on MLO panels.
 - 2. Mechanical type suitable for use with conductor material on MCB panels.
- H. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment ground conductors; bonded to box.
- I. Service Equipment Label: UL labeled for use as service equipment for panel boards with main service disconnect switches.
- J. Future Devices: Mounting brackets, bus connections, and necessary appurtenances required for future installation of devices.
- K. Isolated Equipment Ground Bus: Adequate for branch-circuit equipment ground conductors; insulated from box, where indicated on drawings.
- L. Extra-Capacity Neutral Bus: Neutral bus rated 200 percent of phase bus and UL listed as suitable for nonlinear loads, where indicated on drawings.
- M. Split Bus: Vertical buses divided into individual vertical sections.
- N. Skirt for Surface-Mounted Panel boards: Same gage and finish as panel board front with flanges for attachment to panel board, wall, and ceiling or floor.
- O. Gutter Barrier: Arrange to isolate individual panel sections.
- P. Feed-through Lugs: Compression type suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
- Q. Provide power meters (peak KW, phase amperage, and kWh) with digital displays in the panels where indicated on the drawings. Provide single enclosure large enough for all panel components. Remote mounted meters are not acceptable. Mount meters in the upper portion of the enclosure. Provide correct trim kit for panel and meter. Meter shall have:
 - 1. Phase Amperage
 - 2. Peak Phase Amperage or KW
 - 3. KWh
 - 4. Phase Voltage
 - 5. Data Output connection to building management system for monitoring
 - 6. Digital Display

2.3 PANEL BOARD SHORT-CIRCUIT RATING

- A. UL label indicating series-connected rating with integral or remote upstream devices. Include size and type of upstream device allowable, branch devices allowable, and UL series-connected short-circuit rating.
- B. Fully rated to interrupt symmetrical short-circuit current available at terminals.
- C. See panel schedules for minimum rating.

2.4 LOAD CENTERS

- Α. Overcurrent Protective Devices: Plug-in, full-module circuit breaker.
- В. Conductor Connectors: Mechanical type for main, neutral, and ground lugs and buses.

2.5 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANEL BOARDS

- A. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.
- Β. Doors: Front mounted with concealed hinges; secured with flush latch with tumbler lock; keved alike.

DISTRIBUTION PANEL BOARDS 2.6

- Α. Doors: Front mounted, except omit in fused-switch panelboards; secured with vault-type latch with tumbler lock; keyed alike. Square D I-Line or approved equal.
- Β. Main Overcurrent Protective Devices: Thermal magnetic circuit breaker.
- C. Branch Overcurrent protective devices shall be one of the following:
 - For Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers. 1.
 - For Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers; plug-in 2. circuit breakers where individual positive-locking device requires mechanical release for removal.

2.7 ELECTRONIC GRADE PANEL BOARDS

- A. Doors: Front mounted; secured with vault-type latch with tumbler lock; keyed alike. Manufacturer's standard enamel finish over corrosion-resistant treatment or primer coat.
- B. Main Overcurrent Devices: Thermal-magnetic circuit breaker.
- C. Branch Overcurrent Protective Devices: Bolt-on circuit breakers.
- D. Bus: Copper phase and neutral buses; 200 percent capacity neutral bus.
- Ε. TVSS Device: IEEE C62.41, integrally plug-in-style, solid-state, mounted, parallel-connected, sine-wave tracking suppression and filtering modules. 1.
 - Minimum single-impulse current rating shall be as follows:
 - Line to Neutral: 100.000 A. a.
 - Line to Ground: 100.000 A. b.
 - c. Neutral to Ground: 50.000 A.
 - 2. Protection modes shall be as follows:
 - a. Line to neutral.
 - b. Line to ground.
 - Neutral to ground. c.
 - 3. EMI/RFI Noise Attenuation Using 50-ohm Insertion Loss Test: 55 dB at 100 kHz.
 - Category C combination wave clamping voltage shall not exceed 600 V, line to neutral 4. and line to ground on 120/208 V systems or 1000 V, line to neutral and line to ground on 277/480 V systems.
 - 5. UL 1449 clamping levels shall not exceed 400 V, line to neutral and line to ground on 120/208 V systems or 800 V, line to neutral and line to ground on 277/480 V systems.

PANEL BOARDS

- 6. Withstand Capabilities: 3000 Category C surges with less than 5 percent change in clamping voltage.
- 7. Accessories shall include the following:
 - a. Form-C contacts, one normally open and one normally closed, for remote monitoring of system operation. Contacts to reverse position on failure of any surge diversion module.
 - b. Audible contacts, one normally open and one normally closed, for remote monitoring of system operation. Contacts to reverse position on failure of any surge diversion module.
 - c. Six-digit transient-counter set to total transient surges that deviate from the sine-wave envelope by more than 125 V.

2.8 OVERCURRENT PROTECTIVE DEVICES

- A. Molded-Case Circuit Breaker: NEMA AB 1, with interrupting capacity to meet available fault currents. Breakers shall be fully rated for panel AIC rating.
 - 1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
 - 2. GFCI Circuit Breakers: Single- and two-pole configurations with 30-mA trip sensitivity.
- B. Molded-Case Circuit-Breaker Features and Accessories. Standard frame sizes, trip ratings, and number of poles.
 - 1. Lugs: Compression style, suitable for number, size, trip ratings, and material of conductors.
 - 2. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.
 - 3. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
 - 4. Communication Capability: Circuit-breaker-mounted communication module with functions and features compatible with power monitoring and control system.
 - 5. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 75 percent of rated voltage.
 - 6. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
 - 7. Auxiliary Switch: Two SPDT switches with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
 - 8. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.
 - 9. Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function.
- C. Fused Switch: NEMA KS 1, Type HD; clips to accommodate specified fuses; lockable handle.

2.9 CONTROLLERS

- A. Motor Controllers: NEMA ICS 2, Class A combination controller equipped for panelboard mounting and including the following accessories:
 - 1. Individual control-power transformers.
 - 2. Fuses for control-power transformers.
 - 3. Bimetallic-element overload relay.
 - 4. Melting-alloy overload relay.
 - 5. Indicating lights.
 - 6. Seal-in contact.

- 7. Two convertible auxiliary contacts.
- 8. Push buttons.
- 9. Selector switches.
- B. Contactors: NEMA ICS 2, Class A combination controller equipped for panelboard mounting and including the following accessories:
 - 1. Individual control-power transformers.
 - 2. Fuses for control-power transformers.
 - 3. Indicating lights.
 - 4. Seal-in contact.
 - 5. Two convertible auxiliary contacts.
 - 6. Push buttons.
 - 7. Selector switches.
- C. Controller Disconnect Switches: Fused switch mounted adjacent to and interlocked with controller.
 - 1. Auxiliary Contacts: Integral with disconnect switches to de-energize external control-power source.
- D. Contactors in Main Bus: NEMA ICS 2, Class A, mechanically held general-purpose controller.
 - 1. Control-Power Source: Control-power transformer, with fused primary and secondary terminals, connected to main bus ahead of contactor connection.

2.10 ACCESSORY COMPONENTS AND FEATURES

- A. Accessory Set: Tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.
- B. Portable Test Set: To test functions of solid-state trip devices without removal from panel board.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install panel boards and accessories according to NEMA PB 1.1. Provide 3-foot clearance in front of panel board. Coordinate with other equipment.
- B. Mounting Heights: Top of trim 74 inches above finished floor, unless otherwise indicated. Mount with at least 6 inches of clearance below panel board.
- C. Mounting: Plumb and rigid without distortion of box. Mount recessed panel boards with fronts uniformly flush with wall finish.
- D. Circuit Directory: Create a directory to indicate installed circuit loads after balancing panel board loads. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable. Use manufacturers supplied card and permanent slot location.
- E. Install filler plates in unused spaces.

- F. Provision for Future Circuits at Flush Panel boards: Stub four 1-inch empty conduits from panel board into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch empty conduits into raised floor space or below slab not on grade.
- G. Wiring in Panel board Gutters: Arrange conductors into groups and bundle and wrap with wire ties after completing load balancing.
- H. Where panelboard meters are indicated, provide power to the meter from the panel being served. Provide CT's in the panel enclosure. Connect CT's to the meter and verify operation of demand and voltage.

3.2 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Section "Electrical Identification."
- B. Panel board Nameplates: Label all panel boards with engraved metal or laminated-plastic nameplate mounted with corrosion-resistant screws. Provide red nameplates for emergency or stand-by power branch fed panels. Nameplate shall include:
 - 1. Normal Power
 - a. Panel Name
 - b. Voltage "277/480", "120/208", or "120/240"
 - c. Panel fed from "panel name or transformer name"
 - 2. Generator Powered Panels
 - a. Panel Name
 - b. Voltage "277/480", "120/208", or "120/240"
 - c. Panel fed from "panel name or transformer name"
 - d. Non-Hospital
 - 1) Non-emergency, "Stand-By Branch"
 - 2) Life Safety Non-Hospital, "Life Safety Branch"
 - Hospital Essential Branches:
 - 1) "Life Safety"
 - 2) "Critical Branch"
 - 3) "Equipment Branch"

3.3 CONNECTIONS

- A. Install equipment grounding connections for panel boards with ground continuity to main electrical ground bus.
- B. 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.

3.4 FIELD QUALITY CONTROL

e.

- A. Prepare for acceptance tests as follows:
 - 1. Test insulation resistance for each panel board bus, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.
- B. Testing: After installing panel boards and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements.

- 1. Procedures: Perform each visual and mechanical inspection and electrical test indicated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters.
- 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
- C. Balance Loads: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes as follows:
 - 1. Measure as directed during period of normal system loading.
 - 2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data-processing, computing, transmitting, and receiving equipment.
 - 3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
 - 4. Tolerance: Difference exceeding 20 percent between phase loads, within a panel board, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

3.5 ADJUSTING

A. Provide factory technician to set field-adjustable switches and circuit-breaker trip ranges.

3.6 CLEANING

A. On completion of installation, inspect interior and exterior of panel boards. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

END OF SECTION

SECTION 26 2726 WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes receptacles, connectors, switches, and finish plates.

1.3 DEFINITIONS

- A. GFCI/GFI: Ground-fault circuit interrupter.
- B. SPD: Surge protective device.

1.4 SUBMITTALS

- A. Product Data: For each product specified.
- B. Shop Drawings: Legends for receptacles and switch plates.
- C. Samples: For devices and device plates for color selection and evaluation of technical features.
- D. Maintenance Data: For materials and products to include in maintenance manuals specified in Division 1.

1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.
- B. Comply with NEMA WD 1.
- C. Comply with NFPA 70.

1.6 COORDINATION

- A. Receptacles for Owner-Furnished Equipment: Match plug configurations.
 - 1. Cord and Plug Sets: Match equipment requirements.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents. Deliver extra materials to Owner.

- 1. Telephone/Power Service Poles: One for each 10, but not less than one.
- 2. Floor Service-Outlet Assemblies: One for each 10, but not less than one.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Wiring Devices:
 - a. Bryant Electric, Inc.
 - b. Eagle Electric Manufacturing Co., Inc.
 - c. Hubbell, Inc.; Wiring Devices Div.
 - d. Killark Electric Manufacturing Co.
 - e. Leviton Manufacturing Co., Inc.
 - f. Pass & Seymour/Legrand; Wiring Devices Div.
 - 2. Multi-outlet Assemblies:
 - a. Airey-Thompson Co.
 - b. Wiremold.
 - 3. Floor Service Outlets and Telephone/Power Poles:
 - a. American Electric.
 - b. Hubbell, Inc.; Wiring Devices Div.
 - c. Pass & Seymour/Legrand; Wiring Devices Div.
 - d. Square D Co.
 - e. Wiremold.

2.2 RECEPTACLES

- A. Straight-Blade and Locking Receptacles: Commercial spec grade Configuration NEMA 5-20R. Color by Architect/Owner.
- B. GFCI Receptacles: Feed-through type, with integral NEMA WD 6, Configuration 5-20R duplex receptacle arranged to protect connected downstream receptacles on same circuit. Design units for installation in a 2³/₄-inch-deep outlet box without an adapter. Provide with test light as per NEC.
- C. Isolated-Ground Receptacles: Equipment grounding contacts connected only to the green grounding screw terminal of the device with inherent electrical isolation from mounting strap.
 - 1. Devices: Orange in color and listed and labeled as isolated-ground receptacles.
 - 2. Isolation Method: Integral to receptacle construction and not dependent on removable parts.
- D. TVSS Receptacles: Duplex type, NEMA WD 6, Configuration 5-20R, with integral TVSS in line to ground, line to neutral, and neutral to ground.
- E. USB Receptacles:
 - 1. USB Charger Tamper-Resistant Receptacle, Two USB Type 2.0 ports 3.5 Amp, 5 Volt DC, 20 Amp, 125 Volt AC Decorator Duplex.
 - a. Green LED indicator to show USB power available.
 - b. Impact and chemical resistant.
 - c. Flush fit design.
 - d. Meets UL94 for 5V flammability rating.
 - e. Complies with battery charging specification USB BC1.2.
 - f. Compatible with USB 1.1/2.0/3.0 devices.

- g. Listed to UL498 and UL1310.
- F. Industrial Heavy-Duty Receptacle: Comply with IEC 309-1.
- G. All receptacles on emergency/stand-by power shall be red hospital grade. Faceplate.color by Architect. All emergency/stand-by power receptacles shall have circuit numbers on faceplate. Refer to panel schedules and one-line for emergency/stand-by power branches.
- H. Fifteen amp (15A) receptacles are not acceptable and shall not be installed unless specifically directed by the engineer.

2.3 PENDANT CORD/CONNECTOR DEVICES

- A. Description: Matching, locking type, plug and receptacle body connector, NEMA WD 6, Configurations L5-20P and L5-20R, Heavy-Duty grade.
 - 1. Body: Nylon with screw-open cable-gripping jaws and provision for attaching external cable grip.
 - 2. External Cable Grip: Woven wire-mesh type made of high-strength galvanized-steel wire strand, matched to cable diameter, and with attachment provision designed for corresponding connector. (Kellum or equal)

2.4 CORD AND PLUG SETS

- A. Description: Match voltage and current ratings and number of conductors to requirements of equipment being connected.
 - 1. Cord: Rubber-insulated, stranded-copper conductors, with type SOW-A jacket. Green-insulated grounding conductor, and equipment-rating ampacity plus a minimum of 30 percent.
 - 2. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

2.5 SWITCHES

- A. Snap Switches: Commercial spec grade.
- B. Combination Switch and Receptacle: Both devices in a single gang unit with plaster ears and removable tab connector that permit separate or common feed connection.
 - 1. Switch: 20 A, 120/277-V ac.
 - 2. Receptacle: NEMA WD 6, Configuration 5-20R.
- C. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on/off switches and audible and electromagnetic noise filters rated for amperage and voltage listed.
 - 1. Control: Continuously adjustable slide, and push-button on/off. Single-pole or three-way switch to suit connections.
 - 2. Incandescent Lamp Dimmers: Modular, 120 V, 60 Hz with continuously adjustable slide and toggle or rocker; single pole with soft tap or other quiet switch; electromagnetic filter to eliminate noise, RF, and TV interference; and 5-inch wire connecting leads.

2.6 WALL PLATES

- A. Single and combination types match corresponding wiring devices.
 - 1. Plate-Securing Screws: Metal with head color to match plate finish. Color by Architect.
 - 2. Material for Finished Spaces:

- a. Smooth, unbreakable nylon; color by Architect.
- 3. Material for Unfinished spaces: (Mechanical, Electrical) or surface mounted locations: stainless steel.

2.7 FLOOR SERVICE FITTINGS

- A. Type: Modular, flush-type, dual-service units suitable for wiring method used.
- B. Compartmentation: Barrier separates power and signal compartments.
- C. Housing Material: Die-cast aluminum, satin finished.
- D. Power Receptacle: NEMA WD 6, Configuration 5-20R, gray finish, unless otherwise indicated.
- E. Signal Outlet: Blank cover with bushed cable opening, unless otherwise indicated.

2.8 MULTI-OUTLET ASSEMBLIES

- A. Components of Assemblies: Products from a single manufacturer designed for use as a complete, matching assembly of raceways and receptacles.
- B. Raceway Material: Metal, with manufacturer's standard finish.
- C. Raceway Material: Nonmetal.
- D. Wire: No. 12 AWG.

2.9 TELEPHONE/POWER SERVICE POLES

- A. Description: Factory-assembled and -wired units to extend power, telephone, and data service from distribution wiring concealed in ceiling to devices or outlets in pole near floor.
 - 1. Poles: Nominal 2.5-inch-square cross section with height adequate to extend from floor to at least 6 inches above ceiling, and separate channels for power and signal wiring.
 - 2. Mounting: Ceiling trim flange with concealed bracing arranged for positive connection to ceiling supports, and pole foot with carpet pad attachment.
 - 3. Finishes: One of manufacturers standard finish and trim combinations, including painted and satin anodized-aluminum finishes and wood-grain-type trim.
 - 4. Wiring: Sized for six No. 12 AWG power and ground conductors; one 75-ohm coaxial telephone/data cable; and four four-pair, 75-ohm telephone/data cable.
 - 5. Power Receptacles: four single; 20-A; heavy-duty; NEMA WD 6, Configuration 5-20R units.
 - 6. Signal Outlets: Blank insert with bushed cable opening.

PART 3 - EXECUTION

- 3.1 INSTALLATION
 - A. Install devices and assemblies straight, plumb and secure.
 - B. Install devices as per ADA height requirements.

- C. Review Architectural elevations to coordinate locations and mounting heights. If there are any discrepancies request information prior to install. If height is not listed on the drawings refer to the following:
 - 1. General purpose receptacles @ 18" AFF.
 - 2. General purpose receptacles at retirement facilities, nursing homes, hospice, nursing facilities @ 24" AFF.
 - 3. TV receptacles at the TV mounting location (see architectural elevations) or at 96" AFF.
 - 4. Above counter receptacles @ 6" above backsplash.
 - 5. Toilet room receptacles @ 48" AFF.
 - 6. Equipment receptacles at the piece of equipment. Coordinate with architectural elevations and equipment submittals.
 - 7. Receptacles shall not be installed flat on any counter surface.
- D. Install wall plates when painting is complete. Remove all paint from any wall plates.
- E. Provide GFI receptacles within 6 feet of all sinks, exterior receptacles, undercounter equipment, at exterior HVAC equipment, vending machines, and in kitchens.
- F. Install wall dimmers to achieve indicated rating after de-rating for ganging as instructed by manufacturer.
- G. Do not share neutral conductor on load side of dimmers.
- H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical, and grounding terminal of receptacles on top. Group adjacent switches under single, multi-gang wall plates.
- I. Protect devices and assemblies during painting.
- J. Adjust locations at which floor service outlets and telephone/power service poles are installed to suit arrangement of partitions and furnishings.
- K. GFCI or GFI receptacles shall be wired to "trip" individually not the entire circuit. Receptacles shall not be daisy chained together from a GFI and create a GFI "protected" receptacle.

3.2 IDENTIFICATION

- A. Comply with Section "Electrical Identification."
 - 1. Switches: Where three or more switches are ganged, and elsewhere as indicated, identify each switch with approved legend engraved on wall plate.
 - 2. Receptacles: Identify panelboard and circuit number from which served. Use machine-printed, pressure-sensitive, abrasion-resistant label tape on face of plate and durable wire markers or tags within outlet boxes.

3.3 CONNECTIONS

- A. Connect wiring device grounding terminal to branch-circuit equipment grounding conductor.
- B. Isolated-Ground Receptacles: Connect to isolated-ground conductor routed to designated isolated equipment ground terminal of electrical system.
- C. Tighten electrical connectors and terminals according to manufacturers published torque-tightening values. If manufacturers torque values are not indicated, use those specified in UL 486A and UL 486B.

3.4 FIELD QUALITY CONTROL

- A. Test wiring devices for proper polarity and ground continuity. Operate each device at least six times.
- B. Test GFCI operation with both local and remote fault simulations according to manufacturer's written instructions.
- C. Replace damaged or defective components.

3.5 CLEANING

A. Internally clean devices, device outlet boxes, and enclosures. Replace stained or improperly painted wall plates or devices.

END OF SECTION
SECTION 26 2816 DISCONNECT SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes individually mounted switches and circuit breakers used for the following:
 - 1. Service disconnect switches.
 - 2. Feeder and equipment disconnect switches.
 - 3. Feeder branch-circuit protection.
 - 4. Motor disconnect switches.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Section "Wiring Devices" for attachment plugs and receptacles, and snap switches used for disconnect switches.
 - 2. Section "Switchboards" for individually enclosed, fused power-circuit devices used as feeder disconnect switches.

1.3 SUBMITTALS

- A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Product Data for disconnect switches, circuit breakers, and accessories specified in this Section.
- C. Wiring diagrams detailing wiring for power and control systems and differentiating between manufacturer-installed and field-installed wiring.
- D. Field test reports.
- E. Maintenance data for tripping devices to include in the operation and maintenance manual specified in Division 1.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain disconnect switches and circuit breakers from one source and by a single manufacturer.
- B. Comply with NFPA 70 for components and installation.
- C. Listing and Labeling: Provide disconnect switches and circuit breakers specified in this Section that are listed and labeled.
 - 1. The Terms "Listed" and "Labeled": As defined in the National Electrical Code, Article 100.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Molded-Case Circuit Breakers:
 - a. Siemens Energy & Automation, Inc.
 - b. Square D Co.
 - 2. Combination Circuit Breaker and Ground Fault Trip:
 - a. Siemens Energy & Automation, Inc.
 - b. Square D Co.
 - 3. Molded-Case, Current-Limiting Circuit Breakers:
 - a. Siemens Energy & Automation, Inc.
 - b. Square D Co.
 - 4. Integrally Fused, Molded-Case Circuit Breakers:
 - a. Siemens Energy & Automation, Inc.
 - b. Square D Co.

2.2 DISCONNECT SWITCHES

- A. Enclosed, 600V Nonfusible Switch: NEMA KS 1, Type HD, with lockable handle. Switch shall be rated for equipment protecting.
- B. Enclosed, 600V Fusible Switch, 800 A and Smaller: NEMA KS 1, Type HD, clips to accommodate specified fuses, enclosure consistent with environment where located, handle lockable with 2 padlocks, and interlocked with cover in CLOSED position. Switch shall be rated for equipment protecting.
- C. Enclosure: NEMA KS 1, Type 1, unless otherwise specified or required to meet environmental conditions of installed location.
 - 1. Outdoor Locations: Type 3R.
 - 2. Wet or Damp Indoor Locations: Type 4.

2.3 ENCLOSED CIRCUIT BREAKERS

- A. Enclosed, Molded-Case Circuit Breaker: NEMA AB 1, with lockable handle.
- B. Characteristics: Frame size, trip rating, number of poles, and auxiliary devices as indicated and interrupting rating to meet available fault current. Breakers will be fully rated for panel AIC rating.
- C. Application Listing: Appropriate for application, including switching fluorescent lighting loads or heating, air-conditioning, and refrigerating equipment.
- D. Circuit Breakers, 200 A and Larger: Trip units interchangeable within frame size.
- E. Circuit Breakers, 400 A and Larger: Field-adjustable, short-time and continuous-current settings.
- F. Current-Limiting Trips: Where indicated, let-through ratings less than NEMA FU 1, Class RK-5.
- G. Current Limiters: Where indicated, integral fuse listed for circuit breaker.

- H. Molded-Case Switch: Where indicated, molded-case circuit breaker without trip units.
- I. Lugs: Mechanical lugs and power-distribution connectors for number, size, and material of conductors indicated.
- J. Shunt Trip: Where indicated.
- K. Accessories: As indicated.
- L. Enclosure: NEMA AB 1, Type 1, unless otherwise specified or required to meet environmental conditions of installed location.
 - 1. Outdoor Locations: Type 3R.
 - 2. Wet or Damp Indoor Locations: Type 4.
 - 3. Hazardous Areas Indicated on Drawings: Type 7C.
- M. Transient Voltage Surge Suppressors: IEEE C62.41, to meet requirements for category indicated.
 - 1. Exposure: High.
 - 2. Impulse sparkover voltage coordinated with system circuit voltage.
 - 3. Factory mounted with UL-recognized mounting device.
- N. Motor circuit breakers shall be Square D thermal magnetic breakers.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install disconnect switches and circuit breakers in locations as indicated, according to manufacturer's written instructions. Provide 2-inch clearance for operation and maintenance.
- B. Install disconnect switches and circuit breakers level and plumb.
- C. Install wiring between disconnect switches, circuit breakers, control, and indication devices.
- D. Connect disconnect switches and circuit breakers and components to wiring system and to ground as indicated and instructed by manufacturer.
 - 1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486 A and UL 486 B.
- E. Identify each disconnect switch and circuit breaker according to requirements specified in Section "Electrical Identification."

3.2 FIELD QUALITY CONTROL

- A. Testing: After installing disconnect switches and circuit breakers and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements.
 - 1. Procedures: Perform each visual and mechanical inspection and electrical test stated in NETA ATS, Section 7.5 for disconnect switches 7.6 for molded-case circuit breakers. Certify compliance with test parameters.
- B. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, remove and replace with new units and retest.

- C. Infrared Scanning: After Substantial Completion, but not more than two (2) months after Final Acceptance, perform an infrared scan of each disconnect switch and circuit breaker. Remove fronts to make joints and connections accessible to a portable scanner.
 - 1. Follow-up Infrared Scanning: Perform one (1) additional follow-up infrared scan of each disconnect switch and circuit breaker 11 months after date of Substantial Completion.
 - 2. Instrument: Use an approved infrared scanning device designed to measure temperature or detect significant deviations from normal values. Provide calibration record for device used.
 - 3. Record of Infrared Scanning: Prepare a certified report identifying disconnect switch and circuit breaker checked and describing results of scanning. Include notation of deficiencies detected, remedial action taken and observations after remedial action.

3.3 ADJUSTING

A. Set field-adjustable disconnect switches and circuit-breaker trip ranges as indicated by the Electrical System Coordination Study. Refer to Section – Overcurrent Protection for fault current analysis, coordination study, electrical tests, and device setting requirements.

3.4 CLEANING

A. After completing system installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finish including chips, scratches, and abrasions.

END OF SECTION

SECTION 26 4313 SURGE PROTECTIVE DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes Surge Protective Devices for low-voltage power, control, and communication equipment.
- B. Related Sections include the following:
 - 1. Section "Wiring Devices" for devices with Surge Protective Devices.
 - 2. Section "Panelboards" for factory-installed Surge Protective Devices.
 - 3. Section "Switchboards" for factory-installed Surge Protective Devices.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities; shipping, installed, and operating weights; furnished specialties; and accessories.
- B. Product Certificates: Signed by manufacturers of surge protective devices, certifying that products furnished comply with the following testing and labeling requirements:
 - 1. UL 1283 certification.
 - 2. UL 1449 Third Edition, or most recent edition, listing and classification.
- C. Field Test Reports: Written reports of tests specified in Part 3 of this Section. Include the following:
 - 1. Test procedures used.
 - 2. Test results that comply with requirements.
 - 3. Failed test results and corrective action taken to achieve requirements.
- D. Specification Compliance Review:
 - 1. Manufacturers and bidders must provide the consulting engineer with a Compliance Review of the Specifications and Addenda's. The Compliance Review shall be a paragraph-by-paragraph review of the Specifications and schedule with the following information; "C", "D", or "E" marked in the margin of the original Specifications and any subsequent Addenda's. If the manufacturer or bidder does not provide the Compliance Review to the engineer for review, with the submittal, the submittal will be subject to rejection as non-compliant.
 - a. "C" Comply with no exceptions.
 - b. "D" Comply with deviations. For each and every deviation, provide a numbered footnote with reasons for the proposed deviation and how the intent of the Specification can be satisfied.
 - c. "E" Exception, do not comply. For each and every exception, provide a numbered footnote with reasons and possible alternatives. Non-compliance with the specifications is grounds for rejection as unacceptable. A bid from any alternative or listed equipment manufacturer with any number of exceptions will be reason for rejection for non-compliance without further review.

- d. Unless a deviation or exception is specifically noted in the Compliance Review, the manufacturer shall provide full compliance with entire specification. Deviations or exceptions taken in letters or cover letters in a bid document, subsidiary documents, by omission or by contradiction do not release the manufacturer or bidder from being in complete compliance, unless the exception or deviation has been specifically noted in the Compliance Review and approved by the consulting engineer.
- e. Equipment manufacturers or bidders that do not meet the specifications thru the above process will be subject to rejection without further review.
- E. Maintenance Data: For surge protective devices to include in maintenance manuals specified in Division 1.
- F. Warranties: Special warranties specified in this Section.
- G. All surge suppression device shall be sourced from the same company and current models.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain surge protective devices and accessories through one source from a single manufacturer.
- B. Product Options: Drawings indicate size, dimensional requirements, and electrical performance of surge protective device and are based on the specific system indicated. Other manufacturers' products complying with requirements may be considered. Refer to Division 1 Section "Substitutions."
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. IEEE Compliance: Comply with IEEE C62.41.1-2002, "IEEE Guide for Surge Voltages in Low Voltage AC Power Circuits," IEEE C62.41.2 - 2002. "IEEE Recommended Practice on Characterization of Surges in Low Voltage AC Power Circuits" and test devices according to IEEE C62.45-2002, "IEEE Recommended Practice on Surge Testing for Equipment connected to Low Voltage AC Power Circuits.
- E. NOTE: NEMA LS 1 was rescinded in 2009. Any reference to NEMA LS1 should be removed. We can provide documentation if necessary.
- F. UL Compliance: Comply with UL 1283, "Electromagnetic Interference Filters," and UL 1449 Third Addition, or most recent edition, "Surge Protective Devices."

1.5 PROJECT CONDITIONS

- A. Placing into Service: Do not energize or connect service entrance equipment, panelboards, control terminals, or data terminals to their sources until the installer verifies the service and separately derived system's Neutral to Ground bonding jumpers per NEC. After the system is energized and stable, connect the surge protective device.
- B. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
 - 1. Notify Architect not less than two days in advance of proposed utility interruptions.
 - 2. Do not proceed with utility interruptions without Architect's written permission.

- C. Service Conditions: Rate surge protective devices for continuous operation under the following conditions, unless otherwise indicated:
 - 1. Maximum Continuous Operating Voltage: Not less than 115 percent of nominal system operating voltage for 480Y/277V and not less than 125 percent of nominal voltage for 208Y/120V (Verifiable at UL.com).
 - 2. Operating Temperature: 30 to 120 deg F.
 - 3. Humidity: 0 to 85 percent, noncondensing.
 - 4. Altitude: Less than 20,000 feet above sea level.

1.6 COORDINATION

A. Coordinate location of field-mounted surge protective device to allow adequate clearances for maintenance.

1.7 WARRANTY

- A. General Warranty: Special warranties 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.
 - 1. Provide 5 year manufacturer warranty, 1 year labor install warranty.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

2.

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Manufacturers of a Broad Line of Surge Protective Devices:
 - a. Atlantic Scientific Corp.
 - b. Current Technology, Inc.
 - c. Cutler-Hammer, Inc.
 - d. Hubbell.
 - e. Leviton Manufacturing Co., Inc.
 - f. Liebert Corp.
 - g. Northern Technologies.
 - h. Siemens Energy & Automation.
 - i. Square D Co.
 - j. Tycor International, Inc.
 - k. Advanced Protection Technologies, Inc. (APT).
 - Manufacturers of Category A and Telephone/Data Line Surge Protective Devices:
 - a. MCG Electronics, Inc.
 - b. NTE Electronics, Inc.
 - c. Telebyte Technology, Inc.
 - d. Advanced Protection Technologies, Inc. (APT).

2.2 SERVICE ENTRANCE SURGE PROTECTIVE DEVICE

A. Surge Protective Device Description: Non-modular type with the following features and accessories:

- 1. Visual LED indicator lights for power and protection status including a minimum of one green LED indicator per phase, and one red service LED.
- 2. Audible alarm, with a diagnostic test function and a silencing switch, to indicate when protection has failed.
- 3. One set of dry contacts rated at 5 a, 250-V ac, for remote monitoring of protection status.
- B. Peak Single-Impulse Surge Current Rating: 200 kA per phase, minimum.
- C. Connection Means: Permanently wired.
- D. Protection modes and UL 1449 Third Edition, or most recent edition, Voltage Protection Rating (VPR) for grounded wye circuits with voltages of 480Y/277 and 208Y/120; three-phase, four-wire circuits, shall be as follows:
 - 1. Line to Neutral: 1200 V for 480Y/277 and 700 V for 208Y/120.
 - 2. Line to Ground: 1200 V for 480Y/277 and 700 V for 208Y/120.
 - 3. Neutral to Ground: 1200 V for 480Y/277 and 700 V for 208Y/120.
- E. SPD shall be UL labeled with 200 kA Short Circuit Current Rating (SCCR). Fuse ratings shall not be considered in lieu of demonstrated withstand testing of SPD, per NEC 285.6.
- F. SPD shall be UL labeled as Type 1 (verifiable at UL.com), intended for use without need for external or supplemental overcurrent controls. Every suppression component of every mode, including N-G, shall be protected by internal overcurrent and thermal overtemperature controls. SPDs relying upon external or supplementary installed safety disconnectors do not meet the intent of this specification.
- G. SPD shall be UL labeled with 20 kA Inominal (I-n), which is verifiable at UL.com for compliance to UL 96A Lightning Protection Master Label and NFPA 780.

2.3 PANELBOARD SURGE PROTECTIVE DEVICES

- A. Surge Protective Device Description: Non-modular type with the following features and accessories:
 - 1. Visual LED indicator lights for power and protection status including a minimum of one green LED indicator per phase and one red service LED.
 - 2. Audible alarm, with silencing switch, to indicate when protection has failed.
 - 3. One set of dry contacts rated at 5 a, 250-V ac, for remote monitoring of protection status.
- B. Peak Single-Impulse Surge Current Rating: 100 kA per phase minimum.
- C. Protection modes and UL 1449 Third Edition Voltage Protection Rating (VPR) for grounded wye circuits with voltages of 480Y/277 and 208Y/120; three-phase, four-wire circuits, shall be as follows:
 - 1. Line to Neutral: 1200 V for 480Y/277 and 700 V for 208Y/120.
 - 2. Line to Ground: 1200 V for 480Y/277 and 700 V for 208Y/120.
 - 3. Neutral to Ground: 1200 V for 480Y/277 and 700 V for 208Y/120.
- D. SPD shall be UL labeled with 200 kA Short Circuit Current Rating (SCCR). Fuse ratings shall not be considered in lieu of demonstrated withstand testing of SPD, per NEC 285.6.
- E. SPD shall be UL labeled as Type 1 (verifiable at UL.com), intended for use without need for external or supplemental overcurrent controls. Every suppression component of every mode, including N-G, shall be protected by internal overcurrent and thermal overtemperature

controls. SPDs relying upon external or supplementary installed safety disconnectors do not meet the intent of this specification.

F. SPD shall be UL labeled with 20 kA Inominal (I-n), which is verifiable at UL.com, for compliance to UL 96A Lightning Protection Master Label and NFPA 780.

2.4 AUXILIARY PANEL SURGE PROTECTIVE DEVICES

- A. Surge Protective Device Description: Unit type, panel-mounted design with the following features and accessories:
 - 1. Visual LED indicator lights for power and protection status including a minimum of one green LED indicator per phase and one red service LED.
 - 2. Audible alarm, with silencing switch, to indicate when protection has failed.
 - 3. One set of dry contacts rated at 5 A, 250-V ac, for remote monitoring of protection status.
 - 4. Arrangement with wire connections to phase buses, neutral bus, and ground bus.
- B. Peak Single-Impulse Surge Current Rating: 100 kA per phase minimum.
- C. Protection modes and UL 1449 Third Edition Voltage Protection Rating (VPR) for grounded wye circuits with voltages of 480Y/277 and 208Y/120; three-phase, four-wire circuits, shall be as follows:
 - 1. Line to Neutral: 1200 V for 480Y/277 and 700 V for 208Y/120.
 - 2. Line to Ground: 1200 V for 480Y/277 and 700 V for 208Y/120.
 - 3. Neutral to Ground: 1200 V for 480Y/277 and 700 V for 208Y/120.
- D. SPD shall be UL labeled with 200 kA Short Circuit Current Rating (SCCR). Fuse ratings shall not be considered in lieu of demonstrated withstand testing of SPD, per NEC 285.6.
- E. SPD shall be UL labeled as Type 1 (verifiable at UL.com), intended for use without need for external or supplemental overcurrent controls. Every suppression component of every mode, including N-G, shall be protected by internal overcurrent and thermal overtemperature controls. SPDs relying upon external or supplementary installed safety disconnectors do not meet the intent of this specification.
- F. SPD shall be UL labeled with 20 kA Inominal (I-n), which is verifiable at UL.com, for compliance to UL 96A Lightning Protection Master Label and NFPA 780.

2.5 SPECIAL SYSTEMS CONTROL AND DATA TERMINALS

A. Protectors for fire alarm, copper control, data, antenna, and telephone conductors entering the building from the outside shall be as recommended by the manufacturer for the type of line being protected.

2.6 ENCLOSURES

A. NEMA 250, with type matching the enclosure of panel or device being protected.

PART 3 - EXECUTION

3.1 INSTALLATION OF SURGE PROTECTIVE DEVICES

- A. Provide surge suppression for the incoming service at the switchboard or service entrance equipment.
- B. Provide surge suppression at the tele/data demark phone board or cabinet as close as possible to the incoming conduit and conductors. Provide surge suppression for all tele/data conductors that are run underground from one MDF/IDF to another.
- C. Provide surge suppression at all fire alarm panels that connect to any fire alarm panel or device with underground conductors.
- D. Install devices at service entrance on load side, with ground lead bonded to service entrance ground.
- E. Install devices for panelboard and auxiliary panels with conductors between surge protective device and points of attachment as short (less than 24") and straight as possible. Gently twist conductors together. Do not exceed manufacturer's recommended lead length. Do not bond neutral and ground.
- F. Install devices at service entrance on load side with ground lead bonded to service entrance ground. At Service Entrance or Transfer Switch, a UL approved disconnect switch shall be provided as a means of servicing disconnect if a 60 A breaker is not available.
- G. Install devices for Distribution, MCC and Branch panelboards with conductors between supressors and points of attachment as short and straight as possible. Do not exceed manufacturer's recommended lead length. Do not bond neutral to ground.
- H. SPD shall have an independent means of servicing disconnect such that the protected panel remains energized. Provide a 30 Amp breaker (or larger sized by manufacturer) to serve this function.
- I. Installer may reasonably rearrange breaker locations to ensure short & straightest possible leads to SPDs.
- J. Before energizing, installer shall verify service and separately derived system Neutral to Ground bonding jumpers per NEC.
- K. For surface mounted panel boards, associated surge protective device shall be surface mounted adjacent to the panel board with user access. For recessed mounted panel boards, associated surge protective devices shall be mounted recessed adjacent to the panel board with user access. Do not mount above 84 inches unless directed.

3.2 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturers published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.3 FIELD QUALITY CONTROL

- A. Testing: Perform the following field quality-control testing:
 - 1. After installing surge protective devices, test for compliance with requirements.
 - 2. Complete startup checks according to manufacturer's written instructions.
 - 3. Perform each visual and mechanical inspection and electrical test stated in NETA ATS, Section 7.19. Certify compliance with test parameters.
 - 4. If the SPD led are not green, replace with new unit.

- B. Repair or replace malfunctioning units. Retest after repairs or replacements are made.
- C. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including piping and electrical connections. Report results in writing.
 - 1. Verify that electrical wiring installation complies with manufacturer's installation requirements.

END OF SECTION

SECTION 26 5100 INTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes interior lighting fixtures, lighting fixtures mounted on exterior building surfaces, lamps, ballasts, emergency lighting units, and accessories.

1.3 SUBMITTALS

- A. Product Data: For each type of lighting fixture indicated, arranged in order of fixture designation. Include data on features, accessories, and the following:
 - 1. Dimensions of fixtures.
 - 2. Certified results of independent laboratory tests for fixtures and lamps for electrical ratings and photometric data.
 - 3. Certified results of laboratory tests for fixtures and lamps for photometric performance.
 - 4. Fluorescent and high-intensity-discharge ballasts.
 - 5. Types of lamps.
- B. Shop Drawings: Show details of nonstandard or custom fixtures. Indicate dimensions, weights, method of field assembly, components, features, and accessories.
 - 1. Wiring Diagrams: Detail wiring for fixtures and differentiate between manufacturer-installed and field-installed wiring.
- C. Samples for Verification: For lighting fixtures designated for sample submission in the Interior Lighting Fixture Schedule.
 - 1. Lamps: Specified units installed.
 - 2. Ballast: 120-V model of specified ballast type.
 - 3. Accessories: Cord and plug.
- D. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.
- E. Maintenance Data: For lighting fixtures to include in maintenance manuals specified in Division 1.

1.4 QUALITY ASSURANCE

- A. Fixtures, Emergency Lighting Units, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.
- B. Comply with NFPA 70.
- C. FM Compliance: Fixtures for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM.

D. NFPA 101 Compliance: Comply with visibility and luminance requirements for exit signs.

1.5 COORDINATION

A. Fixtures, Mounting Hardware, and Trim: Coordinate layout and installation of lighting fixtures with ceiling system and other construction.

1.6 WARRANTY

- A. General Warranty: 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. Special Warranties for Fluorescent Ballasts: Written warranty, executed by manufacturer agreeing to replace fluorescent ballasts that fail in materials or workmanship within specified warranty period.
 - 1. Special Warranty Period for Electronic Ballasts: Five years from date of manufacture, but not less than four years from date of Substantial Completion.

1.7 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Lamps: Ten (10) for every 100 of each type and rating installed. Furnish at least one (1) of each type.
 - 2. Plastic Diffusers and Lenses: One (1) for every 100 of each type and rating installed. Furnish at least one (1) of each type.
 - 3. Ballasts: One (1) for every 100 of each type and rating installed. Furnish at least one (1) of each type.
 - 4. Globes and Guards: One (1) for every 20 of each type and rating installed. Furnish at least one (1) of each type.
 - 5. Remote Battery Packs: One (1) for every 10, no less than two (2).

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers and Models: As indicated on the drawings and lighting fixture schedule. Additional manufacturers may be considered as equal after review from the design engineer. Submit two copies to the design engineer for review prior to bid. Include a cross reference for each fixture submitted. Equipment submitted for "as-equal" without complete cutsheet cross reference, to include drawing fixture lettering, is subject to immediate rejection.
 - 1. Additional manufacturers will be considered on a case by case basis prior to bid. Postbid non-approved manufacturers/models are subject to rejection and any cost difference for approved fixtures will be the contractors' responsibility.
- 2.2 FIXTURES AND FIXTURE COMPONENTS, GENERAL
 - A. Metal Parts: Free from burrs, sharp corners, and edges.

- B. Sheet Metal Components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging.
- C. Doors, Frames, and Other Internal Access: Smooth operating, free from light leakage under operating conditions, and arranged to permit relamping without use of tools. Arrange doors, frames, lenses, diffusers, and other pieces to prevent accidental falling during relamping and when secured in operating position.
- D. Reflecting Surfaces: Minimum reflectance as follows, unless otherwise indicated:
 - 1. White Surfaces: 85 percent.
 - 2. Specular Surfaces: 83 percent.
 - 3. Diffusing Specular Surfaces: 75 percent.
 - 4. Laminated Silver Metallized Film: 90 percent.
- E. Lenses, Diffusers, Covers, and Globes: 100 percent virgin acrylic plastic or annealed crystal glass, unless otherwise indicated.
 - 1. Plastic: High resistance to yellowing and other changes due to aging, exposure to heat, and ultraviolet radiation.
 - 2. Lens Thickness: 0.125-inch minimum, unless greater thickness is indicated.
- F. Electromagnetic Interference Filters: Integral to fixture assembly. Provide one filter for each ballast where indicated on drawings. Suppress conducted electromagnetic interference filters as required by MIL-STD-461.

2.3 LED LIGHTING AND LAMPS

8.

- A. General: Comply with fixture component requirements.
- B. All LED products must be UL, ETL and/or CSA listed.
- C. All LED products must have LM-79 and LM-80 testing minimum and noted on specification sheet by an independent test lab and in accordance with the following:
 - 1. Lay-in Troffers: L90 at 60,000 hours at 25 degrees C.
 - 2. Surface Mounted: L80 at 60,000 hours at 25 degrees C.
 - 3. Pendant Mount: L90 at 60,000 hours at 25 degrees C.
 - 4. Recessed Can: L70 at 50,000 hours at 25 degrees C.
 - 5. High Bay: L70 at 97,000 hours at 25 degrees C. or
 - 6. L95 at 60,000 hours at 25 degrees C. *
 - 7. Exterior Pole Mtd: L90 at 100,000 hours at 60 degrees C. *
 - L96 at 100,000 hours at 25 degrees C
 - Exterior Surf Mtd: L90 at 100,000 hours at 40 degrees C or
 - L80 at 100,000 hours at 25 degrees C *
 - 9. High Bay and Exterior Fixtures shall be Thermally Protected Drivers
- D. All LED products should be identified as L70 and/or L90 ratings based on independent test lab data.
- E. Long-life LEDs, coupled with high-efficiency drivers, provide superior level and quality of illumination for extended service life.
- F. All outdoor pole mounted products must have surge suppression within each fixture.
- G. All outdoor and wet location listed products must clearly state the IP rating carried on the fixture based on independent test lab data.

- H. All LED products must be serviceable for accessible for field repair needs. Drivers and internal components are accessible from floor. LED boards include plug-in connectors for easy replacement or servicing. Suitable for direct insulation contact. Suitable for damp location.
- I. Standard embedded controls continuously monitor system performance, allow for constant lumen management/compensation function, facilitate simple "plug-and-play' network and controls upgrading via Cat-5 cable.
- J. Minimum CRI 80.
- K. All outdoor lighting color rendering should be within a 7 step McAdams Ellipse. All outdoor lighting should be 4000 kelvin unless specifically noted.
- L. All indoor lighting color rendering should be within a 3 step McAdams ellipse. All indoor lighting should be 4000 kelvin unless specifically noted.
- M. All outdoor pole mounted products must have surge suppression within each fixture.
- N. All control systems that interface with an LED product will be supported by a project "integrator" until project completion. This includes contact with the installer prior to installation, availability during installation, and final checkout and startup after installation. The quantity of days required for startup will be based on the manufacturer/agents discretion and need.
 - 1. The project integrator must be capable of performing low voltage and dmx terminations. High voltage terminations are performed solely by the electrical subcontractor.
 - 2. Reporting of final startup completion of the controls system back to the engineer is mandatory.
 - a. Invitation to attend the training with the owners representative should be made to the engineer no less than 5 days prior to training
 - b. Signature confirmation of training and startup is required within 5 business days after completion back to the engineer's office.
 - 3. A follow up call will be made to the owner 30-45 days after the startup and training of the controls system by the manufacturer's representative to ensure all systems are operating to design specification. A 3 hour onsite system fine tuning at no additional cost to the owner is inclusive if requested by the owner at that time for additional training and programming.
- O. All LED drivers should be capable of 0-10 volt controls and DMX control and shall dim to 1% of total lumen output. Where specifically specified the dimming driver may be required to dim to .1% of lumen output, otherwise known as "dim to dark".
- P. Driver manufacturers must have a 5 year history producing dimmable electronic LED drivers for the North American market.
- Q. Ambient driver temperatures must be within -20 degrees to 50 degrees C (-4 degrees to 122 degrees F).
- R. Driver must limit inrush current.
 - 1. Base specification: meet or exceed NEMA 410 driver inrush standard of 430 amp per 10 amps load with a maximum of 370 amps/2 seconds
 - Preferred specification : Meet or exceed 30ma's at 277 VAC for up to 50 watts of load and 75A at 240us att 277 VAC for 100 watts of load
 - 3. Withstand up to a 1,000 volt surge without impairment of performance as defined by ANSI C62.41 Category A

- 4. No visible change in light output with a variation of plus/minus 10percent line voltage input.
- 5. Total harmonic distortion less than 20%, and meet ANSI C82.11 maximum allowable THD requirements at full output. THD shall at no point in the dimming curve allow imbalance current to exceed full output THD
- S. Any exceptions are at the engineers discretion based on project needs and applicability.

2.4 EXIT SIGNS

- A. General Requirements: Comply with UL 924 and the following:
 - 1. Sign Colors and Lettering Size: Comply with authorities having jurisdiction.
 - 2. Die cast brushed metal finish exit signage with manufacturer's multi-style mounting (wall, surface, and top). Plastic exit signage is not acceptable.
- B. Internally Lighted Signs: As follows:
 - 1. Lamps for AC Operation: Light-emitting diodes, 70,000 hours minimum rated lamp life.
 - 2. All exit signs shall have battery back-up.
 - 3. Provide with self-diagnostics as indicated on the drawings.

2.5 FIXTURE SUPPORT COMPONENTS

- A. Comply with Section "Basic Electrical Materials and Methods," for channel- and angle-iron supports and nonmetallic channel and angle supports.
- B. Single-Stem Hangers: ¹/₂-inch steel tubing with swivel ball fitting and ceiling canopy. Finish same as fixture.
- C. Twin-Stem Hangers: Two, ¹/₂-inch steel tubes with single canopy arranged to mount a single fixture. Finish same as fixture.
- D. Rod Hangers: 3/16-inch- minimum diameter, cadmium-plated, threaded steel rod.
- E. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.
- F. Aircraft Cable Support: Use cable, anchorages, and intermediate supports recommended by fixture manufacturer.

2.6 FINISHES

- A. Fixtures: See fixture schedule for colors and finishes. Otherwise manufacturer's standard.
 - 1. Paint Finish: Applied over corrosion-resistant treatment or primer, free of defects.
 - 2. Metallic Finish: Corrosion resistant.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Fixtures: Set level, plumb, and square with ceiling and walls, and secure according to manufacturer's written instructions and approved submittal materials. Install lamps in each fixture.
 - 1. Coordinate location of fixtures with architectural ceiling plan.

- 2. Review architectural elevations prior to rough-in for any wall mounted fixtures.
- 3. Center single fixtures in rooms as much as possible.
- 4. Center fixtures in exposed ceilings. Provide equal distance between fixtures and structural elements (walls, columns, furrdowns, etc.).
- 5. Provide switching mechanisms for all fixtures whether indicated on the drawings or not.
- B. Track Lighting
 - 1. Install track parallel with structural or grid. Secure track to structural mounted j-boxes.
 - 2. Conceal transformers above accessible ceiling.
 - 3. Coordinate with architect for track lighting head locations.
 - 4. Aim track heads at objects to be illuminated
 - 5. Adjust pendant track fixtures per architect/owner.
- C. Remote Battery or Ballasts:
 - 1. Mount battery backup over accessible ceiling spaces. Provide appropriate battery backup for mounting distance away from fixture.
 - 2. Remote mount ballasts for fixtures in stairwells or over hard ceilings where ballast is not directly accessible from below.
 - Mount all remote ballasts and battery packs together as much as possible over accessible ceiling spaces and mount on unistrut with backboard. Do not mount directly to wall. Bundle cabling together and label ballasts/battery packs corresponding to fixture. Provide diagram as required.
- D. Connections:
 - 1. Indoors
 - a. With Lay-in ceilings: Provide EMT home runs to structure mounted J-boxes. Provide MC Cable from above ceiling j-boxes to fixtures. Do not daisy chain fixtures together unless specifically indicated on the drawings or allowed by engineer.
 - b. With gypboard ceilings: Provide EMT home runs to structure mounted J-boxes. Provide access to j-boxes or locate above fixtures. Provide MC Cable from above ceiling j-boxes to fixtures. Do not wire daisy chain fixtures together, unless indicated on the drawings.
 - c. Exposed (no ceiling) in finished spaces: Conceal EMT as much as possible in adjacent walls. Route EMT to fixtures in exposed spaces with steel compression fittings and install parallel along structural members to structural mounted j-boxes. Conceal conduit along structural members. DO NOT route conduit across open spaces suspended from structural members unless directed by architect or engineer. Mount fixtures from j-boxes. Center fixtures in spaces.
 - d. Exposed unfinished spaces: Provide EMT runs to structural mounted j-boxes. Route parallel to structural members as much as possible. Mount fixtures or fixture support to j-boxes.
 - 2. Outdoor: Provide IMC for exterior fixtures and connect directly to fixtures or j-boxes as required for fixture mounting. Exterior fixtures mounted in ceilings or structure can use EMT to fixture j-box mounts.
- E. Support for Fixtures in or on Grid-Type Suspended Ceilings: Use grid for alignment.
 - 1. Install a minimum of four (4) ceiling support system rods or wires attached to the fixture structure on **EACH** fixture secured to the building structure. Locate not more than 6 inches from fixture corners.
 - 2. Support Clips: Fasten to fixtures and to ceiling grid members at or near each fixture corner.
 - 3. Fixtures of Sizes Less Than Ceiling Grid: Arrange as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two (2) ³/₄-inch metal channels spanning and secured to ceiling tees.

- F. Suspended Fixture Support: As follows:
 - 1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging. Provide blocking for heavy fixtures.
 - 2. Stem- Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
 - 3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.
 - 4. Coordinate mounting heights with Architect/Engineer. Consult prior to hanging. Stems may need to be field cut.
 - 5. Chain hung fixtures are NOT acceptable unless indicated on the drawings.
 - 6. Provide secondary support for all fixtures without canopy support from structure.
 - a. All high and low bay fixtures shall have secondary support cables secured to structure.

3.2 CONNECTIONS

- A. Ground equipment:
 - 1. Tighten electrical connectors and terminals according to manufacturers' published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- B. Connect Drivers to switch mechanisms (wall switch, contactors, relays).
- C. Provide dual switching for step dimming fixtures. Wire each ballast hot leg to corresponding switch leg. Do not connect together unless directed by engineer.
 - 1. Exception: Step dimming fixtures in corridors may be connected together. Consult engineer prior to connections and installing switch legs.

3.3 FIELD QUALITY CONTROL

- A. Inspect each installed fixture for damage. Replace damaged fixtures and components.
- B. Advance Notice: Give dates and times for field tests.
- C. Provide instruments to make and record test results.
- D. Tests: As follows:
 - 1. Verify normal operation of each fixture after installation.
 - 2. Emergency Lighting: Interrupt electrical supply to demonstrate proper operation.
 - 3. Verify normal transfer to battery source and retransfer to normal.
 - 4. Report results in writing.
- E. Malfunctioning Fixtures and Components: Replace or repair, then retest. Repeat procedure until units operate properly.
- F. Corrosive Fixtures: Replace during warranty period.

3.4 CLEANING AND ADJUSTING

- A. Clean fixtures internally and externally after installation. Use methods and materials recommended by manufacturer.
- B. Adjust aimable fixtures to provide required light intensities.

END OF SECTION

SECTION 27 10 00 STRUCTURED CABLING SYSTEM

PART 1 - GENERAL

This Section identifies the technical design and Specification requirements for the Structured Cabling Systems for the Alamo Colleges Welding/Nursing Classrooms project located in Kerrville, Texas ("Owner"). The Structured Cabling System as specified is a High End (550 MHZ Minimum) Industry Standard Category 6/6A Structured Cable Plant and will support voice and data systems in the new facility.

Contractor shall provide all materials, equipment, and labor necessary to provide a complete and functional High End (400MHZ Minimum) Industry Standard Category 6 Structured Cabling System regardless of any materials and/or equipment not listed or described in this Specification and/or supplementary Drawings.

Data outlets for wireless access points shall be Category 6A.

1.1 REQUIREMENTS INCLUDED

- A. Contractor Requirements
- B. Acceptable Manufacturers
- C. Codes, Standards and Regulations
- D. General Requirements
- E. System Requirements
- F. Testing Requirements
- G. Project Closeout Documentation
- H. Attachments

1.2 RELATED REQUIREMENTS

A. The Drawings, Specifications, General Conditions, Supplementary General Conditions and other requirements of Division 01, apply to the Work specified in Division 27, and shall be complied with every respect. The Contractor shall examine all of the documents, which make up the Contract Documents, and shall coordinate them with the Work on the Technology Drawings and Division 27 of these Specifications.

1.3 CONTRACTOR EXPERIENCE REQUIREMENTS

- A. The Contractor shall be a Certified Leviton Network Installer (LNI) prior to submitting a proposal for the Work.
- B. Installers must be certified, trained and experienced on the specific installation, termination and testing of the systems as specified.
- C. The Contractor shall certify and the Manufacturer of the solution shall warrant the solution for a period of no less than twenty (20) years.

- D. The Contractor shall be an established business with local support and shall have been in business for a minimum of five (5) years.
- E. The Contractor shall have prior experience with Projects of a similar size and scope. The Contractor shall provide a minimum of five (5) installed systems comparable to the Owner's installation, where the systems have been in continuous satisfactory operation for at least one (1) year. The Contractor shall provide the following information for each reference: Project Name, Project Location, Project Start Date, Project Completion Date, Project Start Cost, Project Completion Cost, Brief Description of Project, Client Point of Contact Name and Phone Number.
- F. Past performance with the Owner is a selection criterion. Experience related to any past or present Project with the Owner should be disclosed with bid response.
- G. Qualified Contractors should submit proof of all certifications and experience detail with bid response and product submittals.

1.4 SUBMITTALS

- A. Pre-Installation
 - 1. Original Equipment Manufacturer (OEM) documentation certifying performance characteristics for each component proposed must be provided to Owner. Contractor shall not purchase or install any equipment until OEM documentation has been received and approved by the Architect/Engineer.
 - 2. Product data sheets for all proposed system components. Product data sheets shall include: an equipment schedule listing of all system components to be installed in the Project and the manufacturer's product reference and Specification literature for all products to the utilized and/or installed in the Project. Contractor shall not purchase or install any equipment until product data sheets have been received and approved by the Architect/Engineer.
 - 3. Contractor shall provide to Owner's Representative Shop Drawings of the proposed layouts of equipment and cable Plant. Shop Drawings shall include equipment rack layouts, wall elevations, system schematics and riser diagrams. These include detailed Shop Drawings submitted on 30" X 42" bond paper. Contractor shall not install any equipment until Shop Drawings have been received and approved by the Architect/Engineer.
 - 4. Manufacturer Certifications for Company as identified in Contractor Experience Requirements.
 - 5. Manufacturer Training Certifications for Installers as identified in Contractor Experience Requirements.
 - 6. Manufacturer Certification/Warranty offering as identified in Contractor Experience Requirements.
- B. Post Installation
 - 1. Contractor shall prepare, update and make available to the Architect/Engineer a comprehensive set of Drawings accurately depicting the "As-Built" condition of the Communications Cable Plant as it was installed. As-Built Drawings must be provided in AutoCAD 2017 as well as in pdf format. The Contractor shall prepare, update, and make available to the Consultant a comprehensive set of "As Built" Drawings using the original scale, indicating exact dimensions and locations of all telecommunication rooms, frames, racks, trays, terminal blocks, patch panels, cable runs, cable pathways, Workstation locations, and labeling scheme. These Drawings shall be turned over to the Consultant at the time of final systems acceptance of the cable Plant installation.
 - 2. The Contractor shall provide three (3) sets of test documentation for the Communications Cable Plant to the Architect/Engineer at the time of final systems acceptance. Test results shall be provided in original hardcopy format and on a CD-ROM. Test documentation shall include Power Meter and Light Source Fiber Optic

Tests and Category 6 test results for each cable drop in accordance with Section 3.4 of these Specifications. Final payment will not be made until these test results are received and approved by the Architect/Engineer. Test documentation shall be bound, Sectioned, and tabbed in the following order: Inter-Building Outside Fiber Optic Cable Inter-Building Outside Copper Cable Intra-Building Fiber Optic Cable Intra-Building High-Pair Count Copper Horizontal 4-Pair UTP Data Cable

- Horizontal 4-Pair UTP Voice Cable
- 3. The Contractor shall furnish the original Certificate of Certification/Warranty to the Architect/Engineer at the time of final systems acceptance. Final payment will not be made until this Certificate of Warranty is received and approved by the Architect/Engineer.
- 4. Contractor shall provide warranty information to include the name, address and phone number contacts for warranty call outs. Final payment will not be made until this warranty information is received and approved by the Architect/Engineer.

PART 2 – PRODUCTS

The following Sections specifically list the acceptable equipment types and items for this Project. Proposed equivalent items must meet or exceed these Specifications and the Specifications of the listed item. In the event a specified manufacturer's part number has changed or is no longer valid, Contractor shall substitute the appropriate equivalent manufacturer's part number. Owner or Owner's designate will have final determination of acceptability of all proposed equipment and must approve submitted equipment prior to installation. Where quantities are not noted, they may be obtained from the Drawings. In the event of a discrepancy between the Specifications and the Drawings, the greater quantity and/or better quality will be furnished. Any Owner-furnished materials or equipment not installed in the Project shall be returned to the Owner. Contractor shall store all materials and equipment in accordance with manufacturers' instructions in a weather-tight, secure enclosure. Contractor shall be responsible for safety and security of all Owner-furnished materials until Project is complete and accepted by Owner.

2.1 ACCEPTABLE MANUFACTURERS

- A. Fiber optic cable
 - 1. 9 µm Singlemode
 - a. Bertek
 - 50 μm Multi-mode 10 Gig laser Optimized OM3 a. Bertek
 - 3. Fiber Optic Innerduct
 - a. Indoor (Orange) Plenum
 - i. Carlon CF4X1C-XXXX
 - ii. Pyramid Equivalent
 - iii. Endot Equivalent
 - b. Outdoor PVC
 - i. Carlon A5D251JNNB-XXXX
 - ii. Pyramid Equivalent
 - iii. Endot Equivalent
- B. Copper Cable
 - 1. High Pair Count UTP Voice
 - a. Superior/Essex

- b. General
- 2. 4-Pair UTP Data (Blue Sheath)
 - a. Berktek
 - b. General
 - c. Hitachi
- C. Fiber Optic Termination
 - 1. Leviton Fiber Optic Enclosure
 - 2. Leviton Fiber optic connectors LC
- D. Copper Termination
 - 1. Primary Copper Protectors Lightning Protectors with Solid State Digital Series Modules
 - a. Circa Telecom
 - 2. RJ-45 Patch Panels Data Termination
 - 3. Leviton 48 Port Patch Panel
 - 4. Voice Termination
 - a. Leviton 110 Blocks
 - **Telecommunications Faceplates**
 - a. Leviton
 - 5. Telecommunications Outlets
 - a. Leviton
- E. Equipment Rack(s), Wire Management, and Power Strip(s) (Black)
 - 1. Chatsworth Standard Rack Part #55053-703
 - 2. Chatsworth Double-Sided Wide Vertical Cabling Section Part #11729-703
 - 3. Chatsworth Rack Cabling Manager Part #11753-719
 - 4. Chatsworth Swing Gate Wall Mount Rack
- F. Plywood
 - 1. ³/₄" x 8' h x 4' w Sheets of B/C grade Fire Rated Plywood with Fire Rated Stamp
- G. Paint
 - 1. Fire-Retardant Paint
- H. Cable Support
 - 1. Ladder Rack and all Applicable/Required Accessories
 - a. Chatsworth Universal Cable Runway Part #10250-712
 - 2. J-Hooks and all Applicable/Required Accessories
 - a. ERICO CADDY J-Hooks
 - b. Panduit J-Mod or J-Pro
 - 3. Cable Ties (Plenum Rated)
 - a. Panduit Hook & Loop
- I. Ground Busbars and all Applicable/Required Accessories
 - 1. Chatsworth 12" BICSI & ANSI/EIA/TIA Grounding Busbar (Part # 40153-012)
 - 2. Chatsworth 10" BICSI & ANSI/EIA/TIA Grounding Busbar (Part # 13622-010)
 - 3. Panduit
- J. Fire-Stop (Intumescent Putty and Pillows)
 - 1. STI Spec Seal
 - 2. 3M Products

PART 3 - EXECUTION

- 3.1 CODES, STANDARDS AND REGULATIONS
 - A. American National Standards Institute (ANSI)
 - B. American Society for Testing and Materials (ASTM)
 - C. Alliance for Telecommunications Industry Solutions (ATIS)
 - D. Electronics Industry Alliance (EIA)
 - E. Federal Communications Commission (FCC)
 - 1. FCC Part 15, Radiated Emissions Limits, revised 1998
 - 2. FCC Part 68, Connection of Terminal Equipment to the Telephone NetWork, revised 1998
 - 3. FCC Part 76, Cable Television Service, revised 1998
 - F. International Electrotechnical Commission (IEC)
 - G. Institute of Electrical and Electronics Engineers, Inc. (IEEE)
 - 1. IEEE Standard 81-1983, IEEE Guide for Measuring Earth Resistance, Ground Impedance, and Earth Surface Potential of a Ground System
 - 2. IEEE Standard 1100-1999, Recommended for practice for Powering and Grounding Sensitive
 - 3. Electronic Equipment in Industrial and Commercial Power Systems (IEEE Emerald Book)
 - H. International Organization for Standardization (ISO)
 - I. International Organization of Standardization/International Electrotechnical Commission (ISO/IEC)
 - J. ISO/IEC 11801, Information Technology-Generic Cabling for Customer Premises, 1995
 - K. ISO/IEC 14763-1, Information Technology-Implementation and Operation of Customer Premises Cabling-Administration, 1999
 - L. National Cable Television Association (NCTA)
 - M. National Electrical Code (NEC)
 - N. National Electrical Manufacturers Association (NEMA)
 - O. National Fire Protection Association (NFPA)
 - 1. NFPA-70, National Electrical Code
 - 2. NFPA-75, Protection of Electronic Computer Data Processing Equipment
 - 3. NFPA-101, Life Safety Code
 - 4. NFPA-297, Guide on Principles and Practices for Telecommunications Systems
 - 5. NFPA-780, Standard for the Installation of Lightning Protection Systems
 - P. National Institute Standards and Technology (NIST)
 - Q. Occupational Safety and Health Administration (OSHA)
 - R. Rural Utility Services (RUS)
 - S. Telecommunications Industry Association (TIA)

- 1. ANSI/TIA-568-C.0, Generic Telecommunications Cabling for Customer Premises, 2009
- 2. ANSI/TIA-568-C.1, Commercial Building Telecommunications Cabling Standard, 2009
- 3. ANSI/TIA -568-C.2, Balanced Twisted-Pair Telecommunications Cabling and Components Standard, 2009
- 4. ANSI/TIA-568-C.3, Optical Fiber Cabling Components Standard, 2008
- 5. ANSI/TIA/EIA–569-B, Commercial Building Standard for Telecommunications Pathways and Spaces, 2005
- 6. ANSI/TIA–569-B Amendment 1, Commercial Building Standard for Telecommunications Pathways and Spaces, 2009
- 7. ANSI/TIA-606 -A, Administration Standard for Commercial Telecommunications Infrastructure, 2007
- 8. ANSI-J-STD-607-A, Commercial Building Grounding and Bonding Requirements for Telecommunications, 2002.
- 9. ANSI/TIA-758, Customer-Owned Outside Plant Telecommunications Infrastructure Standard, 2004
- T. Underwriters Laboratories, Inc. (UL)

In the event of any conflicts between documents referenced herein and the contents of this Specification, the Contractor shall notify in writing to the Architect/Engineer of any such occurrences before the purchasing of any equipment, materials and/or installation by the Contractor. The Architect/Engineer will notify the Contractor of any actions required to resolve these conflicts. Such actions may include but are not limited to: design changes, equipment, materials and/or installation changes. In any event Contractor shall not supersede Specifications and standards from the latest NFPA and NEC publications.

3.2 GENERAL REQUIREMENTS

- A. In the installation of this Work, the Contractor shall comply in every way with the requirements of local and City of Kerrville, ordinances, and rules, the laws of the State of Texas, the National Board of Fire Underwriters, and the National Electrical Code. If, in the opinion of the Contractor, there is anything in the Plans or Specifications that will not strictly comply with the above laws, ordinances, and rules, the matter shall be referred to the attention of the Architect/Engineer for a decision before proceeding with that part of the Work.
- B. No change in the Plans or in the Specifications shall be made without full consent in writing of the Architect/Engineer.
- C. The Contractor shall obtain written permission from the Architect/Engineer before proceeding with any Work that would necessitate cutting into or through any part of the building structure such as, but not limited to girders, beams, floors, or partition ceilings.
- D. The Contractor shall install the materials in accordance with the manufacturers' guidelines and Specifications.
- E. The Contractor shall promptly correct all system discrepancies or defects for which the Contractor is responsible.
- F. The Contractor shall coordinate all Work with the Architect/Engineer prior to purchase of products or installation of cable Plant.
- G. The Contractor shall maintain a Work area free of debris, trash, empty cable reels, scrap wire, etc., and dispose of such items on a daily basis and return the site to the original state of cleanliness. The Contractor shall not use Owner's facilities for the disposal of excess or scrap materials.

- H. The Contractor shall be certain that all Work areas are in compliance with the Occupational Safety and Health Administration (OSHA) regulations.
- I. The Contractor shall have written approval from the Architect/Engineer for any additional Work outside the Contract Documents prior to beginning such Work.
- J. The Contractor shall not place any distribution cabling alongside power lines, or share the same conduit, channel or sleeve with electrical apparatus.
- K. The Contractor shall ensure that the maximum pulling tensions of the specified distribution cables are not exceeded at any time during placement. Failure to follow the appropriate guidelines may require the Contractor to provide additional material and labor necessary to rectify the situation. This shall also apply to any and all damages sustained to the cables by the installation Contractor during the implementation.
- L. The Contractor shall install all equipment as close to the wiring fields as possible, taking into consideration, testing, administration, maintenance, and future growth.
- M. The Contractor shall be responsible for testing all cable prior to the installation of the cable. If the Contractor fails to perform this testing operation, the Contractor shall accept the cable as good and assume all liability for the replacement of the cable should it be found defective at a later date.
- N. The Contractor shall plug ALL penetrations, conduits, sleeves, cable trays, etc., where cabling has been installed through rated walls/floors with an UL listed and approved intumescent reenterable fire-stop system consisting of a re-enterable putty for sleeves and conduit penetrations and pillow stop systems for cable trays where they pass through rated walls.
- O. The Contractor shall be responsible for returning any and all penetrations through rated walls or floors made for communications cable to their pre-penetration rating.
- P. The Contractor shall maintain a set of Working Specifications and Drawings on site at all times and shall be responsible for keeping the Drawings updated on a minimum of a weekly basis. These Working Drawings shall be made available for inspection at the request of the Architect/Engineer or the Owner.
- Q. Materials shall be consistent throughout the building. Where two or more units of the same class of equipment or wiring are required, these units shall be the standard product of a single manufacturer and shall be the same product with the same material, model, and manufacturer number.
- R. All wiring, equipment and installation materials shall be new and of the highest quality. Cable, equipment and installation materials shall be delivered and stored in a clean, dry space at the Contractors expense. Materials and equipment will be properly packaged in factory-fabricated type containers and protected from the environment, damaging fumes, construction debris, and traffic, etc. until the job is installed or completion of the Project.
- S. Labels on all wiring, materials, and equipment must show that a nationally recognized testing laboratory lists these. Original Equipment Manufacturer (OEM) documentation must be provided to the Architect/Engineer, which certifies performance characteristics and which meet ANSI/TIA/EIA 568-B.1 standard.
- T. All cable installed above ceiling shall meet or exceed the Underwriters Laboratories (UL) fire rated cable insulation requirements.
- U. Any pulling compound or lubricant used in the installation shall not deteriorate the conductor or

the insulation of the cable.

- V. Ten feet (10') of service loop for inter-building backbone cable shall be coiled, mounted and stored at each cable end above or on the ladder rack in the ER/TR's.
- W. Ten feet (10') of service loop for intra-building backbone cable shall be coiled, mounted and stored at each cable end above or on the ladder rack in the ER/TR's.
- X. Ten feet (10') of service loop for horizontal cables shall be coiled, mounted and stored above or on the ladder rack in each ER/TR's.
- Y. Twelve inches (12") of maintenance loop for horizontal distribution cable shall be coiled and stored on the J-hook directly above the Workstation outlet.
- Z. Twelve inches (12") of maintenance loop for horizontal distribution cable shall be coiled and stored in the gang-box or floor-box as applicable at the Workstation location.

3.3 SYSTEM REQUIREMENTS

- A. Inter-Building Cable Plant
 - 1. Fiber Optic Cable Riser/Tie
 - a. 9 µm singlemode/50 µm Multi Mode OM3 OSP

The Contractor shall furnish and install OSP rated 9 µm singlemode and 50 µm multi-mode fiber optic cables as indicated on the Technology Drawings. These cables shall be installed in Contractor-furnished and installed 1" innerduct and routed utilizing the conduit/manhole system as indicated on the Technology Drawings.

b. Fiber Optic Termination

The Contractor shall terminate all fiber optic cables utilizing Contractorfurnished and installed LC type connectors inside Contractor-furnished and installed fiber optic enclosures. The Contractor shall furnish and install fiber optic distribution shelves with all panels, covers, connectors, couplings and blanks.

2. Copper – Riser/Tie

b.

a. High Pair Count UTP – Voice Cable

The Contractor shall furnish and install 24 AWG Unshielded Twisted Pair (UTP) gel filled Category 3 copper cable as indicated on the Technology Drawings. These cables shall be installed in and routed utilizing the conduit/riser system as indicated on the Technology Drawings. The

- High Pair Count Termination Voice The Contractor shall furnish and install lightning protection blocks and rack mounted Category 6 24 port patch panels in each Equipment Room and/or Telecommunications Room for termination of the high pair count Category 3 cable for voice. The Contractor shall cross connect all copper cables from the lightning protection blocks to the Contractor-furnished and installed wall mounted 110 block. The Contractor ground and bond all copper cables. Prior to the installation, the Contractor shall submit scaled Drawings and obtain written approval from the Architect/Engineer as to the exact location of the lightning protection blocks.
- c. Copper termination unit shall be installed in accordance with manufacturer's guidelines and instructions.
- 3. Horizontal Distribution Cable

No station cable shall be longer than ninety (90) meters. If the Contractor believes any station cable will be any longer than ninety (90) meters, written approval from the Architect/Engineer will be required prior to installation of the station cable.

a. 4-Pair UTP - Data (Blue Sheath)

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b.

The Contractor shall furnish and install 4-pair UTP Category 6/6A cable runs from each Equipment Room and/or Telecommunications Room to each outlet location respectfully as indicated in the Technology Drawings. These cable runs will provide data communications at each outlet.

Data Termination

The Contractor shall terminate all cables at the Workstation locations in appropriately-sized Contractor-furnished and installed faceplates with Category 6 RJ-45 8-pin modular jacks with connector Specifications as defined by the ANSI/TIA/EIA 568-A Commercial Building Wiring Standard with the EIA-568B sequence as indicated in the Technology Drawings. Any unused faceplate position(s) shall have the appropriate number and color of blanks installed.

Before ordering and installation of the horizontal Cable Plant, the Contractors shall coordinate with the Architect/Engineer and obtain written approval of the color of the faceplates and inserts.

Contractor shall furnish and install rack mounted High Density Category 6 patch panels in each Equipment Room and/or Telecommunications Room for termination of the station Category 6 cable for data. The Contractor shall provide and install horizontal wire management between each patch panel installed. Prior to the installation of any High Density Category 6 patch panels, the Contractor shall submit scaled Drawings and obtain written approval from the Architect/Engineer as to the exact location of the High Density Category 6 patch panels.

4. Cable Support

a.

а

Inter-Building Cable Plant

Inter-Building cables shall be supported using the conduit and manhole systems, cores, sleeves and J-Hooks as indicated on the Technology Drawings.

Intra-Building Cable Plant

Intra-Building cables shall be supported using interior conduit systems, cores, sleeves and J-Hooks as indicated on the Technology Drawings.

b. J-Hook Pathways

Horizontal cables shall be supported using Contractor-furnished and installed Category 6 J-Hooks. The Contractor shall furnish and install Category 6 J-hooks to support all communications cable as segments leave cable tray, conduits, cores, or sleeves.

The Contractor shall furnish a separate J-hook for each cable type (data, voice, video, security, public address, clock, etc.) and shall supply and spare J-hook for future growth. All J-hooks shall be installed four (4') to five (5') feet on center, using only manufacturer approved installation methods and materials.

The Contractor is responsible for the establishment of all cable pathways supported by J-hooks and as such shall coordinate pathways with all other disciplines. Under no-circumstances shall J-hook pathways for communications cable Plant be used to support other low-voltage applications such as HVAC, Fire Alarm, etc.

- 5. Equipment Rooms/Telecommunications Room
 - The Contractor shall furnish and install ¾" x 8' h x 4' w sheets of B/C grade fire-rated plywood on all walls in each Equipment Room/Telecommunications Room as indicated in the Technology Drawings. The Contractor shall paint the plywood with two (2) coats of Contractor-furnished Fire-Retardant paint leaving one (1) fire rated stamp visible per sheet of plywood.
 - b. Ladder Racks The Contractor shall furnish and install overhead ladder rack in each Equipment Room and/or Telecommunications Room as indicated on the Technology Drawings. Overhead ladder racks shall be installed using

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manufacturer approved hardware and installation methods and shall be grounded and bonded.

The Contractor shall furnish and install vertical Sections of ladder rack to ensure the ladder rack provides for a smooth transition and support for all cable as the cable transitions from the Equipment Room and/or Telecommunications Rooms to the above ceiling cable pathway.

The Contractor shall furnish and install radius drops for the ladder rack where cables drop from a vertical segment of the ladder rack or exits the horizontal Section of the ladder rack to termination equipment, racks, etc.

c. Relay Racks

The Contractor shall furnish and install relay racks with double sided vertical management in each Equipment Rom and/or Telecommunications Room as indicated on the Technology Drawings. Relay racks shall be installed using manufacturer approved hardware and installation methods. Relay racks shall be secured to overhead ladder rack, grounded and bonded.

- 6. Grounding and Bonding
 - a. Telecommunications Main Grounding Bus bar

The Contractor shall furnish and install a $4^{\circ} \times 12^{\circ} \times 14^{\circ}$ solid copper ground bus bar in IDF Rooms as indicated on the Technology Drawings.

- b. Grounding Electrode Conductor The Contractor shall furnish and install a #6 AWG solid copper conductor between the Main Ground Bus bar and the main electrical building ground.
- c. Telecommunications Grounding Bus bar

The Contractor shall furnish and install a 2" x 10" x ¼" solid copper ground bus bar in each Telecommunications Room as indicated on the Technology Drawings.

d. Telecommunications Bonding Backbone

The Contractor shall furnish and install a #6 AWG solid copper conductor in a star topology between the Main Ground Bus bar inside the Equipment Room to each Telecommunications Ground Bus bar in each Telecommunications Room as indicated on the Technology Drawings.

- e. Equipment Bonding Conductor The Contractor shall furnish and install a #6 AWG solid copper conductor from the ground bus bar in each Equipment Room and/or Telecommunications Room to each applicable piece of Contractor-furnished and installed equipment. All Contractor-furnished and installed equipment shall be properly bonded and grounded in accordance with ANSI/TIA/EIA-607.
- 7. System Labeling

A specific labeling scheme will be coordinated with the Owner and provided to the Contractor. The Contractor shall not permanently label any part of the communications cable Plant until the specific labeling scheme has been provided to the Contractor. In general, the Contractor shall be required to provide the following type of labeling: Inter-Building Cable

The Contractor shall furnish and install machine generated labels on each end of the cable indicating origin and destination.

a. Intra-Building Cable

The Contractor shall furnish and install machine printed labels on each end of the cable indicating origin and destination.

b. Horizontal Cable

The Contractor shall furnish and install machine printed labels on each end of the cable indicating origin and destination.

- c. Terminations
 - Fiber Optic

The Contractor shall label fiber optic distribution shelves in accordance to manufacturer guidelines and ANSI/TIA/EIA-606.

STRUCTURED CABLING SYSTEM

Copper

The Contractor shall label 110 blocks and protector blocks in accordance to manufacturer guidelines and ANSI/TIA/EIA-606.

Faceplates

The Contractor shall label Workstation faceplates in accordance to manufacturer guidelines and ANSI/TIA/EIA-606.

3.4 TESTING REQUIREMENTS

- A. Fiber Optic Cable
 - 1. All fiber optic cable links installed shall be tested in accordance with the field test Specifications defined in ANSI/TIA-568-C standard.
 - 2. 100% of the installed cable shall be tested and must pass the requirements of ANSI/TIA-568-C.
 - 3. Failing links shall be diagnosed and corrected by the Contractor. Corrective actions shall be followed by a new test of the previously failing link(s). The Contractor shall promptly submit all link re-test data to Architect/Engineer in both hard and soft copy.
 - 4. Only Certified Technicians shall perform all fiber optic link testing.
 - 5. Field test equipment for multi-mode fiber optic cables shall meet the requirements of ANSI/TIA/EIA-526-14A.
 - 6. The light source shall meet the launch requirements of ANSI/TIA/EIA-455-50B.
 - 7. Field test equipment for single-mode fiber optic cables shall meet the requirements of ANSI/TIA/EIA-526-7.
 - 8. All fiber optic launch cables and test adapters used for testing shall be of high quality and devoid of excessive wear or exhibit anomalies between strand tests. Test results that indicated anomalies between strands within the same sheath shall be declared a failure unless all strands within the same sheath unconditionally pass testing. The Contractor shall diagnose and repair any fiber optic cable exhibiting strand-to-strand anomalies that result in any test failure(s).
 - 9. The Contractor shall test and certify all fiber optic cable Plant with approved field tester(s) that are within their calibration period. The Contractor shall be liable for all retesting required in the event tests are performed with un-approved test equipment or tester(s) that are not within their calibration period.
 - 10. The Contractor shall invite the Architect/Engineer to witness/verify field testing prior to final acceptance. The Architect/Engineer shall randomly select 5% of the installed links for test verification purposes. The Contractor shall re-test these links in the presence of the Architect/Engineer and the results shall be compared to the previously Contractor submitted test results. In the event that 2% of the verification tests differ in terms of pass/fail from the previously submitted test results, testing shall be declared a failure and the Contractor shall re-test 100% of the installed links with the cost of such tests borne by the Contractor.
 - 11. Fiber optic connector attenuation shall not exceed 0.75dB.
 - 12. Fiber optic splice attenuation (if allowed) shall not exceed 0.3dB.
 - 13. Multi-mode fiber optic cables shall be tested using the following attenuation coefficient parameters:
 - a. 62.5/125 multi-mode 850nm < 3.5dBlkm
 - b. 62.5/125 multi-mode 1300nm < 1.5dBlkm
 - c. 50/125 Multi-mode 850nm < 3.5dBlkm
 - d. 50/125 multi-mode 1300nm <u><</u>1.5dBlkm
 - 14. Single-mode fiber optic cables shall be tested using the following attenuation coefficient parameters:
 - a. 9/125 single-mode (Inside Plant) 1310 <1.0dBlkm
 - b. 9/125 single-mode (Inside Plant) 1550 <1.0dBlkm
 - c. 9/125 single-mode (Outside Plant) 1310 <0.5dBlkm
 - d. 9/125 single-mode (Outside Plant) 1550 <0.5dBlkm
 - 15. Link attenuation for all fiber optic strands shall be calculated using the ANSI/TIA-568-C

Standards formula.

- B. Category 6 UTP Cable
 - 1. All Category 6 cable links installed shall be tested in accordance with the field test Specifications defined in ANSI/TIA/EIA-568-8.1 standard.
 - 2. 100% of the installed cable shall be tested and must pass the requirements of ANSI/TIA-568-C.1.
 - 3. Failing links shall be diagnosed and corrected by the Contractor. Corrective actions shall be followed by a new test of the previously failing link(s). The Contractor shall promptly submit all link re-test data to Architect/Engineer in both hard and soft copy.
 - 4. Only Certified Technicians shall perform all Category 6 testing.
 - 5. Field test equipment for Category 6 UTP cables shall meet or exceed the accuracy requirements for enhanced Level II testers as defined in ANSI/TIA/EIA-526-B; Annex I: Section 1.4.
 - 6. All test interfaces used for testing shall be of high quality and devoid of excessive wear or exhibit anomalies between pairs. Test results that indicated anomalies between pairs shall be declared a failure unless all pairs unconditionally pass testing. The Contractor shall diagnose and repair any Category 6 cable exhibiting pair-to-pair anomalies that result in any Fail, *Fail or *Pass conditions.
 - 7. The Contractor shall test and certify all Category 6 cable Plant with approved field tester(s) that are within their calibration period. The Contractor shall be liable for all retesting required in the event tests are performed with un-approved test equipment or tester(s) that are not within their calibration period.
 - 8. Any Fail or *Pass result yields a Fail for the link under test. In order to achieve an overall Pass condition, the results for each individual test parameter must <u>Pass</u>.
 - 9. The Contractor shall invite the Architect/Engineer to witness/verify field testing prior to final acceptance. The Architect/Engineer shall randomly select 5% of the installed links for test verification purposes. The Contractor shall re-test these links in the presence of the Architect/Engineer and the results shall be compared to the previously Contractor submitted test results. In the event that 2% of the verification tests differ in terms of pass/fail from the previously submitted test results, testing shall be declared a failure and the Contractor shall re-test 100% of the installed links with the cost of such tests borne by the Contractor.
 - 10. Reported test parameters for Category 6 shall comply with ANSI/TIA-568-C.1 standard. All measurements shall be tested at a frequency range from 1MHz and 350MHz.
 - 11. Testing shall indicate and record the following for each tested link:
 - a. Wire Map
 - b. Link Length
 - c. Insertion Loss / Attenuation
 - d. Near end cross talk Loss (NEXT)
 - e. Power Sum NEXT Loss (PSNEXT)
 - f. Pair to Pair Loss (ELFEXT)
 - g. Power Sum Pair to Pair Loss (PSELFEXT)
 - h. Return Loss (RL)
 - i. Attenuation to Cross-talk Ratio (ACR)
 - j. Power Sum ACR (PSACR)
 - k. Propagation Delay
 - I. Delay Skew

3.5 **PROJECT CLOSEOUT DOCUMENTATION**

- A. The Contractor shall provide the following to the Owner upon final acceptance and completion of the cable Plant installation:
 - 1. One Original Reproducible Drawing indicating the "As-Built" condition of the Communications Cable Plant as it was installed. As-Built Drawings must be provided

in original hardcopy format and on a CD-ROM in AutoCAD 2014 or higher. The "As-Built" Drawings shall use the original scale, indicating exact dimensions and locations of all telecommunication rooms, frames, racks, trays, terminal blocks, patch panels, cable runs, cable pathways, Workstation locations, and labeling scheme. These Drawings shall be turned over to the Architect/Engineer at the time of final systems acceptance of the cable Plant installation. Final payment will not be made until these Drawings are received and approved by the Architect/Engineer.

2. One set of Power Meter and Light Source Fiber Optic Tests in accordance with Section 3.4 of this Specification in electronic and hardcopy. Electronics shall be provided on CD. Final payment will not be made until these test results are received and approved by the Architect/Engineer. Test documentation shall be bound, Sectioned, and tabbed in the following order:

Inter-Building Outside Fiber Optic Cable Intra-Building Fiber Optic Cable

3. One set of Category 6 Test results for each cable drop in accordance with Section 3.4 of this Specification in electronic and hardcopy. Electronics shall be provided on CD. Final payment will not be made until these test results are received and approved by the Architect/Engineer. Test documentation shall be bound, Sectioned and tabbed in the following order:

Horizontal 4-Pair UTP Data Cable Horizontal 4-Pair UTP Voice Cable

- 4. One original 20-year Leviton Certificate of Warranty for the Structured Cable System
- 5. One original Contractor Warranty Letter with information to include the contact name, address and phone number for warranty call outs. Final payment will not be made until this warranty information is received and approved by the Architect/Engineer.
- 6. Two duplicate copy sets of the above documentation.

END OF SECTION

SECTION 28 13 00 ACCESS CONTROL

PART 1 - GENERAL

1.1 SUMMARY

- A. The work covered by this Section shall include all labor, equipment, materials, ancillary materials and services to furnish, install, test, and turnover components establishing a complete and operational microprocessor-based Access Control System (ACS), as described herein and in the contract drawings. This section includes specifications for an electronic access control system, which shall perform the following general services:
 - 1. Access Control
 - 2. Photo Badge Production
 - 3. Digital Video Recording
 - 4. Alarm Monitoring
 - 5. Visitor Management
 - 6. Alarm Graphics
- B. Related Sections include the following
 - 1. Division 08 for any door hardware items that interface with electronic safety and security systems.
 - 2. Section 28 23 00 for interface devices and communications protocol to integrate recording control and video camera selection and positioning into electronic safety and security systems.
 - 3. Section 28 16 00 for interface devices and communications protocol to integrate security functions of that Section with electronic safety and security systems.

1.2 PRICE AND PAYMENT PROCEDURES

A. Alternates: Alternate pricing shall be provided as a separate attachment and shall conform to guidelines set in section 1.3

1.3 VALUE ANALYSIS

- A. Any value analysis shall provided as an addition or deduct to this specification proposal. All value analysis items shall provide the following:
 - 1. Value proposition
 - 2. Action submittals as outlined in part 1.6
 - 3. Add / deduct pricing

1.4 REFERENCES

- A. Abbreviations and Acronyms
 - 1. TCP/IP: Transport control protocol/Internet protocol incorporated into Microsoft Windows.
 - 2. UPS: Uninterruptible power supply.
 - 3. WAN: Wide area network.

- 4. RF: Radio frequency.
- 5. I/O: Input/Output.
- 6. LAN: Local area network.
- 7. LED: Light-emitting diode.
- 8. CPU: Central processing unit.
- 9. ACS: Access control system.
- 10. CCTV: Closed-circuit television.
- B. Definitions
 - 1. ABA Track: Magnetic stripe that is encoded on track 2, at 75-bpi density in binary-coded decimal format; for example, 5-bit, 16-character set.
 - 2. Central Station: A PC with software designated as the main controlling PC of the security access system. Where this term is presented with initial capital letters, this definition applies.
 - 3. Controller: An intelligent peripheral control unit that uses a computer for controlling its operation. Where this term is presented with an initial capital letter, this definition applies.
 - 4. Credential: Data assigned to an entity and used to identify that entity.
 - 5. DTS: Digital Termination Service: A microwave-based, line-of-sight communications provided directly to the end user.
 - 6. File Server: A PC in a network that stores the programs and data files shared by users.
 - 7. Identifier: A credential card, keypad personal identification number or code, biometric characteristic, or other unique identification entered as data into the entry-control database for the purpose of identifying an individual. Where this term is presented with an initial capital letter, this definition applies.
 - 8. Location: A Location on the network having a PC-to-Controller communications link, with additional Controllers at the Location connected to the PC-to-Controller link with RS-485 communications loop. Where this term is presented with an initial capital letter, this definition applies.
 - 9. PCI Bus: Peripheral component interconnect; a peripheral bus providing a high-speed data path between the CPU and peripheral devices (such as monitor, disk drive, or network).
 - 10. ROM: Read-only memory. ROM data is maintained through losses of power.
 - 11. RS-232: A TIA/EIA standard for asynchronous serial data communications between terminal devices. This standard defines a 25-pin connector and certain signal characteristics for interfacing computer equipment.
 - 12. RS-485: A TIA/EIA standard for multipoint communications.
 - 13. WAV: The digital audio format used in Microsoft Windows.
 - 14. Wiegand: Patented magnetic principle that uses specially treated wires embedded in the credential card.
 - 15. Workstation: A PC with software that is configured for specific limited security system functions.
- C. Reference Standards
 - 1. FCC: All assemblies shall be in compliance with FCC emission standards.
 - a. Microprocessor based controller: Part 15, Subpart F, Class A.
 - b. Proximity Card Reading Sensors: Part 15, Subpart F (field disturbance sensors).

- c. Dial-up modems: Part 68
- 2. International Fire Code
- 3. American National Standards Institute (ANSI)
- 4. NFPA 70 National Electric Code International Organization for Standardization (ISO)
- 5. NEMA: Electrical equipment shall comply with applicable portions of NEMA.
- 6. Underwriters Laboratories (UL)
 - a. UL-1012 and CSA: All power supplies shall be in compliance with Underwriters Laboratories standard 1012 and CSA standards for power supplies.
 - b. UL-294: The system shall comply with Underwriter Laboratories standard 294 for Access Control Systems.
- 7. All applicable state and local codes

1.5 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: The ACS contractor is required to coordinate with all required trades work that is required by and for "others".
- B. Pre-installation Meetings: Pre-installation meetings shall be held outlining requirements of all trades involved in the successful installation of this ACS.
- C. Sequencing: The work shall be performed in the following sequence:
 - 1. Installation of Access Controllers & Modules.
 - 2. Installation of new devices and new readers.
 - 3. Installation of site control equipment.
 - 4. Commissioning of the new system components.
- D. Scheduling: The ACS contractor shall schedule work in order to complete the ACS in accordance with the project timeline.

1.6 ACTION SUBMITTALS

- A. Submit evidence of compliance for Security Contractor and equipment manufacturer prior to Bid, and as indicated under the quality assurance section(s) of Division 28 Specification Sections and this section.
 - 1. Submit a list of a minimum of 3 facilities within the United States of equal size and technical requirements utilizing the equipment submitted. For each facility, list:
 - a. Name and location of facility.
 - b. Date of Occupancy by Owner.
 - c. Owner's representative to contact and telephone number.
 - d. Construction Manager or General Contractor.
 - e. Architect.
 - f. Provide information on the installed locations with operational equipment.
- B. Submit data consisting of shop drawings and catalog cuts complete with technical data necessary to evaluate the material and equipment. Include dimension, wiring and block diagrams, performance data, ratings, control sequences, and other descriptive data necessary to describe the item proposed and its operating characteristics. Include compete technical specification for the

submitted equipment, noting differences and adherence to all Division 28 Sections.

- C. Submit shop drawings and product data in accordance with Division 1 and this Section.
 - 1. Coordinate with other trades in submittal of shop drawings.
 - 2. Shop drawings shall detail space conditions and shall be subject to final review by the Architect.
 - 3. Submit full size drawings depicting the security monitoring screen floor and site plan layout for each arrangement of associated indicator and control icons.
 - 4. Submit a full size set of color drawings depicting the graphic floor plan and site plan layout for each screen and graphic panel with arrangement of associated lights, icons and switches/pushbuttons.
 - 5. Provide an operational narrative of each component/system.
 - 6. Submit to Owner a complete listing of proposed devices, indicating interconnection equipment locations and specifying terminal/connecter termination locations. Submit a complete set of proposed drawings, identifying equipment locations, types of cabling, numbers of conductors, raceway locations, and termination points of each conductor.
 - 7. The approval of shop drawings or samples does not relieve the Security Contractor of responsibility for any deviation from the requirements of the Contract Documents, unless the Security Contractor has informed the Architect in writing of such deviation at the time of submission, has noted the deviation on the shop drawings, and the Architect has given written approval of the specific deviation. The Architect's approval also does not relieve the Security Contractor from responsibility for errors or omissions in the shop drawings or samples.
 - 8. Coordinate equipment submittals with construction schedules.
 - 9. Do not purchase or install equipment requiring submittal until the review process is complete.

1.7 INFORMATION SUBMITTALS

- A. Coordinate with, and submit for Owner approval a listing of all system components with recommended labeling for identification within the system.
- B. Coordinate with, and Submit for Owner approval a listing of doors recommended for time zone unlocking/alarm shunting.
- C. Coordinate with, and Submit for Owner approval a listing of operator privileges recommended for system segregation.
- D. Project Record Documents:
 - 1. As-Built Drawings: Security Contractor shall maintain record "as-built" drawings. Upon Security Contractor completion of the final punch list, a full size set of drawings and one set of CAD disks shall be submitted for review and record.
 - 2. The Security Contractor shall provide documentation of all final components showing the following information.
 - a. System Label
 - b. Physical Location
 - c. System address
 - d. Functional description

1.8 CLOSEOUT SUBMITTALS

- A. Warranty Documentation: Provide copies of manufacturers warranties for all system components and applicable equipment. Include statement of labor warranty from the manufacturer, Security Contractor, and/or 3rd party entity.
- B. Extra Stock Materials: Furnish materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Fuses of all kinds, power and electronic, equal to 10 percent of amount installed for each size used, but no fewer than three units.
- C. Substantial Design Closeout Documentation
 - 1. Operation and Maintenance Manual Data: Submit data in accordance with Division 1 and this Section for all equipment specified in this Section. Include complete set of supplier's operating instructions, installation instructions, and troubleshooting guide. Include final listing of doors, locations and normal status.
 - 2. Prior to Substantial Completion, provide schematic drawings depicting type and location of interface equipment/components, number of cables and conductors, raceway locations, types of connectors, circuit requirements and type and dimensions of enclosures.
- D. Tools
 - 1. The Security Contractor shall provide documentation of any specialized tools required by the End User in order to perform routine maintenance.
- E. Commissioning Reports: Security Contractor shall provide documentation of both the Final Test Acceptance and Start up Testing as per Part 3, 3.12.

1.9 QUALITY ASSURANCE

- A. Qualifications
 - 1. Manufacturer:
 - a. Manufacturer of products defined in this section shall have at least 10 years experience in manufacturing and servicing access control and management systems.
 - b. Manufacturing process of company shall meet standards of ISO 9001 Certification.
 - 2. Supplier:
 - a. Obtain Central Station, workstations, Controllers, Identifier readers, and all software through one source from a single manufacturer.
 - 3. Installer / Systems Integrator Qualifications:
 - a. An employer of workers trained and approved by manufacturer.
 - b. Company with a minimum of 5 (five) years system design, engineering supervision, and installation experience in the alarm or access control industry.
 - c. Company that is trained, authorized, and certified to install the specified products.
 - d. Company has local coverage for all sites included in this section qualified to service the products being installed.
 - e. Service facility: Systems Integrator shall have service facilities within 50 miles of the installation.
 - 4. Testing Agency
a. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Acceptance: Upon delivery to the site, Contractor shall inspect all products and materials for any damage. Acceptance of the units constitutes that the inspection has occurred and no damaged or unacceptable products were found, and any damage or unacceptable products would be the responsibility of the Contractor.

B. Product Storage and Handling Requirements

- 1. Central Station, Workstations, and Controllers:
 - a. Store in temperature and humidity controlled environment in original manufacturer's sealed containers. Maintain ambient temperature between 50 and 85 deg F (10 and 30 deg C), and not more than 80 percent relative humidity, non-condensing.
 - b. Open each container; verify contents against packing list, and file copy of packing list, complete with container identification for inclusion in operation and maintenance data.
 - c. Mark packing list with designations that have been assigned to materials and equipment for recording in the system labeling schedules that are generated by cable and asset management system specified in Part 2.
 - d. Save original manufacturer's containers and packing materials and deliver as directed under provisions covering extra materials.

1.11 SITE CONDITIONS

- A. Ambient Environmental Requirements: System shall be capable of withstanding the following environmental conditions without mechanical or electrical damage or degradation of operating capability:
 - 1. Control Station: Rated for continuous operation in ambient conditions of 60 to 85 deg F (16 to 30 deg C) and a relative humidity of 20 to 80 percent, non-condensing.
 - Interior, Controlled Environment: System components, except centralstation control unit, installed in temperature-controlled interior environments shall be rated for continuous operation in ambient conditions of 36 to 122 deg F (2 to 50 deg C) dry bulb and 20 to 90 percent relative humidity, non-condensing. NEMA 250, Type 1 enclosure.
 - 3. Interior, Uncontrolled Environment: System components installed in nontemperature-controlled interior environments shall be rated for continuous operation in ambient conditions of 0 to 122 deg F (minus 18 to plus 50 deg C) dry bulb and 20 to 90 percent relative humidity, non-condensing. NEMA 250, Type 12 enclosures.
 - 4. Exterior Environment: System components installed in locations exposed to weather shall be rated for continuous operation in ambient conditions of minus 30 to plus 122 deg F (minus 34 to plus 50 deg C) dry bulb and 20 to 90 percent relative humidity, condensing. Rate for continuous

operation where exposed to rain as specified in NEMA 250, winds up to 85 mph (137 km/h). NEMA 250, Type 4 or 4X enclosures.

- 5. Hazardous Environment: System components located in areas where fire or explosion hazards may exist because of flammable gases or vapors, flammable liquids, combustible dust, or ignitable fibers shall be rated, listed, and installed according to NFPA 70.
- 6. Corrosive Environment: For system components subjected to corrosive fumes, vapors, and wind-driven salt spray in coastal zones, provide NEMA 250, Type 4X or 6P enclosures.
- 7. Begin installation of electronic components only when the following is met, in each installation area:
 - All wet work is completed. a.
 - Area is dust free. b.
 - Painting work is completed. c.

1.12 WARRANTY

- Α. Special Warranty
 - Proximity Access Cards and Readers: Proximity card and readers shall 1. provide a lifetime warranty against workmanship and defects.
 - 2. System Components: One (1) year from date of Substantial Completion.
 - 3. Labor: One (1) year from date of Substantial Completion.
- В. Extended Correction Period: On system components that require an extended correction period after Substantial Completion, the above Warranty shall commence at the end of the extended correction period.

PART 2 - PRODUCTS

1.1 MANUFACTURERS & INTEGRATORS

- Subject to compliance with project requirements, manufacturer's offering Α. Products which may be incorporated in the Work include the following: 1.
 - Access Control System Hardware/Firmware/Software:
 - Security Management System (Vanderbilt Version 6.3) a.
 - b. No Substitutions
 - 2. Power Supplies:
 - Schlage Electronic Security and/or Vanderbilt a.
 - b. No Substitutions
 - 3. Credentials & Readers:
 - Schlage Electronic Security a.
 - No Substitutions b.
 - Remote Key Switches & Request-to-Exit Buttons: 4.
 - Schlage Electronic Security a.
 - b. Approved Equal
 - 5. Door Position Switches/Contacts:
 - Schlage Electronic Security a.
 - Approved Equal b.
 - 6. Request-to-Exit Motion Sensors:
 - Schlage Electronic Security a.
 - b. Approved Equal
 - 7. Electric Horns, Door Alarms, Strobes:

- a. Schlage Electronic Security
- b. Approved Equal
- 8. Acceptable Integrators are as follow:
 - a. Texas Lock & Door Closer, San Antonio, Texas (Mr. Mike Skinner)
 - b. 3Sixty Integrated, San Antonio, Texas (Mr. David Cruz)

1.2 ACCESS CONTOL SYSTEM REQUIEMENTS

- A. General Access Control System Description:
 - 1. The Access Control System's primary function is to regulate access through specific portals to secured areas and provide security functions noted in this Section.
 - 2. The ACS shall utilize proximity card technology as its primary access device but will support other input technologies at each door.
 - 3. SURGE AND TAMPER PROTECTION:
 - a. Surge Protection: Protect components from voltage surges originating external to equipment housing and entering through power, communication, signal, control, or sensing leads. Include surge protection for external wiring of each conductor-entry connection to components.
 - b. Tamper Protection: Tamper switches on enclosures, control units, pull boxes, junction boxes, cabinets, and other system components shall initiate a tamper-alarm signal when unit is opened or partially disassembled. Control-station control-unit alarm display shall identify tamper alarms and indicate locations.
- B. General Access Control Hardware Description:
 - 1. The ACS Hardware shall be expandable to meet all criteria noted in Section 2.4 of this document.
 - 2. The ACS Hardware shall include all options to accommodate all devices in the construction documents.
 - 3. The ACS Hardware shall include devices to accommodate the following functions:
 - a. The system shall include hard wired locking hardware programmable by the ACS system. All hard wired hardware shall provide support for a minimum of 1000 users and 1000 audit events. Hard wired hardware shall be hard powered utilizing local stand alone controllers.
 - b. The ACS shall be able to support proximity credential technology at every access control location.
 - c. The ACS contractor shall provide 300 proximity credentials.
- C. Internal System Security Provisions:
 - 1. Supervised Wiring: Selected field wiring shall be supervised. Cutting, shorting, or altering connections of any wire listed as supervised below, shall be detected, and activate an alarm condition at system workstations. Provide wiring supervision for the following functions:
 - a. Tamper Switches.
 - b. Door Position or Contact Switches.
 - c. Panic/Duress Alarms.

- d. Other intrusion detection/alarm input devices, as defined herein and indicated on the Drawings.
- 2. Provide signs or labels for all tamper monitored enclosures warning that an alarm will sound if access is attempted, and giving the telephone number of the security workstation operator.
- 3. Access Control System head end shall be interfaced with the CCTV system head end to cause automatic call up (via ASCII text string). Upon alarm or selected event condition, the access control system shall cause the CCTV system to automatically call up the camera image associated with the alarm or event point or location.
- 4. Interface with the Fire Alarm System: The ACS shall be programmed so that relay output contact(s) from the fire control panel will be capable of initiating a selected or zoned unlocking of secured portals during potential emergency incidents or situations. Coordinate the requirements of this physical interface with other disciplines affecting the Work.
- D. Ensure integration with, and control of, motorized doors, gates and turnstiles included in the project.
- E. When the access control system is used to activate or open doors equipped with motorized operators and electric locks, provide a 0.5 second delay timer to delay activation of the door operator until the electric locks are released.
- F. Multiple Contractor User privilege levels established during the installation and testing periods of this Project shall be removed from the system, unless otherwise authorized in writing by the Owner.

1.3 MATERIALS, GENERAL

- A. Power: All ACS equipment shall operate on 120-VAC. Any special power treatment required, such as filtering or spike elimination that may be required for proper operation and protection of the ACS, shall be provided with the system.
- B. Backup Power: ACS equipment shall be supplied from a UPS system, which shall be tied to emergency building power circuits. The UPS shall power the equipment including, but not limited to, access control processors, modules, electronic locks and lock power supplies for a minimum of 4 hours. Access control system PC Servers and Workstations shall be equipped with a local Uninterruptible Power Supply (UPS). The UPS shall provide a minimum of 600VA.
- C. Hardware: Provide a distributed access control system as required for a complete operating system as described herein and as shown on the Drawings.

1.4 ACCESS CONTROL SYSTEM HARDWARE / FIRMWARE

- A. All the hardware shall be provided with enclosures, which have hinged doors and latches. All the enclosures shall be equipped with tamper switches.
- B. Control Panels
 - 1. The control panels shall be independently programmed, intelligent devices, which shall be able to make decisions at the local level. The system shall provide reader controllers at 2, 8 and 16-reader capacity.

- 2. The system shall also provide alarm control boards, which has 24 supervised contacts and 24SPDT relays. It shall be connected to reader controllers with 8 or 16-reader capacity. These boards shall be utilized for alarm control as well as elevator control.
- 3. The system shall support direct and master/slave configurations. Reader Interfaces and controllers may be connected to the same board but they may not be mixed in the same channel.
- 4. The system shall also support small controller boards, which is ideal for small systems. These boards shall act as master controllers, which shall be able to support a maximum of sixteen (16), control panels with 2-reader capacity. These controllers shall support any kind of read head technologies and keypads.
- 5. The communication between the PC and the control panel shall be directly through a serial port or through an IP addressable modem. The system shall also support dial up connection.
- 6. The control panel shall also dial the PC automatically when the alarm or the transaction buffer is 75% full.
- 7. The communication between PC and the control panel shall be via RS232 protocol on a direct connection.
- 8. The communication between control panel and the reader interface shall be via RS485 protocol.
- 9. The control panels shall be used with any combination of read head technologies: magnetic stripe, wiegand, barium ferrite, bar code, smart card, biometric and more.
- 10. The panel shall provide monitoring of up to 16 supervised or unsupervised contact inputs and two fourteen (14), 3-amp relay outputs, in addition to monitoring AC power and low battery. To support this functionality, an expansion board shall be required.
- 11. The control panels shall be filtered at the operator level. The filter shall allow operating, editing, viewing or denying access to the hardware.
- 12. All the commands and updates to the panels shall be verified and shall automatically retry if communication have failed.
- 13. Provide a system scheduler that shall automatically call remote locations to update panel information and get transactions.
- 14. Each panel shall be addressed within the system by a unique user defined name.
- 15. The control panel shall incorporate an on-board 16-channel multiplexer to support up to 16 readers. In cases where the physical environment dictates running a single pair of wire, the panel shall provide a point on the board capable of supporting up to 16 card readers in a multiplex or multi-drop configuration. Hardwire connection shall be 2-Wire RS485. Full duplex RS232, shall support only 8 card readers.
- 16. The controller shall incorporate integral on-board auto-answer, auto-dial modem for call back. If a network connection is present, the dial-up connection shall serve as an alarm backup in case the network is busy or fails. There shall be a provision to call alternate telephone numbers when alarms occur. For additional security, the control panel in a dial-up configuration shall dial the PC back before receiving any data. The control panel shall provide a response time from card presentation to GO/NO-GO indication, not to exceed one second, regardless of the number of card readers active in the system at any time.

- 17. The control panel shall provide control of up to 14 scheduled or event driven relay outputs.
- 18. The control panel shall have dynamically allocated RAM memory to store up to 125,000 card ID numbers up to six digits in length. Additional RAM modules shall be available in 3MB and 7MB, to achieve the 125,000-card memory requirement.
- 19. The control panel shall Store a minimum of 4,000 card access transactions when offline from the network.
- 20. The control panel shall incorporate built-in data backup in the form of a lithium battery or "Super cap" to last 168 hours.
- 21. The control panel shall have a 7-Amp hour Gel Cell battery for standby operation.
- 22. The control panel shall incorporate a built-in, real-time clock for providing scheduled event programming. Clock shall be initially set and subsequently updated from the PC or hand-held programmer described above.
- 23. The control panel shall be able to run on low voltage: 14-17VAC or 12VDC. Power consumption shall not exceed 600 mA (excluding card readers).
- 24. The panel shall support a palm application for control panel diagnostics. The user shall be able to use it for trouble shooting purposes.
- 25. Contact Point Supervision
 - a. The control panels shall support supervision of contact points to detect any tampering with the equipment, including breaks and/or shorts in the cable between the reader controller and the supervised input point.
 - b. To detect trouble in the circuit, terminating resistors shall be installed within the contact. These resistors shall allow the controller to distinguish between a contact point opening or closing from the circuit opening or shorting.
 - *c*. The controller shall support three methods, or types of supervision.
 - 1) Type 0: Both series and parallel resistors at the contact
 - a) Door Held Open (DHO) or Door forced Open (DFO)
 - b) Contact Secured
 - 2) Trouble Open (break in the circuit)
 - 3) Trouble Short (a short in the circuit)
- C. Reader Interface
 - 1. Each reader in the system shall have a dedicated reader interface.
 - 2. The reader inter face shall support multiple read head technologies including:
 - a. Proximity
 - 3. The reader interface shall contain and control up to two single pole/double throw 1-amp mechanically latching relays.
 - 4. The reader interface shall provide six supervised or unsupervised contact inputs (in addition to the 16 supervised or unsupervised inputs on the controller).
 - 5. A noise suppression kit shall be included with the reader interface.
 - 6. The reader interface shall communicate via RS-485, two-wire cable up to 4,000 feet from the control panel to which it is connected, using 18AWG, I pair, stranded, shielded, Twisted.
 - 7. The reader interface shall support programmable degraded mode by allowing up to four (4) different facility codes at each controller location.

Degraded mode for an individual reader shall be programmable via the PC system software E.g. door is not).

- 8. The reader interface shall support an audible GO signal.
- 9. The reader interface shall support multi-color LED for GO and NO GO indications.
- D. Optional Devices
 - 1. The system shall provide expansion board with 12 additional relays and 8 contact inputs.
 - 2. The system shall provide memory expansion boards with 3-7 MB memory.
 - 3. The system shall provide on board modems and IP modules.
- E. Pre-wired Enclosures The control panel shall be housed in a pre-wired metal enclosure, which shall accommodate one Reader Controller, 8 RINX Reader Interfaces, and shall include:
 - 1. Pre-wired 16/32 VDC 100 VA power supply.
 - 2. Pre-wired 12/24 VDC 100 VA power supply.
 - 3. Pre-wired (2) 7 amp-hour batteries.
 - 4. Pre-wired 12VDC 4.0 amp power supply.
 - 5. Pre-wired Communication Housing.
 - 6. Individual 1 amp fusing for reader, egress device, electric door lock.
 - 7. Pre-printed and color coded wiring termination labels.
 - 8. Optionally, there shall be a 6 amp 24 VDC lock power supply/charger with Emergency Relay and (2) 7 amp-hour batteries.
 - 9. Dimensions shall be $30'' H \times 30'' W \times 8'' D$, with two-inch EMT knockouts and locking double door.
 - 10. When more than 8 readers are connected to one RCNX Reader Interfaces 9-16 shall be housed in a GENC-RINX enclosure with specifications identical to those listed above.
- F. ACCESSORIES
 - 1. Request-to-Exit Motion Detectors:
 - a. Motion detectors shall be used to shunt alarm signals when exiting. Detectors shall not be used to unlock the access door.
 - b. 12VDC Request-to-Exit (REX) sensors:
 - 1) Field adjustable for coverage.
 - 2) Form C relay output for signaling to Controller.
 - 2. Door Position Switches/Contacts:
 - a. Hermetically sealed magnetic reed switch.
 - b. Contact & magnet housing shall snap-lock into a ³/₄" hole.
 - c. Provide 45-degree condolettes to enclose and protect cabling from door contacts/switches. Condolettes shall be placed as close to the contact/switch as possible.
- G. Hardware Specifications
 - a. Control Panels
 - 1) Power 12-24 VDC, 12 Amps
 - 2) Power consumption 600 mA
 - 3) Ambient temperature 0° to 49° C or 32° to 120° F
 - 4) Humidity 10% to 85%
 - 5) Maximum distance to PC 50 feet RS232 communication
 - 6) Recommended cable 22 AWG/3 conductor stranded, shielded
 - b. Reader Interfaces

- 1) Power 12-24 VDC, 12 Amps
- 2) Power consumption 600 mA
- 3) Ambient temperature 0° to 49° C or 32° to 120° F
- 4) Humidity 10% to 85%
- 5) Recommended cable (connecting to control panels)– 18 AWG/3 conductor stranded, shielded
- 6) Recommended cable (connecting to read heads)– 22 AWG/3 conductor stranded, shielded
- Maximum distance (both to controller board and read head) 500 feet
- c. Accessories
 - 1) Door Contacts
 - a) Voltage: 100 V AC/DC max.
 - b) Current: 0.5 A max.
 - c) Power: 7.5 W max.
 - d) Loop type: Closed N/O.
 - e) Mounting: Recess mounted.
- 1.5 ACCESS CONTROL SYSTEM SOFTWARE (ONLY IS SOFTWARE IS NOT EXISTING)
 - A. System Communication: System shall provide an interface (Communication Interface Module or CIM) to issue all database changes to the Reader Controllers. This software module also shall have the ability to gather all the information (transactions) from the Reader Controller and store it in proper history files.
 - 1. The CIM shall reside on any workstation or server. On a single user system, the CIM shall reside on a workstation, but on a multi user system that uses multiple CIMs, it shall reside on any workstation or server.
 - 2. The communication between the CIM and the controllers shall be through direct cabling, phone lines or TCP/IP communication protocol.
 - 3. All serial ports to which the controllers are connected shall be configured using an easy to follow menu. All the COM PORT status messages shall be color-coded.
 - 4. An operational tab shall be provided to tell the CIM to check for the changes that are made in the database.
 - 5. The CIM shall have a specific window, which shall display all the Controllers connected to a COM Port. The user shall be able to select one particular Controller and get all the information pertaining to that device. (E.g. Device number, channel, address, phone number, connection status etc).
 - 6. The user shall be able to schedule automatic updates of controller panels. The CIM shall be able to communicate with the control panels located at remote locations via a dial up modem, at scheduled intervals and update the data in the controller memory.
 - B. Communication Management: System shall facilitate a program that controls the communication between the CIM and the workstations.
 - 1. Application shall be in charge of directing transactions and alarms to proper workstations.
 - 2. Program shall be capable of sending alarms of e-mail messages to legitimate e-mail accounts.

- C. Access Rights: Software shall allow for assignment of the access rights to badge holders. The access right is the combination of what "Areas" the badge holder can go (badge and elevator readers) and when the badge holder can go there (time zones). Each badge holder shall be allowed multiple "Area" access rights. Each access right shall be allowed to have a different time schedule.
 - 1. Software shall automatically load the proper access rights into each field panel without any operator intervention. There shall be no limits on the number of access rights (who goes where and when) by the system design.
 - 2. Access Privilege Expiration: Include the ability to force an expiration of access privileges in any or all areas with a simple mouse clicking procedure.
 - 3. Extended Access Privilege: Include the ability extend the access privileges in any or all areas with a simple mouse clicking procedure.
- D. Event Triggers: System shall provide flexibility when associating action items with time zone programmed events, i.e. card transactions with contact reporting and relay activation.
- E. System Management: System shall provide a tool that will integrate and categorize the Owner's data and at the same time the user shall be able to simultaneously monitor and maintain a secure working environment.
 - 1. The system shall contain the definition of all intelligent field control panels (i.e. Reader controllers (RCs), card readers, contact inputs etc). There must be a provision to label each device with at least a 20 character alphanumeric description to easily identify each component.
 - 2. System software shall be designed to allow operational management and control at many "tiered levels" with the apex of control being in the hands of a "Global Manager". The "Global Manager" shall have administrative authority for the entire system and delegate administrative responsibility as follows:
 - a. Area Management and Area Sets: Provide a functionality to divide the protected facility into logical areas, which can be either one physical location (e.g. main lobby) or many logically related physical locations (e.g. All the computer rooms in 12 different cities). System administrators shall be assigned jurisdiction in one or more areas through assigning proper security privileges to the areas. The system shall provide a functionality to organize areas to area sets to provide segmented security.
 - 3. Categories: Within one area or many areas, administrators may only have jurisdiction over certain categories of cardholders or devices:
 - a. Cardholder Categories: The system shall permit the administrator or authorized operator to create cardholder categories. The categories shall be used to define access rights for certain types of employees, such as "Temporary workers" or "IT employees". All the categories defined by the user should be available in the form of a drop-down menu for the ease of modification.
 - b. Devices: The system shall allow assignment of operator privileges to be restricted to programming only devices in certain "areas" such as "turnstiles", "handicapped access points", "motion detectors" or "building management" related devices.
 - 4. Door Types: The system shall support a minimum of eight user-definable door types within an area. For example, in a lobby area, it shall be

possible to restrict most employees to "turnstiles", and only physically challenged employees would be permitted to access "handicap gates".

- 5. System State: The system shall have the ability to place an area in various user-defined states such as normal access, fire emergency, strike lockout, etc, thereby changing the access rights to the respective areas without having to change individual cardholder access privileges.
- 6. Holidays and Holiday Sets: The system shall allow the user to define the holidays according to the specific needs. There shall also be the facility to group holiday dates into specific grouping so that, time zone assignments can include all the individual holidays in that. Holidays shall be organized into holiday sets for easy management.
- 7. Time Zones: Time zone definitions shall include starting time, ending time, days of week and holidays. Time shall be definable in either AM/PM or 24-hour (military) time. Maximum time zones that can be defined in a system shall be unlimited.
- 8. Site Codes and Site Code Sets: The system shall allow to program readers in degraded mode. In degraded mode the system should allow access to cardholders when the controller board has lost data communication with the Reader Interface.
 - a. The system shall provide a functionality to assign a number ranging from 1 to 1,000,000 to each site.
 - b. Cardholders shall be assigned one of these numbers for a specific site while the same number should not allow access to another site.
 - c. Any lost communication shall not interfere with access being granted as site codes are downloaded and retained in the reader memory.
 - d. When site codes are programmed and downloaded to the controller, the board should check for validity of that site code against the card that has been read. If the site code does not match what is stored on the board then access should be denied.
 - e. Cards that are purchased from Schlage Security Management System shall have the site codes encoded on the card. The site codes shall be able to organize into site code sets.
- 9. Call Back Numbers and Call Back Sets: The system shall provide a facility to define call back numbers for modem communication between reader controllers and the CIM. The user shall be able to put the Call Back numbers into Call Back Sets.
- 10. Hardware Definitions: The system shall allow the configuration and programming of the system hardware by easy programming. The user shall be able to define workstations, CIM, CIM Ports controllers, readers, relays and contact points. All the information entered shall be editable using an easy to use interface.
- 11. Device Status: The operator shall have the option to view a single device's state at any point off time. The user shall be able to request and receive the status from any reader, relay or contact. The status is displayed in a dialog box when it is received.
- F. System Security: The system shall be secure both in its operation and administration. The system shall offer ample flexibility for the administrator to establish and customize any level of security by assigning security permissions to group of operators. The individual operator shall be able to log into the system using a unique operator ID and a password associated with that operator

ID. The "Administrator" of the system may set the following rules and standards:

- 1. Login Requirements
- 2. Logging into the system shall be restricted using User ID and password. The user ID shall be of alphanumeric characters. It shall be a unique ID and cannot be duplicated. Password also shall be of alphanumeric characters but shall be case sensitive.
- 3. The administrator shall be able to define the expiration date of the password. The administrator shall have the ability to set a predetermined period of days in advance to warn the operators upon login, as to how many days remain before their passwords expire. The administrator shall also have the ability to set the password valid for an indefinite amount of time.
- 4. The administrator may disable an operator's password at any time by merely checking a box for that function. The administrator may also set the following conditions for disabling operator passwords automatically:
 - a. After a programmable number (1-999) of consecutive illegal login attempts, e.g. wrong operator ID or wrong password for that operator ID.
 - b. After a specified number (1-999) of days of non-usage of the system by the individual operator.
- 5. The administrator shall also be able to pre-set the system to automatically lock out the operator workstation currently in use by the offending operator for a specified or indefinite period of time, until the administrator resets the password.
- 6. Operator Security Groups: The system shall provide a functionality to define security groups, assign privileges and place individual operators into these groups. Though one operator shall be placed into only one security group, he/she shall be switched to a different security groups with one mouse click. These security groups shall in turn determine the security privileges of the operator. A security group shall have at least the following permissions:
 - a. Whether multiple logins are allowed as opposed to only being allowed to login to the system a single time.
 - b. Whether the operator has to exit the security system in order to return to the Windows operating system.
 - c. What system software programs are available to the operator in this specific security groups.
 - d. What privileges are extended to the operators in a specific security group as it pertains to accessing various elements of the System Data Base and in performing assigned function's.
- 7. Operator Privileges The administrator shall have the ability to assign permissions to operators as far as gaining access to and exercising database functions. Once an operator has logged into a given workstation, the system shall display only those programs to which the operator has at least Read only permission. The system shall offer tighter security by providing the functionality to assign privileges not only to programs and reports but also to fields like areas, area sets, cardholders, cardholder categories and all user defined fields.
- 8. Default Security Privileges The System Security module shall allow predefining the default permissions settings. These settings shall only affect privileges for new security groups that are added. It shall not cause

any changes to permissions assigned to existing groups. To access these settings, the operator must have Administrative privileges. Permissions for new groups shall default to these settings (set to none), however these settings shall not be assigned to the System Administrator group or members of the security group that added the field. The permissions can be defined on a need to know basis. Privileges are defined as follows:

- a. None No ability to view or edit a particular field in the database (e.g. Encoded number in the cardholder file)
- b. Read Only Only the ability to view the contents of a particular field in the database. The Edit option for the related programs or fields shall be disabled.
- c. Read/Write The ability to both view and edit a particular field in the database, except those fields reserved for operators with "Administrative" status.
- d. Administrative The ability to perform all system-wide functions (functionally same as Read/Write permissions).
- e. The above privileges shall be applied as follows:
 - 1) Area Sets The Administrator shall have the ability to prevent a group of operator from viewing, modifying or deleting (specific) Area Sets while allowing them to insert new Area Sets to the database.
 - 2) Categories The administrator shall have the ability to restrict the operator from viewing, editing or deleting cardholder categories. E.g. Training department, Technical support department.
 - 3) Cardholder Fields The operator privileges shall be extended only to individual user-defined fields in the cardholder database, E.g. "Keypad ID", "Stamped ID".
 - 4) Override Sets Within the assigned area and categories the operator shall be given permissions to override standard system settings to perform such functions as unlock doors, shunt alarm points, turn on or off control points normally operating on a schedule.
 - 5) Device Types Within a defined "Area", the operator privileges shall be extended only to specific user-defined categories of devices, E.g. "Handicapped card readers", "Turnstile card readers", "Life Safety sensors", "Environmental controls", "Vehicular gates", etc.
 - 6) Filters The Administrator shall create filters for transactions and operator privileges shall be extended to the ability to delete or view selected transactions as they occur in real-time mode.
 - 7) Applications Launcher The operator privileges shall be extended only to selected application programs such as "Alarm Monitor", "Alarm Graphics", "Transaction Monitor", "CCTV Camera Control", "Cardholder Definitions" etc. Setting permissions to none for any item shall remove it from the System Launcher screen.
- G. Reports: Assigning appropriate privileges to operators shall restrict generating or running reports.

- H. Badge Layouts: Badge layouts shall be protected by assigning appropriate privileges.
 - 1. New records (new module, report, user defined cardholder field) that are added to the database shall have none permissions until the Administrator modifies the permissions.
 - 2. The operator shall be able to make the selections by placing checkmarks in the boxes as opposed to highlighting the text in order to prevent erroneous assignments, as well as for the ability to make multiple selections.
 - 3. The assigned fields shall display in the permission's color (None, Read Only, Read/Write and Administrative).
- I. Start-up Programs:
 - 1. The programs such as CIM, SP, CCTV, History Archive, Universal Triggers, Alarm Monitor and Alarm Graphics etc (both Alarm Monitor and Alarm Graphics shall not be added as the start up programs at the same time) shall be set to launch before the operator is logged in to the system.
 - 2. The administrator shall be able to select any programs from the above list and set to launch before the operator log in.
- J. Cardholder Creation and Management: The system shall provide an easy to use interface to add, delete or modify cardholder information effortlessly. With the use of wizards the user shall be able to input and retrieve data regarding area access, active, retired badges and cardholder categories etc.
 - 1. The cardholder information shall include the following fields for each badge being issued.
 - a. Cardholder's first name and last name.
 - b. Activation and expiration dates (spanning years).
 - A unique encoded number The number that is encoded within the card and used as a means of identification. The number of digits encoded shall be capable of containing the equivalent of a social security number (e.g. 123-45-6789 = 123456789) plus a 2-digit issuance code (See Badge Issuance Number below)
 - 3. A variable keypad number that the user can select from 1 9999.
 - 4. Badge Technology The technology in use for this particular badge, to be selected from a "drop down" list as follows:
 - a. Proximity
- K. Badge Layout: The visual representation of the badge, as it shall be printed.
 - 1. Areas and area sets the cardholder has access to.
 - 2. The following fields shall be available for the use at the administrator's discretion:
 - a. Stamped ID The number that is "heat stamped" on the card (not the encoded number)
 - b. Badge issuance number Upon entering, the default for this field shall be set at "0". This number can be incremented by the operator if the badge is reissued because it is either damaged or lost.
 - c. Badge Status The current status of the most recently issued badge. This shall be selected from a "drop down list" as follows:
 - d. Active Badge is currently active
 - e. Lost Badge has been reported missing
 - f. Stolen Badge has been reported stolen

- g. Destroyed Badge has been rendered unusable
- h. Suspended Badge has been temporarily suspended
- 3. System shall also provide optional user definable badge states.
 - i. Door States The types of doors that the Cardholder has access to (e.g. Normal, handicapped).
- 3. The system shall provide optional user definable fields
 - a. Badge Created: Shall be automatically generated by the system during badge printing.
 - b. Date Badge Printed: Shall be automatically generated by the system during badge entry.
 - c. Date Badge Modified: Shall be automatically generated by the system during subsequent badge modifications for access or categories for that cardholder
- 4. The system shall allow the user to duplicate specific user definable information like area access, categories, badge layout, technology etc whereas, fields like encoded id, stamped id, portrait, signature etc will be unique to each cardholder. This feature shall be available with in a single mouse click.
- 5. The system shall also allow the creation of templates that contains general cardholder information like area access and categories. Encoded id, stamped id etc shall be unique for each cardholder.
 - a. For example, the system shall allow the creation of a template for all the members of the engineering department or sales department of a company and save it in the database. When the user creates a cardholder and assigns badge, the user shall be able to use the corresponding template.
- L. Allow multiple credentials per cardholder. Cardholder data shall be modified and deleted directly from the main screen or by using menu, hot keys or tool bars. Include the following attributes:
 - 1. The option to retire active credentials whenever a new badge is initiated.
 - 2. Functionality to automatically choose a badge technology and badge layout whenever a new badge is added.
 - 3. While deleting multiple cardholders at the same time, any attempt that fails shall be added to a list and presented to the operator with the cause of error.
 - 4. Functionality to mass change access control fields for activation/expiration dates, access block and anti-pass back.
 - 5. Cardholder search wizard to make finding cardholders a simple process.
 - 6. Functionality to make multiple selections in the cardholder search window by holding down the Ctrl key.
 - 7. Provide options to include time zone reference.
 - 8. Upon editing card information, the updated information shall be sent automatically to the appropriate access control panel, when hardwired, with no other user intervention. If the scheduler is used, then the card updates shall be sent based on scheduling.
 - 9. The system shall allow the user to add e-mail addresses of the cardholders into the database.
- M. Person with Disability: The system shall allow additional access to doors for physically challenged cardholders.

- 1. When a new cardholder is added to the system, the operator shall have an option to select a specific field with Person with Disability option. The event triggers for LED Green transaction shall be programmed in the System Manager. The Duration field shall allow for a longer transaction (e.g 30 second versus the standard 5 seconds). The field, Person with Disability, shall also be added to the All Cardholders and Cardholder by Category grids of System Manager. The value shall default to false. The CIM shall be modified to update panels with the Person with Disability feature when a cardholder record is downloaded. Privileges to this field shall be assigned in the System Security module under cardholder field permissions.
- 1. Online Credentials: The system shall provide the ability to assign online credentials to cardholders that communicate directly with the controllers.
- 2. Offline Credentials: The Schlage Security Management System shall support offline readers which do not communicate with the host controller directly. The user shall be able to create necessary downloadable files and upload to a pocket PC. The data shall be transferred to a PDA by connecting to the serial communication port of the PC. The programming of doors shall be accomplished by connecting a CIP (Computer Interface PAK cable) from the laptop/palmtop to the I-Button ports of the lock.
- N. Assigning Area Access: Provide functionality to define cardholder's access to selected Areas and Area Sets.
 - 1. Provide the ability to define specific time of access.
 - 2. Access Control function shall include validation based on time of day, day of week, holiday scheduling and positive verification of site code, card number or PIN number verification.
 - 3. Provide a template of defined access level detail, where changes can be made to the template and saved as a new access level.
 - 4. Provide an option to create user definable area states and door types and there by giving the cardholder access at special circumstances.
 - 5. The system shall also provide the user to define access control templates while defining area sets. When a new area is added to the area set, templates of access level detail, where changes can be made to the template and saved as a new access level template.
- O. Portrait Capture: Provide ability to store digital images of the cardholder. One cardholder shall have only one image attached to one record.
 - 1. The images shall be taken using a digital camera or a TWAIN device. The system shall also provide the functionality to save the images in the hard drive. The operator shall be able to retrieve the files for future use.
 - 2. The system shall provide necessary tools for image editing like cropping, resizing centering the image etc.
- P. Portrait Enhancement: The system shall provide a functionality to enhance the cardholder portrait. There shall be a utility, which enables the operator to improve the quality of the picture by adjusting the brightness.
 - 1. The operator shall be presented with 15 different views of the cardholder portrait. The "Increase" and "Decrease" buttons shall help the operator to make the picture lighter or darker.
 - 2. The operator shall be able to access this utility from the program where he/she defines the cardholders and captures their portrait.
 - 3. The system shall also provide a transparency preview of the image.

- 4. The system shall also allow the user to edit the image through a third party application. Editing an image shall be limited to changing background color, resizing the image, cropping etc.
- Q. Portrait Exporting: Provide a functionality to export cardholder portraits in JPG format.
 - 1. The operator shall be able to copy the files to a folder that exists outside the system software. The operator shall be able to select the directory to which the portraits are being exported.
 - 2. When exporting files the user shall be provided with an option to decide the file naming convention.
- R. Signature Capture: Provide ability to store a digital signature of the cardholder. Each cardholder shall have only one signature attached to his/her record.
 - 1. The operator shall be able to use an already saved signature or the system shall provide the option to capture a fresh one using any TWAIN device.
 - 2. The system shall provide necessary tools to edit the signatures like cropping, centering etc.
- S. User Definable Fields: The system shall provide a functionality to create additional User Definable Fields that shall be applicable in certain programs. A few examples will be Nickname, Social Security Number etc.
 - 1. The user shall be given an option to select the type of fields from a variety of choices like:
 - a. Look up list
 - b. Boolean
 - c. String
 - d. Integer
 - e. Date
 - f. Time
 - g. Date & Time
 - h. Notes
 - 2. When defining a user definable field, the system shall give the user the flexibility of deciding whether the field is pertinent only to cardholder database or guest pass database or both.
 - 3. The user shall be given an option to make the new fields "Required".
 - 4. The user shall easily modify the user definable fields. The user shall be able to resize, align and position the fields either by dragging the edges of the fields or by entering specific values of dimension.
 - 5. The system shall provide a way to organize the newly created fields along with the predefined fields that already exist in the program.
 - 6. The system shall display the predefined fields in a programmable font color.
- T. Designing Badge Layouts: The system shall provide functionality to design and print badge layouts.
 - 1. The features of the badge-designing program shall include the ability to use background color, background image, inserting pictures, logos, signatures and a variety of fields that the operator uses while defining a cardholder.
 - 2. The user shall be able to use professional layouts.
 - 3. Images of different formats (JPG, GIF, BMP) shall be inserted into the badges.

- 4. The user shall have the option to make the background of the image transparent.
- 5. The user should be able to customize the badge by making the following selections:
 - a. Adding any cardholder fields.
 - b. Text style.
 - c. Font style.
 - d. Font color.
 - e. All upper caps.
 - f. Horizontal alignment.
 - g. Vertical alignment.
 - h. Text background color.
 - i. Border setting.
- 6. The program shall provide a functionality that allows the user to test the portrait or signature's transparency effect by changing the background color.
- 7. The program shall provide an easy way to edit all the information entered into the badge.
- 8. The user shall be able to view both sides of a badge.
- 9. The program shall save the changes automatically while changing the sides or moving to another layout.
- 10. The program shall also support magnetic stripe encoding. The program shall provide three tracks for the magnetic stripe cards. The user shall be able to insert the cardholder information like PIN or Encoded ID or hard coded text (the user shall be able to type in the text) into these fields. Each field added shall be separated with a separator symbol.
- 11. The program shall provide a wizard that helps the user to select the fields he/she wants to insert into the magnetic stripe fields.
- 12. The user shall have the option to duplicate the badge layouts with a single mouse click.
- 13. The badge layouts shall be secured using the system security. Only operators with Read/Write permissions shall be able to modify or create badge layouts. The permissions set to a badge layout shall affect an operator using the badge layout in the Cardholder Definition, Badge Queue and Guest Pass System.
- U. Printing Badges: Once the badge is created the user shall be able to print it from the badge creation program.
 - 1. The badge creation software shall be able to override the default printer settings and use the dimensions of the badge, which in turn will decide which layout to use while printing.
 - 2. The program also shall provide an option to print dossier reports.
 - 3. Badge Automation
 - 4. The system shall provide a functionality that enables the operator to automatically choose a badge layout and a badge technology whenever the user wants to add a badge to a cardholder record.
- V. Export and Import Badge Layouts: The system shall have the ability to export and import badge layouts.
 - 1. The system shall have the functionality to save the badge layouts as binary files in a specified folder whenever they are exported or imported.
- 1.6 TRANSACTION AND ALARM MONITORING

- A. Transaction Monitoring: The software shall include a real time display of all or selected transactions in the system as they occur.
 - 1. The screen shall display substantial information about each transaction (e.g. cardholder, card number, access granted or denied, location, etc.). The operator shall be able to see only those user definable fields, which he has been given permission to view.
 - 2. The Transaction Monitor shall be split into two sections: (1) All cardholder transactions, (2) All device and operator transactions.
 - 3. The system shall provide a feature that enables the CUSTOMER to set filters for unwanted transactions. The software shall allow the CUSTOMER to select specific cardholders or devices that generate the transactions.
 - 4. The software shall provide functionality to save the transaction monitoring screens and auto load them whenever a transactions occurs.
 - 5. The software shall have the capability to dial-up the controllers located at remote locations via a modem and receive transactions.
 - 6. There shall have a facility to view a recommended minimum of five (5) on-line transaction-monitoring screens at one time, at a single terminal.
 - 7. The user shall have the ability to customize the online monitoring screen into two individual partitions. One displaying cardholder transactions and the other one displaying device and operator transactions. The operator shall also have the flexibility of turning off any of these transactions and view only one type of transactions.
 - 8. A pause button shall be provided which shall enable the operator to stop the display of selected transactions.
 - 9. Transactions may be color-coded according to the dictates of the administrator. Color-coding shall extend to both the background color as well as text (foreground) color.
- B. Viewing Previous Transactions: Include ability to view previous (past) transactions from the transaction monitor screen. The user shall have the ability to set a "filter" that shall select what type of event(s), what cardholder(s) and what device(s) shall appear while viewing past transactions. When the scrolling process is complete, the operator shall be able to invoke a single keystroke or mouse click to return to the current transaction screen.
 - 1. Link to Cardholder Database System should allow the operator to right click on any access transaction and bring up the database profile of the cardholder in question, including a thumbnail of the cardholder's portrait.
 - 2. Link to Recorded Video The operator shall be able to right click on any transaction, if there is a camera associated with the access control or contact activation location, the operator will be presented with a "Play Video" button. The operator shall then be able to link with the digital video recorder and play back recorded events from that location. This should be accomplished through a single mouse click. A digital video recording system also shall be available with the access control system to support this feature.
- C. Alarm Processing and Monitoring: The system shall permit the programming of alarms (contact inputs) with a priority level and instructions, if any, to be followed when the alarm occurs. The system shall offer up to 126 levels of priority, with 1 being the highest and 126 the lowest. Each alarm point shall be addressed within the system by a unique user defined name.
 - 1. All system transactions shall be defined as alarms.

- 2. The operator shall be able to view, acknowledge and secure alarms. The system shall alert the user immediately upon receipt of an alarm by popping up an alarm window on-screen. The alarm window shall contain the following information: cardholder information, date, time, transaction description, priority level, device number, and reader controller number, and how many unacknowledged alarms are in memory.
- 3. In a multi-user environment, the user shall have the option of directing incoming alarm signals to an alarm display terminal and/or to a specific individual (identifiable via log-on ID) for the purposes of reviewing and initiating the alarm dispatch function. Alarms emanating from a field panel located in a remote facility shall be transmitted immediately through the remote controller's IP addressable device or a dial-up modem.
- 4. The system shall also have an audio alert (e.g. beep) that an alarm has been received. The administrator shall be able to customize the audio files according to the type of alarm. If more than one alarm is received at one time, the system shall put the higher priority alarm on-screen. The operator shall be able to silence the alarm by pressing any key. The next alarm shall appear immediately.
- 5. The operator shall be able to right click on any alarm and view the portrait of the cardholder in question. The operator shall also be able to link to the cardholder database and get the information regarding the cardholder that enable him/her to take appropriate access control decisions.
- 6. If there is a camera associated with the alarm/contact point in question, the operator must be able to receive "live video" from the scene with a single mouse click.
- 7. The operator, in addition to receiving live video from the scene, shall also have the ability, via a single mouse click, to retrieve recorded video of the scene. The recorded video shall contain a user-defined amount of video frames before the event and subsequent to the event. It is essential that the system shall allow both the live video and the recorded digital video being displayed "side-by-side" on the same computer workstation.
- 8. Provide ability to acknowledge any alarm or reader activity based on priority.
- 9. Provide the display of system activity with higher priorities displayed at the top of the list.
- 10. Alarm Monitor shall continue displaying an alarm, until it is acknowledged and secured. For example, certain alarm transaction types shall relate to normal physical state of a device. When the normal state changes, an alarm may be triggered. E.G. A contact alarm for a door being forced open. This alarm shall remain in the monitor until the contact device has been secured.
- 11. The user shall also be able to view instructions, if any, for responding to a particular alarm. This shall be achieved by a single mouse click. The instructions given to the operator shall be presented on a single screen in Windows graphical interface format. There shall be a functionality to dispatch instructions via sound files (.wav).
- 12. The operator shall be able to view the alarms that occurred in the past without exiting the online monitor.
- 13. Varying alarms shall be color coded according to the dictates of the administrator. Color-coding shall extend to both the background color as well as the text (foreground) color.

- 14. The system shall allow the configuration of different door alarms based on the activity at that door. The alarms shall be caused by any of the following activities.
 - a. Door Forced Open
 - b. Door Held Open
 - c. Access Under Duress
 - d. Access Denied
 - e. Alarm Acknowledgment
- 15. The operator shall be able to direct individual alarms to specific groups of PC/workstations on the network. The user shall have the ability to define 32 different groups of PC\workstations, with up to 15 PC/workstations in a group. Each PC/workstation shall be identified through the workstation name. Each alarm point may be assigned to a specific group of PC/workstations.
- 16. If the first assigned group does not acknowledge an alarm in a period of time defined by the user, the alarm shall be rerouted to another group of PC/Workstations on the LAN, if available.
- 17. As part of establishing standards for alarm acknowledgment, the user may set parameters that force the operators to enter comments either freeform, or by prompting the operator by issuing "labels" to which the operator shall enter a response. The operator shall either select from a menu of "predefined" responses or respond free form. There shall also be the facility to store these responses in the historical logs and add to them at a subsequent time if the situation warrants follow up.
- 18. The administrator shall also force the operator to login before acknowledging the alarm. Only after these criteria are fulfilled can the alarm be considered acknowledged and the operator shall be allowed to return to other system functions.
- 19. The operators shall be able to perform override tasks that are attached to the alarm display when an alarm is defined. These tasks include locking/unlocking doors, changing system state to "Lockdown".
- D. Alarm Graphics: A graphical depiction of the alarm shall be presented to the operator in the form of a blueprint and/or illustrative photo of the scene of the alarm. Icons may be imposed on the graphics whereby the operator can right click on the point of alarm and have immediate access to all of the following:
 - 1. Audio Playback An audio playback of dispatch instructions via a "Windows Wave File" (.wav).
 - 2. Text Interface A text interface whereby the operator can enter comments regarding actions taken. The operator shall either select from a menu of "predefined" responses or respond free form.
 - 3. Live Video If there is a camera associated with the alarm/contact point in question, the operator must be able to receive "live video" from the scene with a single mouse click.
 - 4. Digital Video Playback The operator, in addition to receiving "live video" from the scene, shall also have the ability, via a single mouse click, to retrieve recorded video of the scene. The recorded video shall contain a user-defined amount of video frames before the event and subsequent to the event.
 - 5. Manual Overrides The operator shall be able to execute the defined manual override commands with one mouse click whenever he/she is alerted with an alarm.

- 6. Monitor Device Status The operator shall be able to monitor the status of devices when transactions or alarms occur by double clicking on the icon.
- 7. The system shall support user programmable high-resolution color graphic map displays that are capable of showing the floor plan, location of the alarm device and alarm instructions. The maps can be created in BMP format and shall be capable of being imported from other systems. The system shall provide the ability to drop dynamic object icons to drawings. These icons shall allow the system operator to perform task command related to the object. All the defined alarm graphic maps shall be displayed on the operator's monitor.
- 8. There shall be a facility to define different icons for 4 (four) different alarm states:
 - a. Default
 - b. Unacknowledged and Unsecured
 - c. Acknowledged but unsecured
 - d. Unacknowledged but secured
- 9. Include functionality to create custom animated graphics (icons) for different alarm states. The user also shall be able to edit or modify the animated graphics.
- 10. When an alarm is activated the operator shall be interrupted with the change of an icon state (using animated graphic) and/or with an attached sound file (.wav). The operator shall be able to scroll down to the icon's location in the map
- 11. Alarm Graphics workstations shall be able to communicate with one another and communicate to any number of clients that are connected to the graphics system.
- E. Manual and Automatic Overrides: The system shall allow manual and automatic control of selected output points. Manual panel control shall include energize/de-energize options for output points as well as the option to override any schedule changes in the output state.
 - 1. Manual Overrides: The system shall provide a facility to manually change a device's normal function, possibly to allow temporary access to an area, exit in an emergency situation or as an added security to an access or exit point.
 - a. The administrator shall be able to define the override tasks in such a way that the commands may be sent to several devices simultaneously (e.g. unlocking all the doors in an emergency).
 - b. The operator shall execute these tasks manually via executing a series of keyboard commands by opening the Manual Overrides pull down menu and clicking on the appropriate override tasks.
 - c. There shall be the functionality to establish a conditional, "if A occurs then B shall occur", relationship between an event and an activation of some output (e.g. access denied> relay activation). For example, an access denied into an area can trigger the lights to go on).
 - d. Manual Override Command To Stop An Activated Schedule The system shall allow the user to issue a manual override command to stop a currently activated schedule (e.g. door unlock).
 - 2. Automatic Overrides: The system shall provide a way to override certain tasks automatically at a regular basis (e.g. unlocking the main lobby door during normal business hours).

- a. The user shall be able to define the time zones according to the CUSTOMER'S needs.
- b. In the event of computer or network failure, Automatic Device Override programming shall continue to function as programmed in the off-line mode. The off-line programming shall be universal and intelligent. Groups of up to 16 intelligent field panels shall be connected to a single Master intelligent field panel. The Master intelligent field panel shall then control off line Automatic Override so that an event at any given field panel can trigger an output at any other given field panel.
- c. Activate An Automatic Override Schedule By A Valid Access The system shall provide a secure way to unlock an automatic scheduled door. A valid credential access shall be required to trigger the readers/offline locks scheduled to unlock during a scheduled period.
- 3. Integrated Guest Pass: The Access Control System shall also provide an integrated, personal computer based system, offering the function to preschedule expected visitors and grant temporary access by issuing Access Control Badges and Name Tag.
 - a. System shall be capable of registering an expected guest to the system and the guest information shall be stored in the Guest Pass Database until the user deletes the record completely. The guest information shall be retained in the Guest Pass Database for the ease of pre-scheduling returning guest and report generation.
 - b. System shall allow the administrator to set the requirements (what information is required for giving access rights to the visitors) according to the customer's needs. The system shall provide a step-by-step wizard, which helps the user to select the required fields.
 - c. The system shall also provide an easy to use interface to add a guest into the system. The steps that the user sees while adding a guest shall be depending on the requirements set by the administrator. The guests added to the system shall be displayed in the main window of the system once the window is refreshed dynamically.
 - d. The applications capabilities shall include, adding a guest, signing in a guest, signing out a guest, editing guest information, capturing and viewing images and signatures and badge and label printing.
 - e. The system shall force authorization of the guests added to the system before giving access control permissions. All unauthorized guests shall be added to a pending list.
 - f. The system shall be capable of generating the following reports:
 - 1) Expected guests and arrival dates, host, area to be visited, expected arrival time.
 - 2) Expected guests today, host, area to be visited, expected arrival time.
 - 3) Access control badge usage by Guests.
 - 4) Guests present in facility.
 - 5) Signed out guests
 - g. The system shall allow User Defined Fields to be implemented as required.

- h. The system shall provide for the optional recording of an electronic signature and digital photograph of the guest.
- i. The system shall provide a way to notify the host regarding the arrival of the guest via e-mail.
- j. The system shall use visitor badges with unique encoded id. The user shall be able to type in the text manually or generate automatically.
- k. The user shall be able to set maximum and minimum values for the automatic generation of encoded id. When the user creates a badge, the system shall choose an unused and unique id between the values set in the encoded id settings. As the user creates more badges and once the encoded id reaches the maximum value set, the system shall use the starting value set in the encoded id settings. If that value conflicts any existing badge's encoded id, the system shall use a new value, which shall be unique and unused. At the same time the system shall also provide a way that allows the user to set the starting and ending encoded id values manually.
- I. The operator shall be able to set different locations and add pending guests (the guests who don't have access control permissions) to any location. The system shall allow the user to sign in (give access control rights) the guest only to the location where the Guest Pass System is located.
- m. When there are multiple locations set in the system, the system shall allow the operator to specify one location as the global location. The guest information in the global location can be viewed from any location set in the system.
- n. While creating badges, the user shall be able to use default badge layout, technology and printers. The system shall also allow the use of default label layout and printer.
- o. The operator shall be able to view signed in guest, pending guest, signed out guest and location of the guest in the main window of the system. The system shall also display all the user-defined fields in the main window.
- p. The system shall use different color schemes for valid guest, about to expire guest and expired guest.
- q. Denial of access after x number of visits when a guest has reached the maximum visit count specified in the Guest Pass Settings he/she shall be denied access and cannot be signed in. To allow the guest to override the maximum visit count, an administrator must use the Guest Pass Settings program or their visit count must be reset to 0.
- F. Guest Pass Locations: In the Guest Pass System location shall refer to the site where the computer with the Guest Pass System is installed and used. The system shall provide an option for the administrators to add, delete, modify or select a location.
 - 1. Each Guest Pass Locations shall be linked to Guest Pass Setting and each workstation is linked with a Location. The Guest Pass System shall be installed and operated at any location where Schlage Security Management System is running.
 - 2. Default Location The system shall provide a factory set location and it cannot be edited or deleted. Default location shall be used if you want to

view the guest's information at every location. The default shall be a global location.

- 3. To define additional locations, the system shall require hardware dongle (software license key). The dongle shall be used only on the PC where database server resides. No dongles shall be required at any workstations.
- 4. The Guest Pass System shall only allow the operator to select from Guest Locations that the dongle (license key) allows them to see. If the dongle has a guest location count of 5, only 5 guest locations will display; no matter how many are actually defined. The count does not include the default location.
- G. Pending Guest Records: The system shall provide a way to create pending guest record. The guests who are not signed into the system (the guests who don't have access control permissions) shall be added to this list. The guest who is signed out from the system, but expected to come back at a later time also shall also be added to this list.
 - 1. Guest Sign-In The system shall create a list of authorized and expected guests for each day. The information in this list shall indicate:
 - 2. The identity of the guest.
 - 3. The identity of the person who requested the visit (the host).
 - 4. The responsible person authorizing the visit (an employee with authorizing permissions).
 - 5. Authorized time limits of the visit.
 - 6. Initial information (filled in by the requestor) about the Guest including name, affiliation, purposes of visit, escort/unescorted, access control badge or no access control badge. This information shall be easily transferred or stored in further definition of the Guest record by the operator.
 - 7. Visit Extension The system shall provide the ability to extend a specific Guest's timeframe. If the person making the request is authorized or is the original authorizer, the operator shall click the guest's record and execute the function to extend the record. The choice will be by days or hours. The system shall automatically record the date and time of the extension. The access records of the guest shall be automatically extended by the specified amount of time.
 - 8. License Field Cross Reference -The system shall allow the user to map the fields on a driver's license to the existing cardholder fields. First Name, Last Name, and Initial shall be automatically mapped fields and shall not be changed by the user. The user shall be able to create user-defined fields to match with the driver's license fields and retrieve information by scanning the guest's driver's license.
 - 9. Signing Out The system shall provide for several methods of signing the Guest out of the facility, including:
 - 10. Once the record is marked as Signed Out, all access privileges assigned to the Guest and to their badge shall be removed so that additional usage shall be denied.
 - 11. If an access control badge is assigned, but is lost during the Guest's visit, the operator shall be able to find the Guest record by typing in the name of the Guest. Once the record is retrieved, the operator shall mark it as Signed Out. All access privileges shall be blocked and the operator shall record the fact that the badge were lost and was not returned.
 - 12. The system shall provide the optional recording of a digital photograph of the Guest as they signed in or out of the facility. This photograph shall be

saved with the guest record and shall be used for verification purposes as well as comparison and reporting.

- 13. The system shall be equipped with a Search feature, to access the signed out records easily.
- H. Access Control Templates: The system shall provide a quick and easy way to assign area access rights to guests. This shall be implemented via the use of access control templates. Each template shall contain conventional description and notes fields. Then the user shall be able to select either the hours after sign-in option or the time of sign-in day option.
 - 1. If the hours after sign in option is selected, then the guest shall be expired after the number of hours specified after they were signed in. If the time of sign-in day option is selected, the guest's access rights shall be expired at the specified time of the sign-in day. The user shall also be able to specify the area sets the guest access template will use. The user shall be able to select as many area sets as needed.
 - 2. After these templates are defined, the Guest Pass operator shall select them to make authorization much simpler. The operator shall only need to select one record instead of defining access time and area sets.
 - 3. Automatic Guest Sign-in and Sign-Out The system shall allow the user to define specific readers as sign-in and sign out readers. This shall allow a pending guest signed into the system with a single card swipe and an existing guest signed-out of the system in the same way.
- I. Guest Pass Web Interface: The system shall offer a browser-based web interface to allow an employee to request that a guest be permitted to enter a facility.
 - 1. The web page shall contain a form where the user can enter required information to add a new guest. Once the user submits this information, a new pending guest record shall be created in the system (Guest Pass client). The administrators may use the Guest Pass System to view this information and make appropriate changes.
 - 2. The web interface shall be a simple form, displaying empty fields required to register a guest. The required fields shall be marked with a * sign.
 - 3. The form shall not be submitted, until all the required information has been entered. Once the required information is entered and the form is submitted, the guests added shall be displayed in the pending guests tab in the Guest Pass Client after the views are dynamically refreshed.
 - 4. This form shall be available on authorized client workstations and can be submitted in several ways.
 - 5. The form will be available via an HTML page on the company's intranet or via the Internet and can be submitted via HTML.
 - 6. The form can be opened, completed, and submitted via e-mail.
 - 7. The form may be printed and handed to an authorizing person for signature or approval before final submission to the Guest Pass system.
- J. Web Page Security: The web page shall be secured using Windows 2000 security. The web directory where the Guest Pass Active Server Pages (ASP) will be located shall be secured to specific NT users, giving limited access to the page and to its functionality. There shall be NO login or verification once the user has access to the web pages.
 - 1. Simple Setup for Multiple Databases The Guest Pass Web Page shall easily be setup to connect to any Schlage Security Management System

Database existing on the network. As long as the IIS server has access to the SQL Server database, the Web Page shall be posted to it.

- 2. Report Generation
- 3. The system software shall be able to generate reports of Alarm History, Archive History, Audit Trail, Cardholder Transactions, Guest Pass History and Transaction History Reports. The user may print and/or export these reports to other applications, store to disk or send to mail recipients, as well.
- 4. The system shall provide 53 predefined reports making for a simple and efficient end user experience. There shall be a menu presented to the person requesting the report, prompting him/her to enter the parameters necessary to retrieve the desired information (i.e. date, time, location(s), type(s) of alarms etc.)
- 5. The user shall also be able to derive 73 pre-defined sub reports by defining their own criteria. This type of reports shall require selections to be entered that define the user created sub report. Some examples of criteria may be cardholders by category, transactions in a particular area etc.
- 6. The system shall also allow the end user to create custom defined reports with variable selection, using a third party application like crystal reports.
- 7. When requesting a report, the user shall be able to view a "screen preview" of the alarm activity before directing the report to a printer. For cases when the same report is run repeatedly, the user shall have the ability to "save" the report parameters and format so that it is not necessary to reenter the parameters.
- 8. The reports may be secured using operator login id and password.
- K. Scheduled Reports: The system shall allow the user to create pre-defined reports on a scheduled basis. The system shall provide the user with a wizard that guides him/her through the process of selecting a report, creating a schedule and assigning a printer. The user shall be able to generate the reports and print them on a weekly or daily basis at a specific time period. Any report that is created in the system shall be assigned a schedule.
 - 1. The system shall allow the user to store e-mail addresses of recipients of reports and send transaction history reports periodically.
- L. System Wide Features:
 - 1. Context Sensitive Help: System shall provide context sensitive help for all the modules. It shall be accessed from Help>Contents and Index. The help for a specific module shall be accessed by clicking F1 from the specific module.
 - 2. Wizards The software shall provide step-by-step wizards for easy programming of the entire system.
 - 3. Pull down Menus The system programming shall be menu driven and include tool bar icon for all major options in the menu.
 - 4. Onscreen help The software shall provide onscreen description of all the actions that the user has to perform while programming the system.
 - 5. Search and Advanced Find The system shall include a simple search feature for the user to easily find data in the database. The system shall also provide functionality that helps the user to further customize the search criteria and make the search more precise. The user shall be able to use Boolean logic to run highly precise and more complex searches.

The system shall also be capable of saving the search criteria that the user defines.

6. Right Click Options: The system shall provide right click options for most of the system functionalities.

1.7 FLOOR SELECT ELEVATOR CONTROL

- A. Elevator access control shall be integral to security access.
 - 1. The system shall be able to control an unlimited number of elevators and each elevator may have an unlimited number of floors. The elevator reader interface shall be connected to the same field panel as the digital inputs and digital outputs used to control the elevator cab. There shall be no limit to the number of elevator cabs that can be controlled via the system host software.
 - 2. System shall be capable of providing full elevator security and control through dedicated Controllers without relying on the control-station host PC for elevator control decisions.
 - 3. Access-control system shall enable and disable car calls on each floor and floor select buttons in each elevator car, restricting passengers' access to the floors where they have been given access.
 - 4. System setup shall, through programming, automatically secure and unsecure each floor select button of a car individually by time and day. Each floor select button within a car shall be separately controlled so that some floors may be secure while others remain unsecure.
 - 5. When a floor select button is secure, it shall require the passenger to use his/her access code and have access to that floor before the floor select button will operate. The passenger's credential shall determine which car call and floor select buttons are to be enabled, restricting access to floors unless authorized by system's access code database. Floor select button shall be enabled only in the car where the credential holder is the passenger.
- B. Security access system shall record which call button is pressed, along with credential and time information.
 - 1. System Controller shall record elevator access data.
 - 2. The Controller shall reset all additional call buttons that may have been enabled by the user's credential.
 - 3. The floor select elevator control shall allow for manual override either individually by floor or by cab as a group from a workstation PC.

1.8 SECURITY TOUR SYSTEM

- A. Guard tour module shall provide the ability to plan, track, and route tours. Module shall input an alarm during tour if guard fails to make a station. Tours can be programmed for sequential or random tour-station order.
 - 1. Guard tour setup shall define specific routes or tours for the guard to take, with time restrictions in which to reach every predefined tour station.
 - 2. Guard tour activity shall be automatically logged to the central-station PC's hard drive.
 - 3. If the guard is early or late to a tour station, a unique alarm per station shall appear at the Central Station to indicate the time and station.

- 4. Guard tour setup shall allow the tours to be executed sequentially or in a random order with an overall time limit set for the entire tour instead of individual times for each tour station.
- 5. Setup shall allow recording of predefined responses that will display for the operator at the control station should a "Failed to Check-in" alarm occur.
- B. Guard tour module shall allow proprietary direct-connected systems to use security access-control hardware to perform guard tour management in real time.
- C. System shall be a Windows Client application that shall allow definition of tours, real-time tracking of running tour progress, alerts when tour criteria is not satisfied, and historical reporting of previously run tours. System shall have two modules; the Security Tour Editor and the Security Tour Client. The administrator shall have the ability to define as many tours as required using the Security Tour Editor module.
 - 1. System shall be responsible for holding all running tours in memory. It shall provide a status of all running tours upon request and monitor tour activity by communicating with the System Processor for transactions.
 - 2. Additionally, the Security Tour Service shall allow the addition of new running tours, pausing, resuming, and stopping of currently running tours.
- D. Guard tour and other system features shall operate simultaneously with no interference.
- E. Guard Tour Module Capacity: 999 possible guard tour definitions with each tour having up to 99 tour stations. System shall allow all 999 tours to be running at same time.
- 1.9 VIDEO AND CAMERA CONTROL
 - A. Control station or designated workstation displays live video from a CCTV source.
 - 1. Control Buttons: On the display window, with separate control buttons to represent Left, Right, Up, Down, Zoom In, Zoom Out, Scan, and a minimum of two custom command auxiliary controls.
 - 2. Provide at least seven icons to represent different types of cameras, with ability to import custom icons. Provide option for display of icons on graphic maps to represent their physical location.
 - 3. Provide the alarm-handling window with a command button that will display the camera associated with the alarm point.
 - B. Display mouse-selectable icons representing each camera source, to select source to be displayed. For CCTV sources that are connected to a video switcher, control station shall automatically send control commands through a COM port to display the requested camera when the camera icon is selected.
 - C. Allow cameras with preset positioning to be defined by displaying a different icon for each of the presets. Provide control with Next and Previous buttons to allow operator to cycle quickly through the preset positions.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Site Verification of Conditions
 - 1. Examine pathway elements intended for cables. Check raceways, cable trays, and other elements for compliance with space allocations, installation tolerances, hazards to cable installation, and other conditions affecting installation.
 - 2. Examine roughing-in for LAN and control cable conduit systems to PCs, Controllers, card readers, and other cable-connected devices to verify actual locations of conduit and back boxes before device installation.
 - 3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Furnish any inserts required for building into concrete, masonry, and other work, to support and attach work of this section. Furnish in ample time to comply with schedule of work into which inserts are built.
- B. Verify that power and outlets are in correct locations.
- C. Verify that building structure is properly prepared for mounting, attachment and support of equipment.
- D. Prior to installation of systems components and devices, verify all required preparations have been properly performed and that substrates are acceptable for installation.
 - 1. Verify all rough-ins and field dimensions.
- E. Report in writing to the Architect any prevailing conditions that will adversely affect satisfactory execution of Work in this Section.
 - 1. Security Consultant reserves the right to review proposed methods of construction/installation, reject proposed methods, and have the installation done in a satisfactory method at the Contractor's cost.

3.3 INSTALLATION, GENERAL

- A. Install work in accordance with manufacturer's recommendations, instructions and final Shop Drawings.
- B. Anchor components securely in place, plumb, level, and accurately aligned. Provide separators and isolators to prevent corrosion and electrolytic deterioration.
- C. For card readers that are located in equipment traffic areas, and that are exposed to damage due to collision or impact from forklifts, or manually moved carts, carriers, or other equipment used by the Owner, provide protective bollards, railings, coverings etc. to ensure that all card readers installed are properly protected from such damage.
- D. Provide fastenings, plates, and other incidental items required for complete and operational installation.
- E. Provide required electrical work in accordance with code requirements.
- 3.4 WIRING

- A. General: Comply with provisions of Section 28 05 13 Conductors and Cables for Electronic Safety and Security.
- B. Install all wiring connecting all system components and controlled and monitored devices.
- C. Install all transformers, relays and other accessories.
- D. Install all cable, and perform all cable splicing and equipment terminations.
- E. Use 45-degree condolettes to enclose and protect cabling from door contacts/switches. Condolettes shall be placed as close to the contact/switch as possible.
- F. Pull continuously between connections where possible.
- G. Install electronic systems wiring and cabling in conduit or raceway, as noted on Drawings and as specified in Section 28 05 28.
- H. Pulling cables and wires:
 - 1. Do not force or pressure in a manner, which will stretch, break or damage jacket.
 - 2. Use an inert anti-friction material to assist in pulling wire.
 - 3. Pull all cables and wires to be installed in a raceway all at one time.

3.5 GROUNDING

- A. Comply with Division 26 Section "Grounding and Bonding for Electrical Systems."
- B. Comply with IEEE 1100, "Power and Grounding Sensitive Electronic Equipment."
- C. Ground cable shields, drain conductors, and equipment to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.
- D. Bond shields and drain conductors to ground at only one point in each circuit.
- E. Signal Ground:
 - 1. Terminal: Locate in each equipment room and wiring closet; isolate from power system and equipment grounding.
 - 2. Bus: Mount on wall of main equipment room with standoff insulators.
 - 3. Backbone Cable: Extend from signal ground bus to signal ground terminal in each equipment room and wiring closet.

3.6 IDENTIFICATION

- A. In addition to requirements in this Article, comply with applicable requirements in Division 26 Section "Identification for Electrical Systems" and with TIA/EIA-606.
- B. Using cable and asset management software specified in Part 2, develop Cable Administration Drawings for system identification, testing, and management. Use unique, alphanumeric designation for each cable, and label cable and jacks, connectors, and terminals to which it connects with same designation. Use logical and systematic designations for facility's architectural arrangement.
- C. Label each terminal strip and screw terminal in each cabinet, rack, or panel.

- D. All wiring conductors connected to terminal strips shall be individually numbered, and each cable or wiring group being extended from a panel or cabinet to a building-mounted device shall be identified with the name and number of the particular device as shown.
 - 1. Each wire connected to building-mounted devices is not required to be numbered at the device if the color of the wire is consistent with the associated wire connected and numbered within the panel or cabinet.
- 3.7 SYSTEM SOFTWARE
 - A. Existing software

3.8 SYSTEM PROGRAMMING

A. The Contractor shall work with the Owner to ensure that the new components will be properly programmed into the existing system.

3.9 SITE QUALITY CONTROL

- A. The Contractor shall develop a Final Test and Acceptance (FTA) Plan. The plan shall identify each new system component provided in the work, intent of test, method or methods of test and expected results. Each component listed in the plan shall include space for test part signatures, brief comments, time of test and pass/fail check boxes. The FTA plan shall be submitted to the owner's representative 30 days prior to the scheduled final test.
- B. Provide manufacturer's supervision of final testing of each system.
 - 1. On-Site Testing: Manufacturer trained and authorized Systems Integrator shall functionally test each component in the system after installation to verify proper operation and confirm that the wiring and dressing conform to the wiring documentation.
- C. Each system shall test free from interference, opens, grounds, and short circuits.
- D. START-UP TEST (BURN-IN)
 - 1. Following completion of the Final Test, the system shall undergo a thirty (30) day Operational Demonstration Test (ODT) or Burn-In period. This operational demonstration period shall start when all specified systems and equipment have been installed and "Substantial Completion" is reached, with only a moderate number of punch list items remaining.
 - 2. During this period, the system shall be operated under a normal facility traffic load for no less than 30 days. If any item or system fails during the ODT, the 30-day burn-in period shall be suspended for that item until repaired or replaced. Once repaired or replaced, the burn-in period shall recommence.
 - 3. Final system acceptance of the entire project will be withheld until after successful completion of this operational demonstration period for all systems and components.
 - 4. System will not be considered substantially complete until the following activities have been successfully completed:
 - a. Acceptance of all submittals.
 - b. Delivery of final documentation.
 - c. Successful Final Test and Inspection

- d. Successful Operational Demonstration Test
- e. Successful training and demonstration, including operation of systems using the manuals.
- f. Purging of Contractor User privileges and return of all key card media.

3.10 CLEANING AND WASTE MANAGEMENT

A. Cleaning and Touchup: Immediately after installation, including the completion of wiring and testing, clean all work and touchup all damaged factory finishes.

3.11 Protection

- A. Maintain strict security during the installation of equipment and software. Rooms housing the control station, and workstations that have been powered up shall be locked and secured, with an activated burglar alarm and access-control system reporting to a Central Station complying with UL 1610, "Central-Station Burglar-Alarm Units," during periods when a qualified operator in the employ of Contractor is not present.
- B. Protection: Provide protective covers, fenders, and barriers as necessary to maintain Work of this Section in same condition as installed until time of Substantial Completion.
- 3.12 Closeout Activities
 - A. DEMONSTRATION
 - 1. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain security access system. Refer to Division 01 Section "Demonstration and Training"
 - 2. Develop separate training modules for the following:
 - a. Computer system administration personnel to manage and repair the LAN and databases and to update and maintain software.
 - b. Operators who prepare and input credentials to man the control station and workstations and to enroll personnel.
 - c. Security personnel.
 - d. Hardware maintenance personnel.
 - e. Corporate management.
 - B. Training
 - 1. Operator Training: Instruct operating staff in proper operation, including hands-on training.
 - a. Minimum of twenty-four (24) man-hours covering the operations for each system installed.
 - b. Training sessions shall be provided to supervisors, staff, maintenance personnel and any other personnel designated by the Owner. Contractor should prepare to provide operator training for up to ten (10) personnel.
 - c. Contractor shall be prepared to provide training sessions on all work shifts, including day, evening and night shifts.
 - 2. Refresher Training: Provide a 90-day Refresher Training Session to operators.

- a. Minimum of eight (8) hours of training for each owner-designated session.
- b. Training shall cover summaries of all operator and administrator training topics and shall include greater detail on subject areas or operations not yet mastered by operators or administrators.
- 3. Review in detail all information in the Operations and Maintenance Manuals for each system provided.
- 4. Prior to administering the above training, the Contractor(s) shall prepare an outline of the training, identifying the goals and expectations of the course and detailing what students are expected to learn.
- 5. Training courses shall be videotaped, at Owner's request, for subsequent training use by the Owner.
- 3.13 Life Cycle Activities
 - A. Commissioning: All system components shall be commissioned as to conform to the manufacturer's recommendations for maximum life cycle.
 - B. Operation and Use: Provide, in writing, Operation and Use procedures for each system component. Such procedures shall be written in order to conform to the manufacturer's recommendations for maximum life cycle.
 - C. Maintenance: Provide, in writing, Maintenance procedures for each system component. Such procedures shall be written in order to conform to the manufacturer's recommendations for maximum life cycle.
- 3.01 Installation
- A. Provide, install and wire all Reader Controllers (as required), Access Control Main Panels (Minimum 1 per floor) complete with power supplies for sufficient power to power all AD300 series Access Control Locks being provided in specification section 08 71 00 Finish Hardware.
- B. Furnish, install and wire all Access Controlled openings as to provide a complete and functional Access Control System to match the existing system being used by Alamo Colleges.
- C. Access Control installer shall coordinate and reference all affected specification sections to insure a complete and functional Access Control System.
- D. Provide and install all required RS485 Communication/Power cabling required.
- E. Materials supplied and installed as part of this specification sections are as follows:

1) Card Readers MT-15 wall mounted. Mullion mounted readers are acceptable depending on existing conditions. Exterior doors only.

2) Electrified Card Reader Locks (Hard Wired) AD300-CY-70-MT-RHO-JD and Electrified Panic Exit Device Trim AD300-993-70-MT-RHO-JD. Interior use only.

- 3) Reader Interface Boards VRINX
- 4) Reader Controllers VRCNX-M
- 5) Power Supplies PS906-900BBK-900FA and/or as required by the system size.
- 6) Proximity & Smart Cards (10) per reader or as required by Alamo Colleges.

END OF SECTION

SECTION 28 3000 FIRE ALARM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SCOPE

- A. The scope of work is to install a complete operational licensed fully addressable manual fire alarm system with pull stations at all exits, visual devices in all common and multi-use spaces, remote annunciator and main fire control panel.
- B. Fire alarm provider shall compute all devices requirements and provide expansion panels as required. Contractor shall coordinate power for any expansion panels with electrical contractor and provide 120V circuits as required. Contractor shall bid a complete and working system. Refer to specifications for devices and locations in addition to the floor plan drawings. The contractor shall be responsible prior to bid for a price for a complete system to include; manual stations, detectors, signal equipment, controls, expansion panels, and devices. The drawings are schematic in nature and include approximate locations of devices. The fire alarm contractor shall coordinate the exact location of the visual signaling device in accordance with the candela of the installed devices.
- C. Provide software programming for individual testing of devices without putting the building in alarm (walk-thru mode) or shutting down the entire system.

1.3 SUMMARY

- A. This Section includes fire alarm systems with manual stations, detectors, signal equipment, controls, and devices.
- B. Related Sections include the following:
 - 1. Section "Door Hardware" for door closers/holders/smoke detectors, electric door locks, and release devices that interface with fire alarm systems.
 - 2. Section "Control/Signal Transmission Media" for transmission media used for control and signal circuits.
 - 3. System output signals required to interface with the graphic representations of the connected building on the existing college campuses central station graphics belonging to ACCD and programmed by ACCD staff.
 - 4. The following signals are to be provided:
 - a. For buildings with Fire alarm panels that have Digital Communicator ports, provide:
 - 1) ALR Alarm 1
 - 2) ARS Alarm Restore
 - 3) CST CS Test Signal
 - 4) ERR Code Error
 - 5) FIR Fire Alarm
 - 6) PTB Phone Trouble
 - 7) PTR Phone Trouble Restore
 - 8) SDR System Restore

- 9) SDS System Disabled
- 10) TRB Trouble
- 11) TST Test Signal
- 12) The inherent supervisory signal incorporated into the Bosch system
- 5. For buildings with Fire alarm panels that do not have Digital Communicator ports provide a Bosch D2071 Digital Alarm Communicating Transmitter (DAC) to provide as much of the items listed in 5.a. as possible but at a minimum provide:
 - a. FIR Fire Alarm
 - b. TRB Trouble
 - c. The inherent supervisory signal incorporated into the Bosch system

1.4 DEFINITIONS

- A. FACP: Fire alarm control panel.
- B. LED: Light-emitting diode.
- C. Definitions in NFPA 72 apply to fire alarm terms used in this Section.

1.5 SYSTEM DESCRIPTION

- A. The System supports data network communications. The system allows the Central Station Receiver to connect to Alarm Control Panels using LAN/WAN data networks and UDP/IP protocol. The System description is based on the Conettix IP manufactured by Bosch and shall consist of five basic components, with the following capabilities:
 - 1. Network connection of Alarm Control Panels with digital dialer support is implemented through the use of Dialer Capture Modules (1).
 - 2. Network connection of Alarm Control Panels with either SDI Bus or Option Bus support is implemented through the use of Network Interface Modules (2).
 - 3. Network enabled Alarm Control Panels can be monitored, configured, and programmed by Administrative Systems (3) with a connection to the network
 - 4. The Central Station Receiver (5) network connection is implemented through the use of the Network Adapter (4).
 - 5. Alarm Control Panel reports from are sent to the Central Station Receiver (5), and on to the central station automation software (3).
- B. The Central Station Receiver (5) is optionally monitored, configured, and programmed by Administrative Systems (3) with a connection to the network.
- C. Data communication transmission shall use the owners existing LAN/WAN data networks with the owners existing PBX system as Alternate communications.

1.6 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show details of graphic annunciator.
 - 1. Wiring Diagrams: Detail wiring and differentiate between manufacturer-installed and field-installed wiring. Include diagrams for equipment and for system with all terminals and interconnections identified.
 - 2. Battery: Sizing calculations.
 - 3. Floor Plans: Indicate final outlet locations and routings of raceway connections.
 - 4. Device Address List: Coordinate with final system programming.

- 5. System Operation Description: Detailed description for this Project, including method of operation and supervision of each type of circuit and sequence of operations for manually and automatically initiated system inputs and outputs. Manufacturer's standard descriptions for generic systems are not acceptable.
- C. Coordination Drawings: Plans, sections, and elevations drawn to scale and coordinating installation of smoke detectors, control modules, and relays in ducts and access to them. Show the following near each duct smoke provision of detector installation:
 - 1. Size and location of ducts, including lining.
 - 2. Size and location of piping.
 - 3. Size and arrangement of structural elements.
 - 4. Size and location of duct smoke detector, including air-sampling elements.
- D. Operating Instructions: For mounting at the FACP.
- E. Product Certificates: Signed by manufacturers of system components certifying that products furnished comply with requirements.
- F. Installer Certificates: Signed by manufacturer certifying that installers comply with requirements.
- G. Field Test Reports: Indicate and interpret test results for compliance with performance requirements. Comply with NFPA 72.
- H. Maintenance Data: For fire alarm systems to include in maintenance manuals specified in Division 1. Comply with NFPA 72.
- I. Submissions to Authorities Having Jurisdiction: In addition to distribution requirements for Submittals specified in Section "Submittals," make an identical submission to authorities having jurisdiction. Include copies of annotated Contract Drawings as needed to depict component locations to facilitate review. Resubmit if required to make clarifications or revisions to obtain approval. On receipt of comments from authorities having jurisdiction, submit them to Architect for review.
- J. Certificate of Completion: Comply with NFPA 72, AHJ, and local amendments.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who is an authorized representative of the FACP manufacturer for both installation and maintenance of units required for this Project.
- B. Manufacturer Qualifications: A firm experienced in manufacturing systems similar to those indicated for this Project and with a record of successful in-service performance.
- C. Source Limitations: Obtain fire alarm system components through one source from a single manufacturer.
- D. Compliance with Local Requirements: Comply with applicable building code, local ordinances and regulations, and requirements of authorities having jurisdiction.
- E. Comply with NFPA 72.
- 1.8 SEQUENCING AND SCHEDULING
- A. Existing Fire Alarm Equipment: Maintain fully operational until new equipment has been tested and accepted. As new equipment is installed, label it "NOT IN SERVICE" until it is accepted. Remove labels from new equipment when put into service and label existing fire alarm equipment "NOT IN SERVICE" until removed from the building.
- B. Equipment Removal: After acceptance of the new fire alarm system, remove existing disconnected fire alarm equipment and restore damaged surfaces.
 - 1. Package operational fire alarm and detection equipment that has been removed and deliver to Owner.
 - 2. Remove from site and legally dispose of existing material not designated for other disposition.

1.9 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Lamps for Remote Indicating Lamp Units: Quantity equal to 10 percent of amount installed, but not less than one unit.
 - 2. Lamps for Strobe Units: Quantity equal to 10 percent of amount installed, but not less than one unit.
 - 3. Smoke Detectors, Fire Detectors, and Flame Detectors: Quantity equal to 10 percent of amount of each type installed, but not less than one unit of each type.
 - 4. Detector Bases: Quantity equal to 2 percent of amount of each type installed, but not less than one unit of each type.
 - 5. Keys and Tools: One extra set for access to locked and tamper proofed components.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. BOSCH
 - 2. Other manufacturers equal in design and function will be considered upon A/E approval following substitution procedure in Section 26 00 00 and Division 1 for substitution requirement.

2.2 FUNCTIONAL DESCRIPTION OF SYSTEM

- A. Control of System: By the FACP.
 - Supervision: Conettix IP shall provide control panel supervision using periodic heartbeats (polling, typically one every 75 seconds or longer) in order to monitor the continuity of the network link. Control panels that are connected to the Central Station Receiver by way of he Network Interface Module (NIM) are responsible for their own polling. Control panels that connect via the Dialer Capture Module (DCM) rely on the DCM to monitor polling.
 - a. The Central Station Receiver will be programmed to monitor each network account and assure that the heartbeats from each account are received on a regular basis.
 - b. The Central Station Receiver will return an ACK message for each heartbeat or other message received from an account that is registered in the Central Station Receiver database.

- c. The Central Station Receiver will ignore any message from a device that is not registered.
- d. The periodic heartbeat, and the corresponding ACK, shall both have an average UDP packet size of 64 bytes.
- e. If the programmable time window for a specific network account expires without a valid message being received, the Central Station Receiver shall generate a trouble message, indicating a loss of supervision for the indicated control panel.
 - 1) If a valid message is subsequently received, the Central Station Receiver shall generate a message indicating a restoration of supervision for the indicated control panel.
- f. If the DCM sends ten successive heartbeat messages to the Central Station Receiver without receipt of an ACK, the DCM will fall into a "network communication failure" condition (Fallback Mode).
 - While in Fallback Mode, the DCM will disconnect the control panel from the network. b. The DCM can be configured to connect the control panel to a PSTN line when the DCM is in Fallback Mode. c. While in Fallback Mode, the DCM will continue to poll the Central Station Receiver using periodic heartbeats. d. The DCM will exit Fallback Mode when an ACK is received from the Central Station Receiver.
- g. If the control panel sends, by way of the NIM, a programmable number of successive heartbeat messages to the Central Station Receiver without receipt of an ACK, the control panel will fall into a "network communication failure" condition.
 - 1) After a network communication failure, the control panel will continue to poll the Central Station Receiver using periodic heartbeats. b. The control panel will indicate the restoration of supervision after an ACK is received from the Central Station Receiver.
- 2. Anti-Substitution/Anti-Replay: Conettix IP shall protect against the substitution of a valid control panel with a fraudulent one. Conettix IP shall also protect against the interception and retransmission of authentic control panel messages, preventing an attack in which a valid data transmission is recorded and fraudulently repeated by an adversary who intercepts the data and retransmits it. Control panels that are connected to the Central Station Receiver by way of the Network Interface Module (NIM) are responsible for their own Anti-Substitution/Anti-Replay protection. Control panels that connect via the Dialer Capture Module (DCM) rely on the DCM to provide Anti-Substitution/Anti-Replay protection. At startup of each control panel or DCM. Conettix IP shall coordinate the synchronization of messages between the network modules and the Central Station Receiver. Once synchronized, all subsequent communication sessions numerically validate the authenticity of the sender and receiver, which protects against the replay of authentic sessions, or the substitution of the original control panel or DCM. If Anti-Substitution/Anti-Replay protection is enabled, the Central Station Receiver must receive a valid synchronization key within a programmable number of messages, or a Substitution Alarm message will be generated. Unless the Central Station Receiver receives a valid key within a programmable additional number of messages, the control panel account will be disabled.
- 3. Encryption: Conettix IP shall support communications using the Advanced Encryption Standard (AES) 128-bit Rijndael encryption algorithm. The Conettix IP shall support up to two simultaneous and independent encrypted communications channels.
 - a. Communications between control panels and the Central Station Receiver can be encrypted between the Dialer Capture Module (DCM) and the Central Station Receiver Network Adapter, or between the Network Interface Module (NIM) and the Central Station Receiver Network Adapter.
 - b. Communications between administrative system software and the Central Station Receiver, or between automation software and the Central Station Receiver, can be encrypted between a Network Adapter at the remote computer hosting the

administrative or automation software and the Central Station Receiver Network Adapter.

- 4. Multiple Control Panels: Conettix IP shall support multiple control panels on a LAN that connect to the Central Station Receiver through a router/firewall that uses Network Address Translation (NAT) tables. The NAT table insures that the returning messages for a control panel are forwarded back to the panel that sent out the first message.
 - a. The Dialer Capture Module (DCM) shall support this through Datagram 01.
 - b. The Central Station Receiver Network Adapter shall support this through Datagram 02.
 - c. The Network Interface Module (NIM) shall support this through either Datagram 02 or 07.
- 5. Dialer Capture Module Override: Conettix IP shall allow some basic functionalities of the Dialer Capture Module (DCM) to be overridden by the administrative system software. Changes are effective the next time the Central Station Receiver acknowledges a message from the DCM.
 - a. Message Transmission Rate: The Poll Rate and Retry Count of the DCM can be adjusted as desired. The new settings shall remain effective until they are changed again, or until the DCM is power-cycled and reset.
 - b. Intercept/Fallback Mode: The DCM can be manually ordered into either Intercept or Fallback mode. After 30 minutes in Fallback mode, the Central Station Receiver will generate a "Fallback reminder" message. After 60 minutes in Fallback mode, the DCM will automatically switch back to Intercept mode.
 - c. Output Status: Output 4 can be manually turned on or off.MANUAL PULL STATIONS

2.5 EMERGENCY POWER SUPPLY

- A. General: Components include sealed maintenance free battery, charger, and an automatic transfer switch.
 - 1. Battery Nominal Life Expectancy: 20 years, minimum.
- B. Battery Capacity: Comply with NFPA 72.
 - 1. Magnetic door holders are not served by emergency power. Magnetic door holders are released when normal power fails.
- C. Battery Charger: Solid-state, fully automatic, variable-charging-rate type. Provide capacity for 150 percent of the connected system load while maintaining batteries at full charge. If batteries are fully discharged, the charger recharges them completely within four hours. Charger output is supervised as part of system power supply supervision.
- D. Integral Automatic Transfer Switch: Transfers the load to the battery without loss of signals or status indications when normal power fails.

2.6 AUXILLARY POWER MODULE (NAC)

- A. Description: Intelligent power supply module with built in synchronization, AC power connection, battery charging circuit, and backup battery for 24 hours operation for all powered circuits. Programmable for auxiliary power, constant, resettable, or door holder operation
 - 1. Minimum 6 Amp notification power expander with switching mode
 - 2. Ground fault detector
 - 3. Notification/Aux Power Circuits: 2 Class A, 4 Class B
 - 4. Power input 120V

- B. Communicates with main FACP SBUS with standard manufacturers 4 wire cabling up to 4000 feet.
- C. AC loss of power delay option for shutting off power to door holders. (provide only on NAC panels with door holders on the fire alarm system)
- D. Transmits all signals to the FACP

2.7 ADDRESSABLE INTERFACE DEVICE

- A. Description: Microelectronic monitor module listed for use in providing a multiplex system address for listed fire and sprinkler alarm-initiating devices with normally open contacts.
- B. Integral Relay: Capable of providing a direct signal to the elevator controller to initiate elevator recall or to a circuit-breaker shunt trip for power shutdown.

2.8 WIRE TO FIBER CONVERTOR

- A. Description: Fiber optic cabling to SBUS convertor on a single card mounted in the FA panel or in a remote enclosure and connected to the fire alarm panel.
 - 1. Range: Up to one mile
 - 2. Transfers all signals between panels
 - 3. Does not require TVSS or grounding
 - 4. Duplex connectors for the transmittance and receiving of signals
 - 5. Compatible with the FA system from the same manufacturer
 - 6. Powered from the FA panel locally 9-35 VDC

2.9 DIGITAL ALARM COMMUNICATOR TRANSMITTER

- A. Listed and labeled under UL 864 and NFPA 72.
- B. Functional Performance: The FACP shall have a digital alarm communicator transmitter (DACT) module to transmit alarm signals to a Remote Central Monitoring station. The DACT shall support dual telephone lines. Unit receives an alarm, supervisory, or trouble signal from the FACP panel, and automatically captures one or two telephone lines and dials a preset number for a remote central station. When contact is made with the central station(s), the signal is transmitted. The unit supervises up to two telephone lines. Where supervising two lines, if service on either line is interrupted for longer than 45 seconds, the unit initiates a local trouble signal and transmits a signal indicating loss of telephone line to the remote alarm receiving station over the remaining line. When telephone service is restored, unit automatically reports that event to the central station. If service is lost on either telephone lines, the local trouble signal is initiated.
- C. The fire alarm system shall provide point identification reporting of alarm, trouble and supervisory conditions to the monitoring station. Group reporting will not be accepted.
- D. The communicator shall automatically send restore signals to the central station when alarm, trouble or supervisory is cleared. Required on-premise restore is not acceptable.
- E. Secondary Power: Integral rechargeable battery and automatic charger. Battery capacity is adequate to comply with NFPA 72 requirements.
- F. Self-Test: Conducted automatically every 24 hours with report transmitted to central station.

2.10 GUARDS FOR PHYSICAL PROTECTION

- A. Description: Size and shape for the manual station, smoke detector, gong, or other device requiring protection.
 - 1. Factory fabricated and furnished by the manufacturer of the device.
 - 2. Finish: Paint of color to match the protected device.
 - 3. Manual Pull Station Clear Lexan.
 - 4. Smoke/Heat Detector Wire Mesh.
 - 5. Gong Wire Mesh.

2.11 WIRE

- A. Non-Power-Limited Circuits: Red jacketed plenum rated solid-copper conductors with 600-V rated, 75 deg C, color-coded insulation.
 - 1. Low-Voltage Circuits: No. 16 AWG, minimum.
 - 2. Line-Voltage Circuits: No. 12 AWG, minimum.
- B. Power-Limited Circuits: NFPA 70, Types FPL, FPLR, or FPLP, as recommended by manufacturer.

PART 3 - EXECUTION

- 3.1 EQUIPMENT INSTALLATION
 - A. Connect the FACP with a disconnect switch with lockable handle or cover. Install smoke detectors above the FACP, all expansion panels, and all power supplies.
 - B. Connect devices to FACP, expansion panel, or NAC up to 300 feet from panel. Beyond 300 feet provide additional NAC panels.
 - C. Mount wire to fiber convertors in either the fire alarm panel with stand-offs or in remote cabinet adjacent to fire alarm panel. Provide conduit between remote cabinet and FA panel.
 - D. Manual Pull Stations: Mount semi-flush in recessed back boxes.
 - E. Water-Flow Detectors and Valve Supervisory Switches: Connect for each sprinkler valve station required to be supervised.
 - F. Ceiling-Mounted Smoke Detectors: Not less than 4 inches from a side wall to the near edge. For exposed solid-joist construction, mount detectors on the bottom of joists. On smooth ceilings, install not more than 30 feet apart in any direction.
 - G. Wall-Mounted Smoke Detectors: At least 4 inches, but not more than 12 inches, below the ceiling.
 - H. Smoke Detectors near Air Registers: Install no closer than 60 inches.
 - I. Duct Smoke Detectors: Comply with manufacturer's written instructions.
 - 1. Verify that each unit is listed for the complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
 - 2. Install sampling tubes so they extend the full width of the duct.
 - 3. Install necessary relays and control modules to accomplish mechanical equipment operation upon detector activation.

- J. Heat Detectors in Elevator Shafts: Coordinate temperature rating and location with sprinkler rating and location.
- K. Audible Alarm-Indicating Devices: Install so the top of the device is no less than 90 inches above finish floor and not less than 6 inches below the ceiling. Do not install higher than 120 inches unless directed. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille. Combine audible and visible alarms at the same location into a single unit.
- L. Visible Alarm-Indicating Devices: Install so the top of the device is no less than 90 inches above finish floor and not less than 6 inches below the ceiling. Do not install higher than 120 inches unless directed.
- M. Device Location-Indicating Lights: Locate in public space near the device they monitor.
- N. FACP: Surface mount with tops of cabinets not more than 72 inches above the finished floor.
- O. Annunciator: Install with the top of the panel not more than 72 inches above the finished floor.
- P. Antenna for Radio Alarm Transmitter: Mount to building structure where indicated. Use mounting arrangement and substrate connection that will resist 100-mph wind load with a 1.3 gust factor without damage.
- Q. Auxiliary Power Module (NAC): Locate in accessible areas where batteries and associated equipment may be readily maintained. Provide 120-volt/1-phase power from a dedicated 120-volt 1-phase 20-amp circuit for alarm indicating devices.
- R. All exterior fire alarm devices shall be weatherproof.

3.2 WIRING INSTALLATION

- A. Wiring Method: Install wiring in metal raceway according to specification section "Raceways and Boxes." Conceal raceway and coordinate with structural for conduit routes.
 - 1. Exceptions:
 - a. All wiring in mechanical/electrical/equipment rooms shall be in conduit.
 - b. All wiring 9' AFF and below or below ceilings shall be in conduit.
- B. Wiring within Enclosures: Separate power-limited and non-power-limited conductors as recommended by the manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with the fire alarm system to terminal blocks. Mark each terminal according to the system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.
- C. Wiring between panels or NAC panels:
 - 1. Within the building and conditioned spaces: Provide manufacturers plenum rated cabling between expansion panels and NAC panels within the building in conduit as per raceway and boxes schedule or as per the wiring installation method in this specification section. If the distance exceeds manufacturers copper cabling, provide plenum rated fiber optic cabling with a wire to fiber convertor.
 - 2. Outside the building or not within the conditioned space: Provide exterior rated plenum fiber optic cabling in conduit as per raceway and boxes schedule or as per the wiring installation method in this specification section. Provide a wire to fiber convertor either in the panel or in a remote mounting cabinet installed adjacent to the FA panel.

- 3. Fiber Install:
 - a. Fiber runs shall use long sweep elbows and be protected from damage.
 - b. Provide manufacturer required number of strands. Polish and terminate fiber in connectors per wire to fiber convertor. Connect to the wire to fiber convertor and test for operation.
 - c. Provide single or multi-mode; 50 or 62.5 micron fiber optic cabling per manufacturer convertor.
- D. Cable Taps: Use numbered terminal strips in junction, pull and outlet boxes, cabinets, or equipment enclosures where circuit connections are made.
- E. Color-Coding: Red fire alarm plenum rated conductors. Paint fire alarm system junction boxes and covers red.
- F. Risers: Install at least two vertical cable risers to serve the fire alarm system. Separate risers in close proximity to each other with a minimum one-hour-rated wall, so the loss of one riser does not prevent the receipt or transmission of signal from other floors.
- G. Wiring to Remote Alarm Transmitting Device: 1-inch conduit between the FACP and the transmitter. Install number of conductors and electrical supervision for connecting wiring as needed to suit monitoring function.
- H. Provide TVSS and grounding for all devices connected to a FA or NAC panel, external to the building conditioned space.

3.3 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals according to specification section Electrical Identification.
- B. Install instructions frame in a location visible from the FACP.
- C. Paint power-supply disconnect switch red and label FIRE ALARM.

3.4 GROUNDING

- A. Ground cable shields and equipment according to system manufacturer's written instructions to eliminate shock hazard and to minimize, to the greatest extent possible, ground loops, common-mode returns, noise pickup, cross talk, and other impairments.
- B. Signal Ground Terminal: Locate at main equipment rack or cabinet. Isolate from power system and equipment grounding.
- C. Install grounding electrodes of type, size, location, and quantity as indicated. Comply with installation requirements in Section "Grounding and Bonding."
- D. Ground equipment and conductor and cable shields. For audio circuits, minimize, to the greatest extent possible, ground loops, common-mode returns, noise pickup, cross talk, and other impairments. Provide 5-ohm ground at main equipment location. Measure, record, and report ground resistance.
- E. Ground radio alarm transmitter system and equipment as recommended by the manufacturer. Provide grounding for antenna to building ground.

3.5 APPLICATION SCHEDULE

- A. General Application: Provide fire alarm devices where indicated on drawings or as scheduled below. Locations on drawings are approximate. Contractor shall coordinate exact locations with architectural drawings. Contractor shall submit locations of fire alarm devices to engineer/architect as part of fire alarm shop drawings. Locations shall be based upon ability to mount the device to building construction and coverage afforded the device.
- B. Fire Alarm Panel: Panel shall be mounted in a continuously (during normal hours) occupied space. Provide dedicated smoke detector for fire alarm panel.
- C. Fire Alarm Expansion Panel: Provide fire alarm expansion panel for either every 35 devices or to maintain no more than 15% voltage drop to the device. Provide dedicated smoke detector connected to fire alarm for fire alarm expansion panel.
- D. Remote Annunciator: Provide remote annunciator at building address entrance. Location as shown on drawings is approximate and shall be coordinated with architectural.
- E. Pull Station: Provide pull stations within 5 feet of all exits to building and second floor stairwell access.
- F. Audio/Visuals and Visuals: Device locations indicated on the drawings are approximate. Coordinate with architectural for exact locations and install as per coverage criteria. Install devices in areas that are unobtrusive to room or space intent (e.g. do not install device at the back of the stage, but install stage device off to one side; or do not try to install device on glass block wall).
- G. Control Modules and Relays:
 - 1. Provide control modules and relays at all smoke fire dampers, air handler duct smoke detectors, and equipment smoke detectors for shutdown.
 - 2. Fire alarm activated fire suppression equipment.
 - 3. Provide control module and relay for elevator recall for designated floor, alternate floor, and shunt trip.
- H. Provide relays for all door holds, mag locks and electronically operated doors in the path of egress.
- I. Monitor Modules:
 - 1. Provide monitor modules for all devices to be monitored by the fire alarm system but not controlled.
 - 2. Provide monitor modules for all flow and tamper switches.
 - 3. Provide monitor modules for all dry pipe pressure switches.
 - 4. Provide fire control monitor module for Halon/FM-200 or similar systems that are locally activated.
- J. Master/Slave Synchronization: Provide master synchronization module at fire alarm panel and slaves for every two (2) circuits. Provide notification at fire alarm panel for synchronization and low power or A/C loss.
- K. Duct Smoke Detectors: Provide as shown on the drawings and as indicated below (applications may be redundant with drawings).
 - 1. Duct smoke detectors shall be provided within five feet, with no breaks in the ductwork, of all smoke fire dampers in the direction of airflow. Mount the duct smoke detectors to provide unrestricted access to the control section and for full removal of the sampling tubes.

- 2. Duct smoke detectors shall be provided at the discharge to all air handling units and mounted in accordance with NFPA 72.
- L. Weatherproof Horn/Strobe: Provide weatherproof horn/strobe for all interior courtyards.
- M. Weatherproof Horn: Provide weatherproof horns to be mounted high on exterior wall (coordinate with architectural), audible from any entrance to the building.
- N. Detectors in sleeping Areas: Provide with integral sounder bases. Detectors shall have local sounder bases which activate in alarm and provide signal to the FACP.
- O. Detectors in sleeping Areas with Gas Heat: Provide combination smoke and CO detection with integral sounder bases which activate in alarm and provide signal to the FACP.

3.6 MECHANICAL COORDINATION

A. See mechanical duct accessory specification for smoke fire dampers and mechanical drawings for sequences of operation. Provide control circuits, relays, monitor modules as required. Fire alarm system shall be capable of shutting down all dampers and air handlers during a fire alarm activation. Coordinate for sequencing as per duct accessories specification, mechanical specifications, and mechanical sequence of operation.

3.7 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and connections and to supervise pretesting, testing, and adjustment of the system. Report results in writing.
- B. Pretesting: After installation, align, adjust, and balance the system and perform complete pretesting. Determine, through pretesting, the compliance of the system with requirements of Drawings and Specifications. Correct deficiencies observed in pretesting. Replace malfunctioning or damaged items with new ones, and retest until satisfactory performance and conditions are achieved. Prepare forms for systematic recording of acceptance test results.
- C. Report of Pretesting: After pretesting is complete, provide a letter certifying the installation is complete and fully operable, including the names and titles of witnesses to preliminary tests.
- D. Final Test Notice: Provide a minimum of 10 days' notice in writing when the system is ready for final acceptance testing.
- E. Minimum System Tests: Test the system according to procedures outlined in NFPA 72. Minimum required tests are as follows:
 - 1. Verify the absence of unwanted voltages between circuit conductors and ground.
 - 2. Test all conductors for short circuits using an insulation-testing device.
 - With each circuit pair, short circuit at the far end of the circuit and measure the circuit resistance with an ohmmeter. Record the circuit resistance of each circuit on record drawings.
 - 4. Verify that the control unit is in the normal condition as detailed in the manufacturer's operation and maintenance manual.
 - Test initiating and indicating circuits for proper signal transmission under open circuit conditions. One connection each should be opened at not less than 10 percent of initiating and indicating devices. Observe proper signal transmission according to class of wiring used.

- 6. Test each initiating and indicating device for alarm operation and proper response at the control unit. Test smoke detectors with actual products of combustion.
- 7. Test the system for all specified functions according to the approved operation and maintenance manual. Systematically initiate specified functional performance items at each station, including making all possible alarm and monitoring initiations and using all communications options. For each item, observe related performance at all devices required to be affected by the item under all system sequences. Observe indicating lights, displays, signal tones, and annunciator indications. Observe all voice audio for routing, clarity, quality, freedom from noise and distortion, and proper volume level.
- 8. Test Both Primary and Secondary Power: Verify by test that the secondary power system is capable of operating the system for the period and in the manner specified.
- F. Retesting: Correct deficiencies indicated by tests and completely retest work affected by such deficiencies. Verify by the system test that the total system meets Specifications and complies with applicable standards.
- G. Report of Tests and Inspections: Provide a written record of inspections, tests, and detailed test results in the form of a test log. Submit log on the satisfactory completion of tests.
- H. Tag all equipment, stations, and other components at which tests have been satisfactorily completed.

3.8 CLEANING AND ADJUSTING

A. Cleaning: Remove paint splatters and other spots, dirt, and debris. Touch up scratches and marred finish to match original finish. Clean unit internally using methods and materials recommended by manufacturer.

3.9 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel as specified below:
 - 1. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, adjusting, and maintaining equipment and schedules. Provide a minimum of 8 hours' training.
 - 2. Training Aid: Use the approved final version of the operation and maintenance manual as a training aid.
 - 3. Schedule training with Owner, through Architect, with at least seven days' advance notice.

3.10 ON-SITE ASSISTANCE

A. Occupancy Adjustments: When requested within one year of date of Substantial Completion, provide on-site assistance in adjusting sound levels, controls, and sensitivities to suit actual occupied conditions. Provide up to three requested visits to Project site for this purpose.

END OF SECTION